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Volume III, 2015-16

ABSTRACTS



Directorate of Post-Graduate Studies
Assam Agricultural University
Jorhat -13, Assam, India

Post-Graduate Theses Abstracts

Vol III, 2015-16



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(Recipient of Sardar Patel Outstanding Institution Award)



14-08-2017

Foreword

I am extremely happy to learn that the 3rd edition of the treatise of the findings of the Master and Ph D Research work is ready for publication. I must congratulate the Director of Post-Graduate Studies and his team for their dedicated effort to bring-out this publication on a regular basis which undoubtedly will assist the disciplines/departments in critically reviewing the Research conducted thereby enabling them to capture newer areas of Research as per the call of the time as well as to engage the students in continuing those research programs which were indicative of opening up of further studies to arrive at a suitable recommendation or technology package. This treatise shall also provide a glimpse to the finding agencies on the quality and relevance of Research programs undertaken in our University.

I sincerely hope that newer editions, atleast once in 2 years, shall be brought out by the Directorate to keep on updating the Researchers and Faculties on the trend and desirability of Research.

I thank once again the team behind this publication.

(K.M. Bujarbaruah)



Dr. C. Hazarika
Director



Directorate of Post Graduate Studies
Assam Agricultural University
Jorhat -785013, Assam, India

Preface

I am really happy that the 3rd volume of the abstracts of Post- Graduate theses, for the year 2015-16 of Assam Agricultural University, Jorhat is ready for publication. Pursuing a higher education, starting with an associate's degree or a bachelor's degree, perhaps working up to master's or doctorate-level studies, leads to a better job prospects and higher paying positions. Higher education can also lead to a healthier and more balanced life, according to some research, all of which may factor into a decision to study at this level.

The State Agricultural Universities have played a very significant role in agriculture and allied sectors, ushering in green, blue, yellow and white revolutions in the country, thus bringing prosperity to the country and to the farmers. Post Graduate Students of State Agricultural Universities (SAUs) have also contributed significantly towards research and development in the agricultural and allied sectors. Recent issues like climate change, water use efficiency, doubling the farmer's income, post harvest management including entrepreneurship development with modern technologies were generally targeted by the PG students and several new information and technologies are generated by the PG students. The work done by the PG students of various universities need to be documented so that the findings can help the researchers and students in the discipline. Publishing the abstract of the thesis along with the identifying information of the theses is very much important as it receives more attention than some other types of academic writings. Altogether, 219 theses were submitted to the AAU during the academic session 2014-15. This includes 179 masters and 40 Ph. D. Theses.

I take this opportunity to profusely thank our Vice Chancellor, Dr. K. M. Bujarbaruah sir, who gave all encouragement and support to bring out this publication on a regular basis. I extend my deep appreciation to Dr. (Mrs)Rinjumoni Dutta, Assistant Professor, and in-charge, Academic cell, o/o the DPGS, Jorhat for her support in preparation and editing of this compilation. I also thank Mr. Paban Borah, contractual computer operator, o/o the DPGS for his sincere effort in setting the manuscript. Last, but not the least, I am thankful to Nekib, Aayan's World, for typesetting and printing of the compendium.

I sincerely hope that the students and the teachers who are involved in teaching and research will be immensely benefited through the ' Abstracts'. This publication will be useful to plan the research work without duplication. Further, it will also serve as an important reference material for the students. I earnestly hope, the 'Abstracts' will be published regularly without any interruption in future also.

(C. Hazarika)

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Development and characterization of abiotic stress tolerant North Eastern rice cultivars by over-expressing the chimeric *PDH47* gene

L. Dhanawantari Singha

Rice yield is greatly affected by environmental stresses such as drought stress. In response to the challenge of producing rice plants tolerant to drought stresses, we introduced Pea DNA Helicase 47 (*PDH47*), a DEAD-box helicase from *Pisum sativum*. DEAD-box helicases (Asp-Glu-Ala-Asp amino acid) are among the genes that respond to abiotic stresses adaptation processes. They involve in unwinding of nucleic acids by utilizing the energy from ATP hydrolysis (Vashisht and Tuteja, 2005). Pea DNA Helicase 47 (*PDH47*) is one of the DEAD-box helicase and its expression is upregulated in response to salinity, cold, and heat and ABA treatment in pea (Vashisht *et al.*, 2005). However, there exists no report on the drought tolerance property of *PDH47* gene. In the present study, we introduced the expression cassette of *PDH47* driven by constitutive 35S Cauliflower Mosaic Virus promoter into rice mediated through particle bombardment as well as *Agrobacterium* using immature embryos as explants. The North Eastern rice cultivars used in the present study were Ranjit, Profulla, Dhanushri, ASD16 & IR64. Out of 61 T₀ PCR positive transgenic lines, 20 lines expressed varied levels of *PDH47* transcripts as evident by semi-quantitative reverse transcription PCR (RT-PCR). The highest transformation efficiency (13.6%) was observed in ASD16. Five T₁ transgenic lines (ASD16-68/1, R-5/1-3, ASD16-20/1, ASD16-90/1 & ASD16-97/1) were selected for further detailed analysis based on expression level of *PDH47* transcripts. Three lines (R-5/1-3, ASD16-90/1 & ASD16-97/1) showed single copy transgene integration as evident by quantitative real time PCR and the transgene followed standard Mendalian segregating ratio in subsequent progeny. These lines also showed higher expression of *PDH47* transcripts both in leaf and root. T₁ transgenic lines were subjected to drought stress by treating with 10% PEG under hydroponic conditions and revealed significantly increased accumulation of osmolytes like proline, increased relative water content (RWC) and decreased reactive oxygen species (ROS) as compared to untransformed plants. We reported here expression of *PDH47* gene also affect other stress responsive genes in rice transgenic lines. Out of 10 stress responsive genes, 6 genes were upregulated, 2 genes were

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Department : Agricultural Biotechnology
Major Advisor : Dr. S. Singh

downregulated and 2 genes remain unaffected under drought stress. In this study, we also presented a comparative structural insight of PDH47 and rice internal stress responsive DEAD-box helicase, *Oryza sativa* ATP binding protein (OsABP) through various *in silico* approaches. Helicase domains of both PDH47 and OsABP shared 19% sequence identity, but showed ~63% similarity within the secondary structure elements and shared a common bipartite structural fold comprised of N-terminal domain I and C-terminal domain II with an extended domain in OsABP. Molecular dynamics (MD) simulations showed the stable conformation of both DEAD-box helicases in aqueous solution. Computational alanine scanning analysis revealed that Glu61 (PDH47) and Gln749 (OsABP) residues plays pivotal role in ATP binding. Molecular docking analysis showed that PDH47 possess higher ATP binding energy (-14.32kCal/mol) than rice native helicase (OsABP) (-10.62 kCal/mol) indicating that *PDH47* is more efficient and potential candidate gene for stress tolerance in rice. In conclusion for the first time, we reported the involvement of *PDH47* imparting drought tolerance in transgenic rice.

Molecular cloning, characterization and tissue specific expression analysis of the gene encoding 3-hydroxy-3-methylglutaryl Coenzyme A (HMG-CoA) reductase in *Centella asiatica* to comprehend the regulation of tri-terpenoid biosynthesis using RNAi approach

Ratna Kalita

Centella asiatica is an important medicinal plant with proven medicinal value. Metabolic engineering approach is a promising tool to improve the key component which is limiting in many of the medicinal plants. Prior knowledge of the pathway leading to accumulation of the secondary metabolite is prerequisite before intervention. Thus, the present study is the first step aimed to delineate the biochemical pathway using RNA silencing approach by targeting the two key regulatory enzyme (HMGR and DXR) in two different pathway viz. MVA and MEP. 3-hydroxy-3-methylglutaryl-CoA reductases (HMGR) play an important role in catalyzing the first committed step of isoprenoid biosynthesis in the mevalonate (MVA) pathway in plants. The full length cDNA encoding HMGR was cloned and sequenced (CaHMGR, GenBank accession number: KJ939450.2) and it has been characterized using bioinformatics tools from *Centella asiatica*. Sequence analysis indicated that the cDNA was of 1965 bp, which had an open reading frame of 1617 bp and encoded a protein containing 539 amino-acids with a mol. wt of 57.9 kDa. A BLASTp search against non-redundant (nr) protein sequence showed that CaHMGR has 65%–81% identity with HMGRs from different plant species and multi-alignment comparison analysis showed the presence of two HMG-CoA-binding motifs and two NADP(H) binding motifs. Tissue Specific Expression analysis indicates that CaHMGR is differentially expressed, with a strong expression in nodes and leaves and low in roots. Our results suggest that nodes may be crucial to terpenoid biosynthesis in *Centella asiatica* if at all the MVA pathway is involved. Transient analysis of the RNAi-CaHMGR using RT-PCR confirmed the silencing of the endogenous HMGR gene in *Centella asiatica*. Thus, the cloning of full length CDS, characterization of CaHMGR gene enable us to understand the HMGR's structure, functions and the RNAi knockdown approach is the first step to elucidate triterpenoid biosynthesis pathway and shall pave the way to intervene following metabolic engineering approach in future.

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Department : Agricultural Biotechnology
Major Advisor : Dr. P. Sen

Total factor productivity in Assam agriculture

Rinumoni Buragohain

Technical change in agriculture increases production at the same level of input-use and enables it to avoid trapping into Ricardo's law of diminishing returns to which the sector is more prone. Total Factor Productivity (TFP) is often seen as the real driver of growth within an economy. Many studies showed that, different factors of TFP like Policy support, production strategies, public investment in infrastructure, research and extension for crop, livestock and fisheries etc., have significantly helped in increasing the agricultural productivity, food production and its availability. Assam's economy is predominantly agrarian. Agriculture and its allied activities play an important role in the socio-economic development of the State of Assam as this sector is the major contributor to the State economy as well as providing livelihood to a significant proportion of the population of the State. Assam accounts for a fairly significant share of the country's acreage and output of many crops. In spite of having high inherent potentiality, Assam's agriculture is yet to experience modernization in real sense. Agriculture in Assam exhibits most of the characteristics of underdeveloped/backward agriculture. During last few decades, Assam Government has made lots of investments in agricultural sector for the development of the sector. But, whether these investments have been contributing significantly towards the agricultural growth in the real scenes or not, it is very much important to know. Considering this, the present study was conducted with the three objectives to estimate the TFP growth and its contribution to Assam agriculture, to examine the determinants of TFP in Assam agriculture and to suggest policy measures for improving TFP in Assam agriculture.

The study was conducted for three crops rice, jute and rapeseed and mustard both individually and collectively termed as total crops for the time period of two decades from 1991-92 to 2010-11. Further, for more convenience, the entire study period was divided into two sub periods viz., 1st period (1991-92 to 2000-01) and 2nd period (2001-02 to 2010-11). The study was based on secondary data collected from different reputed published sources. Tornqvist Theil index was used for computing TFP indices of the three selected crops. The input, output and TFP indices were calculated both in current price and constant price (at price of 1991-92) of the inputs and outputs to find out whether there any nominal price effect was existed or not. Again, the indices were also computed for per hectare area

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Department : Agricultural Economics and Farm Management

Major Advisor : Dr. (Mrs) N. Deka

and total area under the selected crops in Assam to know how efficiently inputs were used under both situations. In order to evaluate the determinants of TFP in Assam, the TFP index was regressed against the variables *viz.*, rice area under flood, no. of villages electrified, rainfall, share of irrigated area to total cropped area, expenditure in Agricultural research and education, investment in Agriculture and allied activities, share of HYV area to total rice area, rural literacy and cropping intensity by using Cobb Douglas production function.

The results of the study revealed that, all the three crops rice, jute and rapeseed and mustard of the state had experienced negative TFP growth at current price, but at constant price, it was estimated to be positive in both per hectare area and total area for the study period. It revealed the presence of the nominal effect of increased input costs resulted in a lower (negative) TFP at current price pointing out the occurrence of gap between the farm harvest prices of the farm outputs and costs of inputs incurred in production of those three major crops in the state. Again, except rice, for other two crops, jute and rapeseed and mustard, TFP index were estimated to be higher in per hectare area rather than their total area. It implied that, in jute and rapeseed and mustard both, inputs were more efficiently allocated and utilized per hectare area rather than total area in the state. Only rice was found to have highly significant TFP growth (at constant price). Other two crops were reported to have positive TFP with very lower growth rate, but not significantly in Assam.

Expenditure in Agricultural research and education, rural literacy, irrigation and cropping intensity were found to have positive impact on TFP of all three crops both individually and collectively. However, none of the selected variables was found to have significant impact on TFP of jute as well as rapeseed and mustard. Investment in agriculture and allied activities also was an important source of TFP for all selected crops except jute. In rice, HYV area also contributed positively in TFP. Villages electrified and rainfall exhibited no any effect towards TFP growth of all selected crops individually as well as collectively also. The findings of the study have important policy implications for construction of proper price structure, improving input-use efficiency in total area under these crops, allocating scarce public resources to agricultural research, education, irrigation etc. and increasing HYV area and cropping intensity for enhancing the TFP in the state for better sustainable growth in agriculture.

Farm level Production technologies, Post harvest losses and marketing efficiency of major vegetables: A study in the Darrang district of Assam

Sumi Dutta

Vegetables are important supplements to the human diet. India ranks 2nd after China in the world with total production of 162.19 million tones. In Assam area under vegetable is about 2.73 lakh hectares with annual production of 49.79 lakh MT. Vegetables are highly perishable food products in nature and in the process of supply from the farm level to the market level. The seasonal gluts and lack of infrastructure and marketing facilities in the developing countries have significant effect on the extent of post harvest losses of vegetables. In Assam not much information is available regarding the farm level adoption of production technologies and quantum of post harvest loss of vegetables at various stages of marketing and its impact on marketing efficiency. The present study was conducted in the Darrang district of Assam and was designed to collect information regarding the level of production technologies, assessment of productivity, technology gaps of some major vegetables, physical and value loss at farm level and at various stages of marketing and to examine the impact of post harvest loss on farmer's net price, marketing costs, margins and efficiency of major vegetables.

The study was based on both primary and secondary data. Bechimari and Kharupetia two major vegetable growing areas were identified. Both tabular and functional analysis was done in analyzing data. Cost concepts used in farm management studies were applied to calculate costs in the present study and results indicated that cost of production increased with increase in size of the farm and regarding knowledge on different parameters of vegetable production it was observed that almost all farmers (99.33%) had the knowledge about the ploughing and application of organic manures (99.00%). The extent of adoption gaps for selected vegetables is estimated and 7 technology components were found. More than 30 percent of technology adoption gaps were observed in terms of technology components T4, T5 and T6 i.e. Manuring and fertilization, Number of irrigations applied & Intercultural and weed control. As vegetables are perishable in nature so during the process of distribution and marketing substantial losses are incurred. The post harvest loss was estimated first at

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Department : Agricultural Economics and Farm Management

Major Advisor : Dr. R. N. Barman

farm level and then at market level and in case of market level it can be clearly observed that the physical loss was highest in itinerant level followed by wholesaler and retailer level. 4 major marketing channels of vegetables were identified namely Channel I: Producer–Consumer, Channel II: Producer–Retailer–Consumer, Channel III: Producer–Wholesaler–Retailer–Consumer, Channel IV: Producer–Itinerant traders–Wholesaler–Retailer–Consumer. Marketing efficiency was estimated in different marketing channels and it was found that Channel II was the most efficient channel and Channel IV was the least efficient channel. But Channel IV was considered as the most effective one because farmers sold majority of their marketed surplus through Channel IV.

Improved farming system technology inclusion into existing farming system for sustainable agriculture

Pranjit Sutradhar

A study was conducted during 2012–13 to 2014–15 in Silikha Sanatan village of Titabor Sub-division of Jorhat District of Assam to find out the productivity and profitability of the inclusion of improved farming systems in their existing farming systems especially effective for small and marginal farmers. Benchmark survey was carried out in the village and accordingly different types of existing farming systems were identified and their constraints were analyzed. Mono-cropping of rice was predominant practice in that area and small earthen aperture were treated as water reservoir which failed to meet the demand during *Rabi* period. In total, there were 54 (fifty four) numbers of farmers selected out of which most of them belong to the tribal community. According to their farm holding size and income, they were categorized into two groups- Resource constraint and Resource available. There were in total 12 (Twelve) existing farming systems identified and accordingly scientific interventions were made in their existing farming systems such as nutrient management on the basis of soil test value, multiple cropping and balanced feeding to live-stocks etc. In the year 2015, impacts were analyzed. Out of 12 farming systems among both the group of farmers, Module-V (Crop + Fishery + Duckery) was found to be very profitable with B:C ratio 2.80 followed by Module-II (Crop + Cattle + Poultry) with B:C ratio 2.64 which were practiced by resource constraint farmers. Besides, the final soil properties such as pH, organic carbon and nutrient status were improved over initial more particularly in case of the farmers growing greengram and blackgram in their cropping sequence. It can be concluded that, existing farming systems can be improved through scientific interventions and Module-V and Module-II can be suggested for resource available and resource constraint farmers which were found to be economically profitable and socially acceptable farming systems for the marginal farmers of the Silikha Sanatan Village of Titabar sub-division of Jorhat District.

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Department : Agronomy
Major Advisor : Dr. Ajit Baishya

Evaluation of different contingency plans for delayed *sali* rice cultivation

Rajasri Saikia

A field experiment was conducted at the Instructional-Cum-Research (ICR) Farm, Assam Agricultural University, Jorhat during *kharif* season in the year 2012 and 2013 on the topic “**Evaluation of different contingency plans for delayed *sali* rice cultivation**” in order to investigate the effect of delayed planting, age of seedling with transplanting method and variety. The experiment was laid out in a split plot design with three replications. The treatment consisted of five dates of planting *viz.* 16 August (D₁), 26 August (D₂), 5 September (D₃), 15 September (D₄) and 25 September (D₅) as main plot treatment and six types of seedling with four varieties *viz.* staggered planting of long duration photo sensitive variety Manoharsali with seedling age 60 days and more (S₁: STP-Manoharsali), double planting of long duration photo sensitive variety Manoharsali with 30 + 30 days and more seedling age (S₂: DP-Manoharsali), normal planting of long duration photo sensitive variety Manoharsali with 30 days old seedling (S₃: NP- Manoharsali), double planting of long duration photo insensitive variety Ranjit with 30 + 30 days and more seedling age (S₄: DP-Ranjit), normal seedling age of mid duration variety Basundhara with 25 days old seedling (S₅: NP-Basundhara) and normal seedling age of short duration variety Luit with 21 days old seedling (S₆: NP-Luit) were allotted in sub plots.

The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.4 and 5.2), medium in available N (299.00 and 285.34 kg/ha), P (19.71 and 16.33 kg/ha) and K (164.20 and 147.84 kg/ha). The crop was fertilized with a uniform dose of 40 kg N, 20 kg P₂O₅ and 20 kg K₂O per hectare. The amount of rainfall received by the crop during growth period was 1197.9 mm in 2012 and 1375.9 mm in 2013.

The results revealed that both grain and straw yields were significantly influenced by planting time and type of seedling. Among different planting times, planting on 16 August produced highest grain yield (36.49 and 39.04 q/ha) and straw yield (50.63 and 50.12 q/ha) in 2012 and 2013, respectively. Delaying the planting date from 16 August to 25 September caused 78.82 and 78.38 per cent reduction in grain yield in 2012 and 2013, respectively. All the growth and yield attributing characters recorded higher values on 16 August planting and decreased with delay in planting time. Crop duration under earlier date of planting

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Department : Agronomy

Major Advisor : Dr. K. Kurmi

registered more number of days to 50 per cent flowering and maturity. On the other hand, the residual available N, P and K in soil were significantly higher on 25 September planting as compared to earlier planting dates.

Higher grain yield (32.02 and 32.68 q/ha) and straw yield (45.09 and 48.65 q/ha) in 2012 and 2013, respectively were recorded with double planting of Manoharsali over other types of seedling.

The highest net monetary return of 35,827.12 and 37,938.77 and benefit-cost ratio of 2.37 and 2.45 were recorded with treatment receiving double planting of Manoharsali on 16 August planting during first year and second year, respectively.

Physiological performance of green gram genotypes under acidic soil condition of Assam with special reference to phosphorus use efficiency

Lolesh Pegu

A study was conducted during *kharif* and summer seasons of 2013-14 and 2014-15 with twenty genotypes of green gram to assess the physiological performance of green gram genotypes under acidic soil condition of Assam with special reference to phosphorus use efficiency. The mean monthly rainfall during crop growing season was 208.3 mm for *kharif* season and 82.35 mm for summer season. The soil is acidic with medium value of organic carbon, low in available N, P and K content. The recommended spacing, seed rate, fertilizer dose and other package of practices were followed for raising the crop. The genotype Pusa Baisakhi was found to be the highest seed yielder during *kharif* season which was followed by Pant Moong 4, Pratap, SGC 25 and SGC 20. The genotype Pusa Baisakhi showed the highest value for total dry matter content per plant, leaf area per plant, longest root length, root surface area, root volume, nodule numbers per plant, nodule dry weight, *in vivo* nitrate reductase activity, leaf photosynthetic rate, number of pods per plant and harvest index. Moreover, the genotype Pusa Baisakhi showed higher value for plant height, number of branches per plant, crop growth rate, net assimilation rate, phytase enzyme activity, acid phosphatase enzyme activity, phosphorus uptake efficiency, phosphorus utilisation efficiency, number of seeds per pod etc. which might have contributed towards higher seed yield for this genotype during *kharif* season. The genotypes Pant Moong 4, Pratap, SGC 25 and SGC 20 were also found to exhibited higher values for these parameters during *kharif* season. On the other hand, during summer season the genotype SGC 25 was found to be the highest seed yielder followed by SGC 20, Pusa Baisakhi, Pant Moong 4 and Pratap. The genotype SGC 25 was found to record highest value for plant height, number of branches per plant, crop growth rate, nodule dry weight, total leaf chlorophyll content, leaf photosynthetic rate, internal CO₂ concentration, stomatal conductance, phytase enzyme activity in root cells and rhizosphere soil, acid phosphatase enzyme activity in root cells, phosphorus uptake efficiency, phosphorus utilization efficiency, number of pods per plant, test weight of seed and harvest index. The genotype SGC 25 also showed higher

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Department : Crop Physiology
Major Advisor : Dr. P. Kalita

value for total dry matter content per plant, leaf area per plant, specific leaf weight, leaf area ratio, relative growth rate, net assimilation rate, longest root length, root surface area, root volume, root to shoot ratio, nodule numbers per plant, *in vivo* leaf nitrate reductase activity, number of seeds per pod etc. which might have contributed towards higher seed yield for this genotype during summer season. Higher values for these parameters were also exhibited by the genotypes SGC 20, Pusa Baisakhi, Pant Moong 4 and Pratap during summer season. The performances of the genotypes Pusa Vishal and HUM 1 for plant height, plant dry matter, leaf area per plant, crop growth rate, net assimilation rate, longest root length, root volume, nodule number per plant, nodules dry weight, leaf nitrogen content, leaf photosynthetic rate, number of pods per plant, seed yield per hectare etc. were intermediate during *kharif* season; however, their performance during summer season was poor. A significant and positive correlation of total dry matter content per plant, leaf area per plant, leaf photosynthetic rate, phosphorus uptake efficiency, phosphorus utilisation efficiency, number of pods per plant and harvest index with seed yield ($r=0.95, 0.88, 0.90, 0.83, 0.85, 0.86$ and 0.94 respectively for *kharif* season and $0.96, 0.95, 0.95, 0.89, 0.96, 0.98$ and 0.98 respectively for summer season) was found both during *kharif* and summer season. The genotype PDM 178 was found to be the lowest seed yielder during *kharif* season and the genotype PDM 87 was found to be the lowest seed yielder during summer season. On an average during *kharif* season 27.21% higher seed yield could be obtained compared to that of summer season.

Molecular Characterization and Physiological Aspects of *Lepidiota mansueta* Burmeister (Coleoptera: Scarabaeidae)

Gautam Handique

The present investigations were carried out in the Department of Entomology and Department of Soil Science, DBT-AAU Centre, Assam Agricultural University (AAU), National Bureau of Agricultural Insect Resources, Bangalore and Tezpur University, during the years 2011-2015 to generate a comprehensive information on the molecular phylogeny as well as some physiological aspects of *Lepidiota mansueta*, a major white grub species endemic to Majuli river island of Assam.

Molecular analysis of genetic diversity revealed that the highest per cent polymorphism and Polymorphism Information Content (PIC) was found for BEM 22 marker which was 80 per cent and 0.799 respectively, while lowest percent polymorphism and PIC was recorded for BEM 11 *i.e.* 8 per cent and 0.083, respectively. Estimation of genetic similarities among the 18 species of scarab beetles suggested that all species were dissimilar to one another. The similarity value ranged from 0.130 to 0.714. The lowest similarity value was found in between *Adoretus renardi* and *Apogonia blanchardi* (0.118) followed by *A. blanchardi* and *Holotrichia* sp. (0.130) and the highest similarity value was found between *Maladera insanabilis* and *Onitis philemon* (0.769) followed by *O. philemon* and *Adoretus bicolor* (0.714). The species *L. mansueta* had a close similarity to *Maladera insanabilis* (0.643) while the same was observed to be the lowest with *Apogonia blanchardi* (0.250). Two major clusters were derived from the dendrogram in which, *L. mansueta* could be comprehended to be genetically close to *M. insanabilis*, *Catharsius molossus*, *O. philemon*, *A. renardi*, *Anomala pellucida* and *A. bicolor*. However, within this group, *L. mansueta* stands as an outgroup.

Laboratory experiments also revealed distinct sexual dimorphism in the antennal segments between the male and female beetles of *L. mansueta*. The length and breadth (mean \pm SD) of pedicel (0.574 \pm 0.165; 0.326 \pm 0.057), flagellum (1.452 \pm 0.272; 0.472 \pm 0.113), proximal lamellae (1.699 \pm 0.378; 0.767 \pm 0.103), middle lamella (1.724 \pm 0.174; 0.729 \pm 0.092) and distal lamella (1.686 \pm 0.137; 0.652 \pm 0.097) was significantly higher in males than the females which was recorded to be 0.322 \pm 0.014 & 0.214 \pm 0.011, 0.797 \pm 0.058 & 0.293 \pm 0.046,

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Department : Entomology
Major Advisor : Dr. A.A.L.H. Baruah

1.503±0.229 & 0.594±0.069, 1.572±0.190 & 0.577±0.080 and 1.460±0.214 & 0.532±0.027 for pedicel, flagellum, proximal lamellae, middle lamella and distal lamella, respectively. Sensilla located in the antennae of both sexes of *L. mansueta* beetles also exhibited dimorphism. Scanning Electron Microscopic studies revealed 3 types of sensilla in males and 7 types in females. Wind tunnel bioassays showed clear affinity of adult males and females to prothoracic region (PTR) extracts of males while only males were found to be attracted to the abdominal extracts of females. GC-EAG readings also exhibited clear response of both male and female antennae to the PTR extracts of males while significant response was observed only in male antenna to abdominal extracts of females. GC-MS/FID analysis revealed 4 different compounds in the PTR extracts of males viz., cis-9-Hexadecenal, cis-9-Hexadecenoic acid, Octadec-9-enoic acid and 1-Hexacosene. Likewise, female abdominal extracts also registered 4 compounds viz., cis-9-Hexadecenoic acid, 18-Nonadecenoic acid, Octadec-9-enoic acid and 9,19-Cyclolanost-24-en-3-ol, acetate during the course of study.

Microbial investigation of the gut content of third instar grubs of *L. mansueta* revealed 20 different bacterial cultures. Out of these, 5 bacterial cultures designated as B₁, B₆, B₁₁, B₁₅ and B₁₉ had the population load with highest colony forming unit/ml. Bacterial flora was considerably varied in size, margins, elevation, gram staining and shape and the variations were based on utilisation of carbohydrates as well as their response to different enzymes. Out of the 5 bacterial cultures, B₁, B₆ and B₁₅ exhibited cellulose degrading activities in laboratory conditions.

Species diversity and molecular characterization of wild honey bees

Janardan Saikia

Species diversity and molecular studies on wild honey bees *viz.*, *Apis dorsata* F. and *Apis florea* F. for the three physiographic zones of northeast India has been carried out. The present investigations have been carried out in the Department of Entomology, Assam Agricultural University and Department of Agricultural Biotechnology, during the period 2012-2016 to generate comprehensive information on species diversity as well as molecular characterization of wild honey bees from three physiographic zones *viz.* Brahmaputra valley, Meghalaya Plateau and South-eastern hill zones of Northeast India. Five locations under each zone were selected *viz.* Brahmaputra valley zone: Dhubri, Jorhat, Gossaigaon, Nagaon, Golaghat; Meghalaya Plateau zone: Sanmer, Sohra, Umiam, Umrangso, Umsning and South eastern hill zones: Diphu, Dimapur, Kohima, Medziphema and Wokha. Exploration has been made and five bee samples from each physiographic zone, with twenty numbers of bees from each location (20x5=100) were collected while foraging for pollen and nectar on different crops.

In species diversity, a total of three wild honey bee species have been collected out of which two species *i.e.*, *Apis dorsata* and *Apis florea* are common in all three physiographic zones, except for *Apis andreniformis* being collected from Brahmaputra valley zone. Species diversity index was found to be highest from Brahmaputra valley zone (0.7045) followed by South-eastern hill zone (0.6605) and Meghalaya Plateau (0.6411) respectively. Morphometric characteristics *viz.*, body length, ratio of head length and width, fore wing length, ratio of mandible length and width, proboscis length and cubital index etc. has been taken for the study.

Morphometric study of *Apis dorsata* from three physiographic zones revealed that *Apis dorsata* from South-eastern hill zone had larger average body length (17.86±0.36mm) followed by ratio of head length and width (0.93±0.05), proboscis length (5.53±0.12mm), fore wing length (12.26±0.22mm), hind wing length (7.94±0.26mm) as compared to Brahmaputra valley and Meghalaya Plateau zones. While morphometric study of *A. florea* from all three physiographic zones revealed that, the bees from Meghalaya Plateau were found to be larger in average body length (7.67±0.37mm), metasoma length (3.99±0.60mm),

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Department : Entomology
Major Advisor : Dr. A. Rahman

fore wing length (5.38 ± 0.29 mm), femur length (1.47 ± 0.28 mm) and tibia length (1.69 ± 0.08 mm). *Apis andreniformis* from Brahmaputra valley were found to have average body length (5.58 ± 0.08 mm), ratio of head length and width (0.93 ± 0.05) and cubital index (4.12 ± 0.50).

Cluster analysis for euclidean distance of *Apis dorsata* among three physiographic zones has revealed that, maximum euclidean distance was between Dhubri and Diphu (11.80) and minimum distance has been found between Umrangso and Umsning (3.85) respectively. Two main clusters and two independent clusters were formed, representing the variation among the three physiographic zones. Similarly for *Apis florea*, two main clusters and one independent cluster were formed and maximum euclidean distance has been found to be 15.265 between Dhubri and Umrangso, whereas minimum distance was found to be 2.664 between Gossaigaon and Nagaon.

Further, cluster analysis for genetic diversity of *Apis dorsata*, revealed that maximum similarity of 0.824 *i.e.* (82.40%) was observed between Medziphema and Wokha whereas, minimum similarity of 0.133 *i.e.* (13.30%) between Jorhat and Golaghat. Five main clusters and four independent clusters were formed from all three physiographic zones. Similarly in cluster analysis for *A. florea* revealed that maximum similarity was found to be between Medziphema and Wokha (0.944) *i.e.* (92.40%) and minimum similarity between Umsning and Golaghat (0.133) *i.e.* (13.30%). Four main clusters and six independent clusters were observed among the three physiographic zones.

Based on morphometric characterization of wild honey bees, it has been found that there are two distinct morphoclusters within the three physiographic zones forming hill races and plains races which can be concluded with maximum genetic similarity.

Behavioural Studies on *Lepidiota mansueta* Burmeister (Coleoptera: Scarabaeidae)

Mrinmoy Das

Behavioural studies on *Lepidiota mansueta* Burmeister (Coleoptera: Scarabaeidae) were carried out in Majuli river island and Soil Arthropod Pests Laboratory of Assam Agricultural University, Jorhat during 2012-16. The effects of mating on some important biological attributes of *L. mansueta* was assessed under two different methods. The virgin females were allowed to mate with virgin males at different days (1-7 days) by following the male withdrawal method. Fecundity and female longevity was found to be maximum (26.98 ± 2.80 numbers and 19.70 ± 2.00 days respectively) when the female was allowed to mate with male for three consecutive days whereas minimum (22.68 ± 2.54 numbers and 18.33 ± 1.62 days respectively) when the female was allowed to mate for one day only. Egg deposition was found to be highest (92.77%) when the female was mated continuously for three days followed by female mated with male for five days (92.70%) as compared to the normal mating (92.27%). Reversed observations were recorded in case of male longevity which was found maximum (23.93 ± 1.10 days) when the male was deprived after one day of mating but minimum (21.65 ± 2.06 days) in case of male which was mated consecutively for five days. There was no significant differences among the treatments in terms of preoviposition period (7.18-7.70 days), egg load (27.40-29.40 numbers), hatching percentage (92.16-93.56), length (5.06-5.11 mm) and breadth (4.06-4.12 mm) of eggs. Efforts were also made to understand the effects of both normal and multiple mating on some important biological attributes of the beetles by allowing the virgin female to mate with different numbers of virgin males (1-7 males/female) in male retained method. Experimental results indicated that the fecundity and female longevity was found to be maximum (29.63 ± 3.72 numbers and 20.85 ± 1.41 days respectively) when the female was allowed to mate with three males and it was found to be significantly superior over the fecundity and female longevity registered in case of normally mated pairs (25.83 ± 3.36 numbers and 19.83 ± 1.45 days). The lowest fecundity and female longevity (24.55 ± 4.02 numbers and 19.30 ± 1.20 days respectively) was recorded in condition where the female was allowed to mate with seven males. Egg deposition was found to be maximum when the single female was allowed to mate with three males (98.44%) followed by female which was mated with four males

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Major Advisor : Dr. Badal Bhattacharyya

(97.91%) and two males (95.88%) as compared to the normally mated females (92.25%). Experimental results further indicated that there were no significant differences among the treatments in terms of male longevity (21.83-22.67 days), preoviposition period (7.33-7.88 days), egg load (27.10-30.10 numbers), hatching percentage (94.37-95.78), length (5.07-5.11 mm) and breadth (4.04-4.10 mm) of eggs.

Efficiency of six different light sources in trapping *L. mansueta* adults revealed that the highest numbers of beetle (781.24±7.88; Mean sex ratio: 3.66:1) were trapped in Solar Light Emitting Diode (LED) light trap, which was found to be significantly superior over light traps operated through Compact Fluorescent Lamp (CFL) bulb, Mercury bulb, Ultra violet (UV) lamp, Tungsten & LED bulb. In case of light traps operated through CFL bulbs, the highest number of beetles were trapped in light traps with 15 watt CFL bulb (725.27±8.85; Mean sex ratio: 4.09:1). The beetles trapped in case of light traps operated through mercury bulb and UV lamp registered 389.24±5.49 and 199.11±4.58 with mean sex ratio of 4.38:1 and 4.42:1, respectively. Relatively lower numbers of beetles were attracted to the light traps with Tungsten and LED bulbs. Based on above observation, a battery operated LED light trap was designed and tested in the beetle endemic areas. The effectiveness of “Modified battery operated LED light trap” was assessed in terms of beetle catches and found significant differences with solar LED light trap (paired ‘t’ value: 17.39) and light trap operated with CFL bulb 15 watt (paired ‘t’ value: 15.15).

All total seven numbers of shelter plants preferred by the beetles for mating purpose were recorded and their morpho-physiological parameters were examined. Out of these, the most preferred plant by the beetles (14.40±1.17 numbers/ plant) was found to be *Tamarix dioica* which registered a mean plant height of 187.50±14.77 cm, total leaf area of 2.18±0.15 cm², leaf length of 6.91±0.78 cm and leaf breadth of 0.26±0.07 cm. Field observation also revealed that the shelter plants with alternate type of leaf phyllotaxy and horizontal spreading canopy were mostly preferred by the beetles over the plants with whorled/opposite leaf phyllotaxy.

The survival of third instar grubs of *L. mansueta* in four different soil classes was investigated. Grubs were successfully reared up to adult stage in both surface and subsurface soil of Entisols and Inceptisols. The mean survival of grubs was registered in surface (214.46 days) and subsurface (212.20 days) soil of Entisols with per cent adult emergence of 73.33 and 86.66 respectively, whereas in case of Inceptisols survival of grubs was found to be 210.03 and 205.67 days with per cent adult emergence of 5.00 and 11.67, respectively. However, not a single grub was found to be survived in both Alfisols and Ultisols indicating the strong effects of soil physicochemical properties on survival of the grubs.

The relationship between different tillage practices and the existence of beetle holes was also studied in some selected *L. mansueta* endemic areas of Majuli. Experimental results revealed that maximum number of beetle holes (13.91-15.94/ sq.m) were recorded in areas where no tillage operations were carried out and kept as uncultivated land whereas minimum number of holes (3.16-3.67/ sq.m) was found in areas where tillage operation was performed by the tractors. There were no significant differences in terms of depth of beetle holes in soil irrespective of the tillage operations conducted.

Adoption of Organic Farming Practices and its Impact on Organic Farmers: A Study In Mizoram

B. Lalrosiami Khuhly

The buzz word of ‘Organic Farming’ has been gaining momentum in recent years with more people focusing on the issues of sustainable agriculture production. ‘Organic farming is a system of cultivation which is eco-friendly and which can achieve sustainable productivity without the use of artificial and external inputs such as chemical fertilizers and pesticides and shall include organic processing’ (Mizoram Organic Farming Act, 2004). The state of Mizoram situated in Northeast India is blessed with rich flora and fauna and has one of the most enchanting hilly terrains in eastern India. With a population of only 10,91,014 its population density is 52 persons/sq.m and contributes 0.09% to the total population of the country (2011 census). By tradition, the Mizo farmers practice farming by using organic manures like livestock waste, crop residues and tree wastes as a way of rejuvenating the soil. The lifestyle of the people was simple with no particular investment in improved seed varieties, fertilizers or chemicals. Even when there were crop failures, they considered it as their fate and did not take any protective measures. This mindset and practice and minimal use of chemical fertilizers during the farming operations led the state to be known as *organic state by default*.

The potential of Mizoram going fully organic in terms of agricultural produce has awakened policy makers, decision makers and agriculture scientists across the country. However, its actual level of adoption regarding various organic farming practices, either traditional or scientific, has not yet been explored. Hence, with this interest, the researcher has undertaken the study with the following objectives:

1. To study personal, socio-economic, psychological, and communication characteristics of organic farmers in Mizoram
2. To study extent of adoption of organic farming practices
3. To assess the impact of organic farming on the organic farmers of Mizoram
4. To examine relationship between the selected independent variables with the extent of adoption of organic farming practices
5. To analyse problems and constraints faced by the organic farmers in Mizoram and their suggestions to reduce adoption gap

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Department : Extension Education
Major Advisor : Dr. P. Mishra

The study was conducted in the State of Mizoram, India. Five districts were selected purposively, viz. Aizawl, Lunglei, Champhai, Mamit and Kolasib. Ex-post-facto and analytical research design was followed. The villages in each of the sample districts were selected randomly. 26 respondents were selected from each district and a total of 260 farmers constitute the respondents.

From the findings, it was observed that majority (52.70%) of the respondents were marginal farmers aged between 40-53 years (60.38%) and have farming experience ranging from 7-13 years (78.00%). 88 per cent of them were males and 46.15 per cent of them had educational qualification upto high school. The annual income of the respondents on an average was Rs.40,358 to Rs.1,23,918 (78.85 %). Most of the farmers (52.68%) were from large families having family members ranging from 6-8 members. Among the prevalent organic farming practices, majority (74.23%) of the respondents practise manual weeding and apply crop residues/tree(73.46%) as well as debris poultry manure(71.92%) to their farms. FYM was also applied by 58.58 per cent of the respondents while cow dung and pig manure was also used by 56.92 per cent and 50.77 per cent of the respondents respectively. Majority (65.77%) of the respondents opined that the products that they obtained from their farms were immediately sold to the local market without grading the products (88.46 %). 57.69 per cent of the respondents transport their products with the help of pick-up trucks and sell them according to the market information that they get mostly (34.61 %) from their personal visit to the markets and also their peers/others who visit the market (15.38 %). The findings further reveal that the respondents (39.60%) had moderate to high (32.30 %) level of knowledge about organic farming practices. The respondents also had moderate levels of achievement motivation (61.15%), innovativeness (55.00%), risk bearing abilities (71.53%) and economic motivation (66.15%). It was also observed that majority (77.69%) of the respondents had moderate level of perception towards organic farming as a technology. 63.1 per cent of the respondents felt that organic farming was low cost and inputs obtained easily (47.69%), profitable(62.30%), simple(43.07%), physically compatible (48.07%), culturally highly compatible (54.23%) but involves some risk (41.15%). 47.69 of the respondents showed moderately favourable attitude towards organic farming (60.00%) and shifting cultivation (36.92%). The respondents were cosmopolite in nature where 46.97 per cent of them visit the nearby town once a week for personal and domestic purpose (57.30%) as well as for purpose relating to agriculture (37.30%). It was also found that 73 per cent of the respondents occasionally attend extension meetings and trainings (61.54%).

The overall level of adoption of organic farming practices by majority of the respondents (76.53%) was moderate. It was observed that 71.92 per cent of the respondents fully adopt the application of poultry manures (timely weeding (77.31%), forest litter as natural resource (72.31%) and mixed cropping (58.85%).68 per cent of the farmers also perceived organic farming as moderately useful. The correlation analysis showed that parameters like age ($r = 0.3977^{**}$), farming experience ($r = 0.633^{**}$), extent of involvement in organic farming practice($r = 0.582^{**}$), Innovativeness ($r = 0.453^{**}$), extension participation ($r = 0.203^{**}$) size of family ($r = 0.2571^{**}$), operational land holding ($r = 0.270^{*}$), attitude of farmers towards organic farming ($r = 0.210^{**}$), perceived attributes of

organic farming as a technology ($r = 0.191^{**}$), level of knowledge about organic farming practices ($r = 0.117^{**}$), had positive and significant correlation with the extent of adoption of organic farming practices. It was also observed that the attitude of farmers towards shifting cultivation ($r = -0.106^*$) had negatively significant correlation with the extent of adoption of organic farming practices. The value of coefficient of multiple determination (R^2) value, 0.724 indicated that the independent variables jointly contributed 72 per cent towards variation in extent of adoption of organic farming practices. The path analysis showed that the highest direct effect was exhibited by Age of the respondents (X_1 , 3.335). It was also observed in the same table that the highest direct effect on that adoption of organic farming practices was shown by Age (X_1 , 2.5273), followed by Attitude of farmers towards Shifting cultivation (X_6 , 2.2476), Farming experience (X_2 , 2.154), Level of knowledge about Organic Farming Practices (X_4 , 2.0013) and Involvement in organic farming (X_3 , 1.783). Majority (96.50%) of the respondents also ranked 'Lack of assured market for organic produce' as the most common problem.

Considering the findings of the research, it is suggested that in order to increase the adoption of organic farming practices, a strategic planning and management approach has to be followed. Modern and improved organic and sustainable crop production plan need to be strategized in order to have a sustainable organic agriculture in the state of Mizoram. Extensive sensitization and awareness programmes as well as skill development programmes should be implemented for the farmers as well as the consumers. Steps should be taken to reduce the certification costs so that the farmers can afford to register for organic certification as it is essential. More efforts have to be given towards development of organized and regulated markets so that the farmers can have an assurance and continue practicing organic farming.

Morpho-biochemical and molecular characterization of some *Piper longum* lines of NorthEast India

Amrita Khound

The present investigation was carried out in the Experimental farm, Department of Horticulture, Assam Agriculture University (AAU), Jorhat -13, as well as laboratory, Department of Biotechnology and Biochemistry and Agricultural chemistry, AAU, Jorhat during 2013-14 and 2014-15 to investigate the morphological and bio-chemical characters of selected *Piper longum* L. lines of North East India; genetic variation among the selected lines through molecular markers and to find out the suitable line of *Piper longum* L. for commercial cultivation under North East Indian condition.

A total of 16 *P. longum* L. lines (germplasm) including the check variety “Viswam” were evaluated. The germplasm PLJ-19 significantly differed in morphological characters from all others with mean shortest internodal length (6.56, 5.89 and 5.68cm), maximum leaf length (6.07, 5.92 and 5.12cm), petiole length (5.63, 5.58 and 4.63cm), stipule number (14.87, 13.92 and 11.89), highest leaf area (37.84, 37.16 and 34.16sqcm.) and highest L:B ratio (1.24, 1.12 and 1.10) at vegetative, flowering and harvesting stage respectively over check variety “Viswam”. The highest mean root length (9.01cm), root diameter (1.97mm) and number of rootlets (12.00) were recorded in germplasm PLJ-19 and differed significantly from other germplasm of *P. longum*.

The mean minimum days from planting to initiation of spike (221.40days) was recorded in germplasm PLJ-19 followed by PLJ-01 (228.10 days) and check variety (263.40 days). Germplasm PLJ-19 recorded minimum days for spike initiation to maturity (61.0days) followed by PLJ-01 (61.04days) and check var. (70.3days). Significant difference was observed in mean number of flowering spike per plant in different germplasm with highest number (113.73) in PLJ-19 followed by PLJ-01 (109.40) and check var. (92.07). The maximum mean number of fruiting spike (96.60), highest mean fresh weight of spike (48.69 gm), mean dry weight of spike (4.87gm) per plant and mean spike length (3.71cm) were significant and found to be in germplasm PLJ-19 and observed to be superior as compared to check variety “Viswam”. *P. longum* germplasm PLJ-01 exhibited highest mean peduncle length (1.88cm) followed by germplasm PLJ-19 (1.82cm) whereas the check var. showed 1.52cm peduncle length.

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Department : Horticulture
Major Advisor : Dr. P. C. Barua

The data revealed that the highest mean per cent piperine content was found in germplasm PLJ-11 (7.85) followed by PLJ- 09 (7.64), PLJ- 30 (6.52), PLJ- 17 (6.33) PLJ- 19 (5.54) and PLJ- 03 (5.46) which were superior over the check var. (5.15).

The RAPD analysis, yielded appreciable amount of good quality DNA as represented by A_{260}/A_{280} ratio of more than 1.8. The gel analysis revealed good quality DNA as confirmed by intactness and minimal shearing. Twenty decamer random primers were used to generate RAPD fingerprints of the studied germplasm. Differential polymorphism was observed in 16 different germplasm showing variation in percentage of polymorphism ranges from 25.01 to 60.00 using 20 primers. The maximum level of polymorphism was recorded by OPB19 (60.00%), followed by OPB 1 (57.14%), OPA08 (50.5%), OPB02 (50.0%) OPB20 (50.0%), OPA 11(50.0%). The UPGMA cluster analysis of RAPD banding pattern for correlation coefficient of similarity matrix showed that similarity value ranged from 0.587 to 0.862. A dendrogram grouping pattern revealed that the germplasm formed four main clusters, cluster I consisted of germplasm PLJ-18, PLJ-19, PLJ-03 and PLJ-20. Cluster II consisted of PLJ-28, PLJ-29, PLJ-30 and PLJ-32. Cluster III comprises of germplasm PLJ-09, PLJ-01, PLJ-22, PLJ-17 and PLJ-11. Lastly cluster IV consisted of two germplasm PLJ-16 & PLJ-10. The germplasm “Viswam” do not form any cluster and considered as out group.

The performance of germplasm in respect to benefit: cost ratio, highest B:C ratio was obtained to be 2.11 in PLJ-19 followed by PLJ-01 (2.08), PLJ-11 (2.04), PLJ-16 (1.98), PLJ-20 (1.93), PLJ-18 (1.89) and PLJ-10 (1.86) whereas B:C ratio 1.80 was recorded from check variety.

The observed data on morpho-biochemical study revealed that the germplasm PLJ-19, PLJ-01 and PLJ-11 were found to be promising for commercial cultivation in North East Indian condition.

Shelf life enhancement of Kew Pineapple and *Khasi* mandarin using biotic polymer, microbial antagonist and UV radiation

Jyoti Prasad Mili

Studies were carried out at Department of Horticulture, Assam Agricultural University during the period 2012-2014 with an objective to study the effect of biotic polymer, microbial antagonist and UV radiation on shelf-life of *Khasi* mandarin and Kew pineapple fruits and to study the economics of using the treatments.

The study revealed that decay of fruits was mainly caused by *Penicillium digitatum*, *P. niger*, *P. chryogenum* and *Aspergillus niger* on *Khasi* mandarin and *Penicillium* sp., *Aspergillus niger*, *Fusarium subglutinas*, *Nigrospora* sp. on Kew pineapple. The decay percentage, PLW, pH, TSS, acidity and peroxidase enzyme activity of *Khasi* mandarin and Kew pineapple fruits increased with increase in the period of storage while texture value, fruit weight, moisture content, ascorbic acid and chlorophyll content decreased during storage period.

Amongst all the UV treatments; UV radiation and chitosan combined treatment (T₉) was found most effective in retention of shelf life. UV radiation and *Pseudomonas* combined treatment (T₁₂) and *Bacillus* and *Pseudomonas* combined treatment (T₈) had best result in most of the microbial antagonist treatments on *Khasi* mandarin and Kew pineapple fruits, respectively. Chitosan treatment had produced the best result among all the treatments and helped in retention of fruit texture and colour, had lower decay percentage, lower enzymatic activity and retained overall better fruit quality in both *Khasi* mandarin and Kew pineapple fruits during storage. This might be due to the properties of chitosan which not only has antimicrobial properties but also has the ability to form coating on fruit and vegetable surface, reducing the respiration rate by adjusting the permeability of carbon dioxide and oxygen.

The UV radiation treatment showed less impressive results as compared to chitosan treatment. This was due to the free radicals generated from UV radiation might target cell membranes, nucleic acids, cell walls and enzymes, inducing the acceleration of senescence.

The chitosan treatment was found to be the best in enhancing shelf life in both *Khasi* mandarin and Kew pineapple fruits during storage.

Abstract of Ph.D. Thesis

Department : Horticulture

Major Advisor : Dr. Pritom Kumar Borthakur

Uni-packaging for shelf life extension of *Khasi* mandarin (*Citrus reticulata* Blanco.)

Namita Bhuyan

A laboratory experiment was carried out in the Quality Control and PHT Laboratory, Department of Horticulture, Assam Agricultural University, Jorhat during 2012-2014, to study the effect of packaging materials, storage conditions and different altitudes on quality and storability of *Khasi* mandarin.

The fruits were harvested at physiologically mature, i.e. colour break stage from three different altitude viz., relatively high altitude, medium altitude and low altitude. Healthy fruits were treated with 100 ppm sodium hypo chloride solution for 2 minutes. After drying the fruits in shade, fruits were uni-packed in different perforated packaging films viz., low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), polyvinyl chloride (PVC) and polyolefin films. The film-packed fruits were then stored under ambient (22-27°C and 70-75% RH), A.A.U developed semi-underground evaporative cool chamber (17-24°C and 89-90% RH) and cold storage conditions (6°C and 68-72% RH). The various physico-chemical and sensory attributes of fruits were recorded at weekly intervals during the entire storage period.

Among the packaging materials, fruits packed in perforated HDPE films retained the highest sensory and nutritional quality (ascorbic acid, total carotenoid and pectin content) with slow and steadier change in the respiration rate, ethylene evaluation, PME activity, moisture content, titrable acidity and weight loss as compared to control (unpacked fruits). In all the packaged fruits under different storage conditions, the value of CCI (Citrus colour index) increased with progress of storage period. Fruit packed in perforated HDPE films under cold storage registered lower CCI value (1.66) compare to other packaging materials and storage conditions. Highest value was recorded in unpacked fruits (3.01) under cold storage condition.

Higher amount of juice per cent was found in low altitude fruits but acidity and vitamin C was lower as compared to high altitude fruits. From the sensory quality study, it was observed that higher and medium altitude fruits packaged with perforated HDPE films scored the highest values on colour, texture, flavour and overall acceptability under all the storage conditions during the entire storage period. The lowest acceptability and sensory quality was registered in lower altitude fruits without packaging films.

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Department : Horticulture
Major Advisor : Dr . P. C. Barua

Individual *Khasi* mandarin fruit packed with perforated HDPE films can be successfully stored for 32 days under ambient condition, 40 days under evaporative cool chamber and 59 days under cold storage condition with highly acceptable sensory quality. The control (unpacked) fruits, on the other hand, maintained postharvest shelf life of 15, 28 and 37 days under ambient condition, evaporative cool chamber and cold storage condition, respectively. These results indicate that use of perforated HDPE films can prolong the shelf life by maintaining quality attributes and external appearance of *Khasi* mandarin fruits and hence extend their marketing period.

Morpho-biochemical characterization of pummelos (*Citrus grandis* L.) of Assam

Rinku Bharali

Pummelo (*Citrus grandis* L.), commonly known as 'Rabab Tenga' is an underutilized citrus fruit of Assam. It is mostly grown as backyard crop in homestead garden. The fruit is a rich source of vitamins, minerals, flavonoids, limonoids etc. It is monoembryonic in nature and highly cross pollinated. Most pummelo plants are of seedling origin in the region and thus tend to exhibit a wide range of variability in terms of morphological and biochemical parameters. Therefore, an investigation was undertaken during 2014-2016 on 'Morpho-biochemical characterization of pummelos (*Citrus grandis* L.) of Assam to study the existing variability. One district in each of the six agro climatic zones was chosen and four plants were selected in each district, comprising of twenty four plants. Wide variability was observed among the selected pummelo accessions for qualitative characters of tree, leaf, flower, fruit and seed. Five different fruit shapes were recorded viz. spheroid, pyriform, obloid, obovoid and ellipsoid. Wide variations in pulp colour i.e. ivory white, pink, light red and red were recorded in the selected pummelos. Cluster analysis of 23 qualitative characters using UPGMA resulted in grouping of the pummelo accessions into three broad groups and four sub groups. Group I consisted of two accessions (AP04T2 and AP06T4) which had twelve characteristic traits. Group II consisted of eight accessions from all the locations with one characteristic trait (white albedo colour) and varied for all other traits. Group III consisted of fourteen accessions from all the locations with one characteristic trait (pink albedo colour). No groups were formed based on geographical location indicating that qualitative traits were largely influenced by genetic factor. The quantitative characters of flower, leaf and fruit showed significant variation among the pummelo accessions. The maximum fruit weight was recorded in accession number AP02T2 (1523.40 g) and the minimum was recorded in AP03T4 (379.00 g). In terms of biochemical constituents, the highest TSS was recorded in accession number AP06T3 (12.54 °Brix) and the lowest was recorded in AP05T3 (7.16 °Brix). The highest TSS-acid ratio was recorded in accession number AP06T2 (16.37) and the lowest was recorded in AP05T2 (6.01). HPLC quantification of naringin and limonin showed significant variations among the pummelo accessions which ranged from 6.07 to 47.71 mg/100ml and 2.37 to 7.09 mg/100ml, respectively. Some of the morphological traits

Abstract of Ph.D. Thesis

Department : Horticulture

Major Advisor : Dr. R. K. Bhattacharyya

i.e. fruit length, seeds per fruit, juice per cent showed significant variation among different locations. Significant differences among the locations were observed with respect to biochemical constituents of pummelo juice. The highest TSS, total sugar, TSS-acid ratio were recorded in location L6 (Cachar) and the lowest value was recorded in location L5 (Karbi Anglong). Comparison among three types (white flesh, pink flesh and red flesh) of pummelo revealed that the red type had higher TSS, total sugar, TSS acid ratio and total flavonoid content whereas high ascorbic acid content was recorded in white type which significantly correlated to total antioxidant activity. In the present study, fourteen different fruit forms were recognized based on fruit shape, albedo colour and pulp colour. Six superior types were identified having high TSS acid ratio, less seed content, thin to medium rind thickness with medium fruit size. Propagation of pummelo accessions through seeds recorded 78.5% germination while cuttings recorded low success percentage of 4.16 and air layering recorded a higher success percentage of 71.66.

Characterization of different ecotypes of Assam lemon

Sarmistha Rani Baruah

Assam is very rich in citrus wealth. Variability is observed in different citrus germplasm including *Citrus. limon* (Hazarika, T.K. 2011). It has wide adaptability in this region as evidenced by its availability throughout the North East India up to an elevation of 1700m. However, only two types of citrus are commercially grown in Assam, one is Khasi mandarin (*Citrus reticulata*) and another is Assam lemon (*Citrus. limon*). Various forms of Assam lemons (Kazi nemu) available in different districts of Assam were explored by Hazarika, T. K. (2011). But, So far no attempt has been made to document and characterize the diversity of Assam lemon germplasm available in Assam. Regarding post harvest study of Assam lemon, limited post-harvest studies has been carried out with reference to increase the shelf life. Therefore, this investigation was directed to characterizing 30 Assam lemon accessions based on morphological markers and also to study the post harvest behaviour of the variety.

The dissimilarity matrix ranged from 4.72 to 11.60 indicating diverse nature of collected accessions. The lowest coefficient of dissimilarity (4.72) was observed between KP-1 and TZ-3 signifying that they were closely related. The highest coefficient of dissimilarity (11.60) was observed between TZ-1 and KN-2 signifying that they were the most distant of all the collected accessions. Dendrogram based on the Euclidean distance using UPGMA cluster analysis of morphological and biochemical characters, differentiated 30 accessions in to three major clusters, cluster-I, cluster-II and cluster-III. Thus, cluster analysis revealed sufficient variation between the collected accessions by grouping them in to different clusters. The principal component analysis (PCA) of the traits revealed that, the first 12 principal components were important out of total 30 components and they accounted for 82.71 % of the total variability. Based on PCA and correlation matrix of 34 morphological and biochemical traits, 23 traits were identified as minimum descriptor for easy evaluation and preliminary characterization of Assam lemon germplasm. The clustering pattern based on 34 traits and that based on 23 descriptors were found to be identical indicating that, the prepared minimum descriptor is likely to cover the existing diversity of the variety.

Regarding post harvest changes during storage of Assam lemon fruits, individual shrink wrapped fruits (Treatment4) stored at ambient temperature (30-32°C and 80-85% RH) showed better results in respect to fruit colour, firmness, respiration and citric acid content and helped to extend the shelf life without deterioration in quality of the fruit.

Abstract of Ph.D. Thesis
Department : Horticulture
Major Advisor : Dr. U .Kotoky

Carpogenic germination of Sclerotia of *Sclerotiniasclerotiorum* (Lib.) de Bary and development of an IDM modules for management of *Sclerotinia* rot of French bean

C. Lalfakawma

Studies conducted on morphological and pathogenic variability among 30 isolates of *Sclerotiniasclerotiorum* (Lib) de Bary, derived from infected French bean (*Phaseolus vulgaris*) plants showing typical symptoms of white mold, collected from different geographical location of NE. All the isolates showed variation in morphological characters based on their mycelial growth, colony character and sclerotial formations. Out of 30 isolates, 14 isolates showed highly virulent reaction, each of 8 isolates revealed moderately and less virulent reaction respectively on French bean. HPLC analysis of mycelial culture extracts of highly, moderately and less virulent isolates from *S. sclerotiorum* showed that higher number of phenolic acid and higher concentration of oxalic acid were observed in highly virulent isolates of *S. sclerotiorum*, while lowest number of phenolic acids and least conc. of oxalic acid detected in less virulent isolates. In *in vitro* study of growth of highly virulent isolates of *S. sclerotiorum* against fungal antagonists showed that *T. harzianum* caused maximum inhibition of radial growth of *S. sclerotiorum* among the antagonists. Maximum growth and least per cent inhibition of radial growth by different antagonists was observed in AS₃ (Assam) isolate of *S. sclerotiorum*.

Effect of burial depth, soil drenching with Carbendazim and mycoparasites on carpogenic germination of Sclerotia of *S. sclerotiorum* were evaluated under pot condition. It was observed that higher number of apothecia were produced when Sclerotia placed at '0' cm depth, while no apothecia were found at deeper depths viz., 6, 8 and 10cm respectively. Soil application of Carbendazim were more effective when applied 10 days after burial as compared to application at '0' day of burial in inhibition of carpogenic germination of Sclerotia and there was a decreased sclerotial germination with increased concentration of fungicide. Amongst the antagonists, *T. harzianum* was found to be the most effective agent and caused highest reduction in carpogenic germination of Sclerotia followed by *G. virens* and *T. koningii* respectively.

Abstract of Ph.D. Thesis
Department : Plant Pathology
Major Advisor : Dr. B.C. Das

Under field condition, maximum reduction of white mold incidence and higher growth response and yield were observed when seeds were treated with Carbendazim @ 0.2% and it was integrated with soil application of *T. harzianum* @ 2%(w/w) of soil and Carbendazim spray @ 0.1% at 15 and 30 DAG in FYM amended soil as compared to other treatment combinations.

Rhizome rot of ginger (*Zingiber officinale* Rosc.) – Pathogenic variability, effect of soil physico - chemical properties on disease severity and management

Kausar Hasina Begum

A study was conducted to find the organism(s) associated in causing Rhizome rot of Ginger under Assam situation, their conventional as well as molecular identification, effect of soil physico-chemical properties on rhizome rot disease and management through soil amendment and pH manipulation. Observation on thirty nine samples from different districts covering all the Agro-Climatic zones of Assam revealed the association of *Pythium myriotylum* (7.69%), *Ralstonia solanacearum* (41.02) and *Fusarium oxysporum* f.sp. *zingiberi* (51.28%). Cultural and morphological studies indicate variability amongst the isolated. Further, study on intra-specific genetic variation of the dominant pathogen (*Fusarium oxysporum* f.sp. *zingiberi*) by Random amplified polymorphic (RAPD) technique indicate that the isolates can be divided into two clusters with coefficient of similarity ranged from 0.28 to 0.89. Interactive effect of the three pathogens revealed synergistic effect on rhizome rot disease. The highest disease incidence (90%) was recorded when all the three pathogens are applied together followed by the treatment where *Pythium myriotylum* and *Ralstonia solanacearum* (86.67%) is applied in combination

Effect of soil physico chemical properties on rhizome rot of ginger incidence indicates dominant role of Potash on disease incidence and a ready to use formula has been proposed to predict disease incidence on the basis of Potash content of a particular soil. Management of the disease through soil amendment as well as pH manipulation revealed that the rhizome rot incidence was lowest at pH 5.5 and vermicompost level 6t/h (28.33%) with highest yield of 606.7 gm as against 78.33% disease incidence and yield of 116.67 gm in control.

Abstract of Ph.D. Thesis

Department : Plant Pathology

Major Advisor : Dr. Ashok Bhattacharyya

Development of RNA based vaccine against Cucumber mosaic virus infecting Bhut Jolokia (*Capsicum chinense* Jacq.) crop and Citrus tristeza virus infecting citrus plantations of Assam

Munmi Borah

Development of RNA based vaccine against *Cucumber mosaic virus* infecting Bhut Jolokia (*Capsicum chinense* Jacq.) crop and *Citrus tristeza virus* infecting citrus plantations of Assam” were carried out at and Department of Plant Pathology, Assam Agricultural University, Assam, India and Laboratory of Plant Breeding and Biometry, Department of Crop Science, AUA, Athens, Greece.

Utilizing virus genome properties enabled the design of novel, safe, and efficacious vaccines against different viral diseases infecting plants. In this study, it was shown that, dsRNA derived from viral sequences could interfere with cognate virus infection in a sequence-specific manner by delivering dsRNA to plant cells. In dsRNA-mediated protection, a dsRNA homolog of a viral silencing suppressor gene expressed in plants, which interferes with or prevents various stages of the viral life cycle, resulting in attenuated disease symptoms or resistance. It was aimed to produce CMV specific RNA vaccine to manage CMV infecting Bhut Jolokia crop of Assam. Application of these RNA based vaccines at the seedling stage could effectively reduce CMV infection at the later stage of the crop. These virus-free seedlings of Bhut Jolokia crop could give rise to a healthy crop growth. Taking it as a model system, it was further aimed to produce CTV specific RNA vaccine and to carry out a proof-of-concept to substantiate the same concept further in management of CTV infecting citrus plantations of North East India. A protocol for the synthesis of dsRNA using T7 RNA polymerase was utilized to produce RNA based vaccine against *Cucumber mosaic virus* infecting Bhut Jolokia (*Capsicum chinense* Jacq.) crop and *Citrus tristeza virus* infecting citrus plantations of Assam.

CMV-encoded 2b gene based dsRNA was produced and tested against CMV infecting Bhut Jolokia (*Capsicum chinense* Jacq.) plants of Assam. The infection of CMV in Bhut Jolokia pepper plants was successfully interfered, demonstrating the applicability of RNA-based vaccination. In this study, double-stranded RNA derived from CMV-2b silencing

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Department : Plant Pathology
Major Advisor : Dr. P.D. Nath

suppressor gene sequence in *Escherichia coli*, could interfere with cognate virus infection. When dsRNA CMV-2b exogenously applied, along with CMV strain, onto Bhut Jolokia plants resulted in suppressing CMV infection. DAS-ELISA was used to identify the presence of CMV in the inoculated plants. Bhut Jolokia Pepper plants infected with CMV became severely stunted, nonproductive with dull light green foliage having a leathery appearance. In contrast, plants that received dsRNA of CMV-2b were less symptomatic and remained healthy as compared to those infected by CMV. Four experiments were conducted where; disease incidence was 15%, 5%, 29.5% and 0% when dsRNA of CMV-2b molecules were co-applied with CMV, as compared to 55%, 55%, 92% and 70% when only CMV was infected. As a result of dsRNA mediated resistance crop canopy increased, which is necessary for improved yields of the crop. This study constitutes a non transgenic approach of protection of Bhut Jolokia pepper plants against CMV.

With the success of CMV specific RNA vaccine, the investigation further aimed towards production of a dsRNA construct coding for the three silencing suppressors of CTV to generate RNA-based resistance and to conduct a proof-of-concept of specific protection against viral infection. It was aimed to get more insight on the role of the CP, p20 and p23 genes as silencing suppressors of CTV in pathogenesis through topical application of these dsRNA molecules. The CP, p20 and p23 gene sequences of the North East India strain of *Citrus tristeza virus* was folded into a double-stranded (ds) RNA structure. dsRNA of sufficient quantities (several micrograms) obtained using in vitro transcription protocols for CP, p20 and p23 genes of the virus. The proof-concept experiment on application of these dsRNA against CTV infected citrus plants revealed that, while applied topically over leaf surface against the cognate virus, all three dsRNA constructs (CTV-CP, CTV-p23 and CTV-p20), could suppress the virus replication. This results successfully interpreted the proof-of-concept about the suppression of viral titre locally up to 10 days of topical application, through RNAi based method in citrus crop infected with CTV-North East India strain.

The results support the view that a dsRNA intermediate in virus replication acts as efficient initiator of post transcriptional gene silencing in natural virus infections, triggering the viral RNA for degradation. A dsRNA construct encoding silencing suppressors could be significantly suppressed the replication of viruses and confer potential resistance against the virus.

Bioremediation of iron toxicity in lowland rice ecosystem of Assam

Danish Tamuly

Two sets of experiment *viz.*, pot (2012-13) and field (2013-14) was carried out to find bioremediation potential to ameliorate iron toxicity in lowland rice ecosystem of Assam. Rice crop was cultivated in Yoshida medium (hydroponic culture) developed specifically for rice. The experimental set up consisted of 6 boxes containing 60 PVC cut pipes each. Two check cultivars namely *Mahsuri* (sensitive) and *Padumoni* (tolerant) were tried along with eight test cultivars namely *Ranjit*, *Moniram*, *Kushal*, *Pankaj*, *Luit*, *Basundhara*, *Jaymoti* and *Bahadur*. Two weeks old seedlings from sand cultured nursery beds were transplanted into the PVC pipes fixed with half-split foam plugs in such a way that only root was in direct contact with the Yoshida solution. Liquid paraffin oil (low density) was added to each PVC pipe to maintain a 3 mm layer for checking oxidation process. Three bacterial inoculations *viz.*, Control, PSB_{5w} and PSB_{25w} along with four iron levels, 0, 500, 1000 and 1500 mg Fe L⁻¹ were tried in different combinations.

Sampling at maximum tillering stage of crop revealed leaf scoring ranging from 0.0 to 4.9 with a mean of 0.3 to 3.7. The highest mean scoring of 3.7 was observed at 1500 mg Fe L⁻¹, which was followed by 1000, 500 and 0 mg Fe L⁻¹ with 2.9, 1.4 and 0.3 scoring respectively. The least scoring of 1.2 was observed in PSB_{5w} followed by PSB_{25w} (2.0) and PSB₀ (3.1) inoculated cultivars. Among the rice cultivars the leaf scoring was in the order *Mahsuri* (1.4) < *Joymoti* (1.6) < *Moniram* (1.7) < *Prafulla* (1.9) < *Podumoni* (2.0) < *Ranjit* (2.2) < *Luit* (2.2) < *Kushal* (2.3) < *Basundhara* (2.4). Increasing levels of iron from 0 to 1500 mg Fe L⁻¹ was found to significantly reduce the yield attributing traits of cultivars *viz.*, root length (8.0 to 7.0 cm) and shoot length (22.4 to 17.6 cm). Similar reduction was also observed with N, P and K content in both leaf and stem i.e. leaf N (2.42-0.97%), stem N (1.55-0.90%), leaf P (0.220-0.041%), stem P (0.271-0.039%), leaf K (0.473-0.069%) and stem K (1.420-0.208%). The Fe content in different plant parts *viz.*, leaf, stem and root was found to significantly increase with increased Fe-level. Mean root Fe-plaque was found to significantly increase from 0.19 (Fe₀) to 0.94 (Fe₁₅₀₀) mg Fe g⁻¹ root. PSB x Fe-level had significant effect on agronomic growth traits *viz.*, root length and number of leaves and on N, P and K content in both leaf and stem. Both leaf and stem N content was found to be

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Department : Soil Science
Major Advisor : Dr. K.N. Das

significantly higher with cultivars inoculated with PSB_{5w}. However, P and K content in both stem and leaf were found to be higher in PSB_{25w} inoculated cultivars. PSB_{5w} inoculated cultivars recorded significantly lower leaf Fe, stem Fe and root Fe than control and PSB_{25w}. Significantly, higher root Fe plaque was found in cultivars inoculated with PSB_{5w} than PSB_{25w} and control. Negative and significant correlation exist between scoring with root length, shoot length, number of leaves, leaf N%, stem N%, leaf P%, stem P%, leaf K% and stem K%. However, positive and significant correlation was observed between scoring with leaf Fe, stem Fe, root Fe and Fe plaque.

Subsequent validation of results of pot experiment was carried out in the ICR Farm, AAU, Jorhat. Six rice cultivars viz., *Mahsuri*, *Moniram*, *Joymoti*, *Prafulla*, *Podumoni* and *Ranjit* in increasing order of scoring were selected. Following this, the strain PSB_{5w} which showed least scoring was also selected with the highest iron level of 1500 mg Fe L⁻¹. PSB_{5w} inoculated cultivar showed significantly higher root length (21.50 cm), leaf N (2.20%), leaf P (0.313%), stem P (0.277%) and leaf K (0.804%) than non inoculated cultivars. Except for *Moniram*, all other cultivars showed significantly lower leaf and stem iron content. Significant difference in grain yield was observed with inoculated (1730.70 kg ha⁻¹) and non-inoculated (1644.30 kg ha⁻¹) cultivars. Relatively higher grain yield was achieved in PSB_{5w} inoculated cultivars *Mahsuri* (2000 kg ha⁻¹) and *Prafulla* (1850 kg ha⁻¹) as compared to control.

Thus the *Bacillus* sp. PSB_{5w} with suitable carrier material can be used as a bioremediation tool for chronically Fe-toxic lowland rice ecosystem in Assam. Further, a stress encountering bio-package consisting of seedling root dip treatment in PSB_{5w} especially for rice cultivars *Mahsuri* and *Prafulla* may be advocated for Fe toxicity affected low land rice ecosystem from the present investigation.

Effect of long-term tea cultivation on soil and water quality in some soils of Jorhat District, Assam

Nandita Baruah

Tea (*Camellia sinensis*) is one of the most important perennial cash crops of Assam used for domestic consumption and export. Assam produces 55% of the tea produced in India and $\frac{1}{6}$ th of the tea produced in the world. The total area under tea cultivation in Assam is 3,22,214 ha which is more than half of the country's total area under tea. Most of the small tea gardens of the state are confined to Upper Brahmaputra valley zone where Jorhat accounts for 13% (139 nos.) of the total tea gardens. A study on productivity trend in 83 tea estates spreading over 35,423 ha in three agro-climatic regions of North-East India showed a decline of factor productivity from different age group of Tea irrespective of cultivars and agro-climatic conditions. Though the underlying causes were not clear, the deteriorating soil health over prolonged monoculture and depletion of nutrients or nutrient imbalance compounded by poor physical, chemical and biological conditions of the soils appear contribute significantly. Among the other factors concerned, deterioration in soil quality may be one of the reasons for this un-sustainability. Therefore, the present investigation was undertaken to identify the Minimum data Set for soil quality assessment in these production systems. Through principal component analyses, critical soil quality indicators identified in deep, fine loamy well drained soil under less than 15 years of continuous cultivation were Av N, MWD, pH, Ex Ca, PD and Av Zn. Among these, most sensitive indicator of soil quality was Av N and its value contributed to 34.50 % towards SQI. Under 15-30 years of cultivation, the critical soil quality indicators identified were TN, pH, AWC, BD, CEC, Av Zn and TN contributed maximum 28.83% towards SQI. Under 30-45 years of cultivation, the critical soil quality indicators identified were TN, WHC, BD, CEC, Av P₂O₅, pH. The TN contributed around 27.7% towards SQI. Under 45-60 years of cultivation the Av N, F, BD, Av P₂O₅, Av Zn are MDS indicators and Av N contributes the highest 37.59% towards SQI. Under more than 60 years of cultivation, Ex Ca, Clay, AWC, Av N, Av K₂O and DHG and Ex Ca contributed maximum 31.66% towards SQI. On the other hand, critical soil quality indicators identified in very deep, fine loamy, well drained soil under less than 15 years of continuous cultivation were pH, Ex Ca, Av P₂O₅, WHC, Av K₂O, OC and CEC. Among these, most sensitive indicator of soil quality was pH and its value contributed to 21.71%

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Department : Soil Science

Major Advisor : Dr. B.K. Medhi

towards SQI. Under 15-30 years of cultivation, the critical soil quality indicators identified were TN, clay, pH, Ex Ca, F, DHG, Av K₂O, CEC and Av P₂O₅ and TN contributed maximum 20.94 % towards SQI. Under 30-45 years of cultivation, the critical soil quality indicators identified were Av N, Ex Al, OC, MBC, Av P₂O₅, Av Zn and PD. The Av N contributed around 25.61% towards SQI. Under 45-60 years of cultivation the OC, BD, Av K₂O, MBC, F, Av N and Av Zn are MDS indicators and OC contributes the highest 27.82% towards SQI. Under more than 60 years of cultivation, Ex Al, WHC, DHG, EC, BD, Av B, MWD, and Av Zn and the Ex Al contributed maximum 27.64% towards SQI. In very deep, coarse loamy, well drained soil critical soil quality indicators identified in very deep, fine loamy well drained soil under less than 15 years of continuous cultivation were OC, Av K₂O, pH As, Av Zn, MBC and DHG. Among these, most sensitive indicator of soil quality was OC and its value contributed to 32.88% towards SQI. Under 15-30 years of cultivation, the critical soil quality indicators identified were OC, AWC, Av B, pH, Av P₂O₅, F, Ex Ca and MWD and OC contributed maximum 19.91% towards SQI. Under 30-45 years of cultivation, the critical soil quality indicators identified were Av Fe, WHC, CEC, PD, Av K₂O. The Av Fe contributed around 31.04% towards SQI. Under 45-60 years of cultivation the OC, Ex Al, AWC, Av B, EC are MDS indicators and OC contributes the highest 30.23% towards SQI. Under more than 60 years of cultivation Ex Al, WHC, MWD, Av N, MBC, DHG. The WHC contributed maximum 25.52% towards SQI. The soil quality index under very deep, coarse loamy, well drained soil was found to be lowest (10.34) and the highest (15.34) was in very deep, fine loamy, well drained soil.

Mapping of Carbon Stock in different Agro-Ecosystems of Jorhat District using Remote-sensing

Rashmi Baruah

Soil organic carbon mapping at larger scale to assess the carbon stock using remote-sensing is useful in predicting the need based strategies to be adopted in the context with land use change and different land management scenarios. The present study aims to develop data base for mapping carbon stock in different agro-ecosystem (AESs) for forest and agricultural lands of Jorhat district and to study the effectiveness of contiguously spaced spectral bands *vis-a-vis* other multispectral remote-sensing in carbon stock assessment.

This study revealed that forest ecosystem had higher potential to sequester carbon than agricultural land. Among different agro-ecosystems (AESs), *Humid Alluvial Flood Free (HAFF)* situation have the highest biomass C stock followed by *High Land (HL)*, *Humid Alluvial Flood Prone (HAFP)* and lowest in *Char Area (CA)*. Soils of Jorhat district have high amount of organic carbon, especially in forest area of *HL* and *CA*. Among physical properties, bulk density ranged from 1.0-1.48 g/cc in *HAFF*, 1.19-1.61 g/cc in *HAFP*, 1.08-1.43 g/cc in *HL* and 1.15 g/cc to 1.51 g/cc in *CA* with increasing trend down the profile. In all the profiles under study, limit of variability in BD was within 11% of observed value with respect to mean. Sand content was dominant in all AESs followed by clay and silts content, baring for *HL* and *CA*. The extent of variability in relation to mean was found to be highest in silt fraction followed by clay and sand in *HAFF* and *HL* situations, while, highest variability was observed in case of clay followed by silt and sand fractions in *HAFP* and *CA*. Among different chemical properties, soil pH ranged 4.19-6.39 in *HAFF*, 5.26-7.22 in *HAFP*, 5.06-6.14 in *HL* and 5.35-6.88 in *CA*. Soil organic carbon ranged 0.90-20.40 g/kg in *HAFF*, 1.50-14.70 g/kg in *HAFP*, 1.20-17.40 g/kg in *HL* and 0.30 g/kg to 16.50 g/kg in *CA*. Cation exchange capacity (CEC) ranged from 1.80-9.80 cmol (p⁺) kg⁻¹ in *HAFF*, 0.13-10.20 cmol (p⁺) kg⁻¹ in *HAFP*, 5.0-17.40 cmol (p⁺) kg⁻¹ in *HL* and 0.60-13.0 cmol (p⁺) kg⁻¹ in *CA*. The maximum variations with respect to mean was found in case of EC followed by CEC and then pH in all AESs but in *CA*, soils showed highest variations in case of organic carbon (OC) followed by TN. Profiles under forest land use system exhibited relatively higher SOCD than paddy irrespective of AESs with an exception in one location of *HAFF* where

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Major Advisor : Dr. B.K. Medhi

land use under paddy showed higher value than forest land use system. Highest SOCD was recorded in *HL* followed by *HAFF*, *HAFP* and lowest in *CA*. Soil carbon stock (SCS) was highest for *HAFF* (56.24Tg) followed by *HAFP* (35.61 Tg), *HL* (12.29Tg) and lowest was recorded in *CA* (4.36Tg). Variations in SOCD of 94.20 per cent were found to be predictable from OC, depths, TN and clay content in forest soils, whereas, 89.40 per cent variations in SOCD were predicated from OC, depth and BD in case of paddy soil. Soil OC had significant negative correlations with pH ($r = -0.496^{**}$) and BD($r = -0.594^{**}$) while, it was correlated positively with Clay ($r = 0.447^{**}$), CEC($r = 0.454^{**}$) and TN ($r = 0.496^{**}$). Similarly, SOCD showed negative and significant correlation with pH ($r = -0.395^{**}$) and BD($r = -0.353^{**}$) and positive significant correlation with clay ($r = 0.443^{**}$), CEC ($r = 0.291^{**}$) and TN ($r = 0.256^{*}$).

Maximum efficiency to remove tones equivalent of CO₂ from atmosphere as stable carbon was worked out to be highest in *HAFF* (2145.70 Tg) followed by *HL* (899.59 Tg), *HAFP* (616.85 Tg) and Char (16.0 Tg) which indicate potential efficiency of these zone in carbon sequestration and therefore, it is important in strategizing zones to plan for increasing efficiency accordingly in putting much thrust to conserve such situation in climate resilient perspective point of view. Moreover, spatial map prepared by kriging was found to be accurate with minimum error. Semivariogram generated by kriging showed higher autocorrelation of samples with minimum sampling error (Nugget value <1.0). Soil carbon stock could easily be calculated using krig map and could be recommended for precise data estimation. Considering total geographical area of Jorhat district (2852 sq.km), total potential for CO₂ removal from atmosphere was worked to be 30.41 Tg as stable carbon over the Agro-Ecosystem.

Impact of micro enterprise on economic empowerment of women entrepreneurs of Assam

Pubali Saikia

Women play an important role in the development of our country. Therefore, entrepreneurship development among women is a global issue. It is important for development of a family and social progress. Micro enterprise is also considered as a right path for economic development among women. The study entitled “Impact of micro enterprise on economic empowerment of women entrepreneurs of Assam” was undertaken with the objectives of i) To develop a complete understanding of the women entrepreneurs engaged in micro enterprises, ii) To study the problems faced by the women entrepreneurs in establishing and managing the micro enterprises, iii) To identify problems faced by the promotional agencies in performing their role, iv) To provide suggestive measures for better performance of the entrepreneurs. The present study was conducted in three districts namely Jorhat, Lakhimpur and Kamrup district of Assam. Proportionate random sampling technique was adopted for selecting the sample of 240 women entrepreneurs for the present investigation. Both registered and unregistered women entrepreneurs were selected for this study. Data were collected through interview method using structured interview schedule and scale developed by the researcher for this study. A total of 32 number of promotional agencies were included to find out the problems faced in promoting women entrepreneurs. The findings revealed that a large majority of the respondents (75.00% in weaving, 90.83% in food processing and preservation) were from lower middle age group, general caste. Forty per cent in weaving completed H.S.L.C. while 34.16% engaged in food processing and processing passed H.S. Majority were married (84.17%, 88.33%), had nuclear and small family in the profession of weaving 63.33%, food processing and preservation (61.67%). Majority of respondents possessed pucca houses (75.00% in weaving, 70.00% in food processing and preservation). Only 26.66 per cent to 30.00 per cent had organizational membership, involvement in enterprise was every day for 79.17 per cent in weaving and 53.33 per cent in food processing and preservation, average time spent was four hours. Personal motivational factor was ranked I by the respondents in both the areas.

Sole proprietorship was recorded for most of the respondents, engaged regular employees (71.67%) and daily wage earner (40.00%), selected monthly repayment for

Abstract of Ph.D. Thesis

Department : Extension and Communication Management (H.Sc)

Major Advisor : Dr. (Mrs) Manoshi Baruah Deka

employees in both the areas. Chaddar –Mekhela, *pitha* , *laddu* were most popular woven and processed products prepared by majority of respondents engaged in the area of weaving and food processing and preservation respectively, started business in own land (90.83%,95.00%), invested own capital (83.33%, 90.00%),financed by Assam Gramin Vikash Bank (8.33%) and Nationalized banks (7.50%),selected monthly mode of repayment (15.00%, 10.00%) in both the areas. Majority (56.67%, 75.00%) of the respondents started their business in katcha houses as business premises and preferred self marketing .Problems reported in different areas such as financial, socio-personal, managerial, raw material, technical and marketing were shortage of money, lack of technical knowledge on maintenance of machineries and attachments, lack of coordination among employees, availability of quality raw material and limited to retail marketing. Suggestions offered by the respondents were increase in number and frequency of training in different locations, conducting awareness to improve the knowledge on banking procedures for availing of loan and other services. Officials of promotional agencies reported that lack of knowledge on legal procedure of bank and poor participation in EDP training by women entrepreneurs to start an enterprise were ranked I and II respectively. The change in different aspects of empowerment such as economic, social, familial was highly significant for entrepreneurship engaged in weaving and food processing which was indicated through different indices and CRD analysis.

Economic Empowerment of Rural Women of Assam through Agro-based Enterprises

Rulima Bharali

The present investigation on economic empowerment of rural women of Assam through agro-based enterprises was carried out in three agro climatic zones. A multi stage purposive cum simple random sampling design was followed for sample selection. Two districts from each zone, namely Jorhat and Dibrugarh of Upper Brahmaputra Valley Zone, Udalguri and Darrang from North Bank Plain Zone and Kamrup (M) and Kamrup (R) of Lower Brahmaputra Valley Zone were selected randomly. All total 240 rural women from 24 villages of selected zones and who were mostly engaged in both vegetable cultivation and livestock rearing were included as respondents for the present study. Data collection was done by using structured interview schedule. The study revealed that majority of the rural women (52.92%) were of middle aged group, married (70.83%) and belonged to middle socio economic status (54.17%) group. Most of the rural women were involved independently in post harvest activities like cleaning and grading of harvested crop (88.33%), collection of seed from harvested crop (83.33%), transplanting, planting and sowing of seeds (74.76%) and application of manure (64.16%). Further they participated independently in different livestock activities such as providing daily feed (82.08%), cleaning of shed (79.16%), care of sick animal (74.58%) and taking care in vaccination of livestock (70.83%). Majority of the rural women had low level of knowledge in vegetable cultivation (44.32%) whereas 40.45% and 15.23% had medium and high level of knowledge respectively. In rearing of livestock majority of the rural women (42.77%) had medium level of knowledge followed by 39.49% and 17.74% had low and high level of knowledge. The major inhibiting factors which hampered in carrying out the agrobased enterprises were lack of technical person for immediate help and solution(2.56), weak marketing linkage(2.55) and sudden outbreak of diseases(2.53). Study also revealed that the agricultural projects planned and working on PPP mode for benefit of rural women increased their economic standard gradually. The five strategic options were drawn by introducing SWOC matrix analysis, namely i) provide specific training on the demand of the entrepreneurs on selected enterprises. ii) continuous assistance from extension personnel about production process and production management iii) develop linkages with input suppliers and markets iv) access to current and reliable market information and v) ensuring easy availability of low cost high yielding breed/variety.

Abstract of Ph.D. Thesis

Department : Extension and Communication Management (H.Sc)

Major Advisor : Dr. (Mrs) Manju Dutta Das

Process development for production and quality evaluation of banana powder

Nimi Barooah

The present study was aimed to optimize the process for producing spray dried banana powder using response surface methodology, from the most commonly available banana variety, i.e., Jahanji (*Musa paradisiaca*). Apart from optimizing the spray drying of banana juice to powder, the other specific objectives included studying of the physicochemical parameters of the optimized powder and its shelf life studies.

Initial studies conducted on the characteristics of banana pulp revealed moisture, protein, crude fibre, fat and total ash content to be 77.52%, 0.81g 100⁻¹, 0.25g 100⁻¹, 1.12g 100⁻¹ and 1.31g 100⁻¹ respectively. Potassium and iron content were found to be 17.6mg 100⁻¹ and 2.53mg 100⁻¹ respectively. Total sugar and reducing sugar were found to be 8.15g 100⁻¹ and 2.15g 100⁻¹ respectively of the banana pulp.

A laboratory scale spray dryer (Model LSD-01) was used in optimization of the banana powder. Using response surface methodology, 15 experimental trials were developed with the independent variables of inlet temperature, atomization pressure and feed rate. The responses evaluated for deciding the optimum conditions were product yield, bulk density, tapped density, particle density, porosity, flowability, cohesiveness, pH, water activity, wettability, dispersibility, hygroscopicity, degree of caking, water absorption index, water solubility index and non enzymatic browning.

Out of all the responses, based on the deduced values of moisture content, bulk density, tapped density and hygroscopicity were selected to optimize the independent variables in spray drying of the banana juice powder. The derived optimum conditions of inlet temperature (175.8°C), atomization pressure (0.57mPa) and feed rate (6ml/ min) were used for further production of spray dried banana powder.

Banana powder properties and process parameters yielded best quality powders with a yield of 71.63%. Moisture, protein, crude fibre, fat and total ash content of the optimized powder were 2.44%, 4.26g 100⁻¹, 0.44g 100⁻¹, 0.092 g 100⁻¹ and 1.86 g 100⁻¹ respectively. Potassium, iron, total sugar, reducing sugar and titrable acidity content were recorded to be 30.1mg 100⁻¹, 4.07mg 100⁻¹, 196g 100⁻¹, 25.73g 100⁻¹ and 2.98% respectively. The physical parameters analysed were: bulk density (0.32g/cm³), tapped density (0.41 g/ cm³), particle density (1.39 g/ cm³), porosity

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Department : Food Science and Nutrition (H.Sc)

Major Advisor : Dr. Pranati Das

(1.39%), flowability (65.6), cohesiveness (21.30), pH (4.95), TSS (18), a_w (0.33), dispersibility (73.37%), wettability (192 secs), hygroscopicity (23.89%), degree of caking (96.67%), water absorption index (44.44%), water solubility index (42.67%) and non enzymatic browning (0.037) in banana powder. Second order polynomial regressions equations were developed to establish a statistically significant relationship between the independent and the dependent variables.

Storage studies were conducted on the optimized banana powder for a period of 90 days starting from 0 day at an interval of 30 days across all the three types of packaging materials viz., aluminium foil laminated pouch, high density polyethylene and low density polyethylene. Physico chemical parameters studied on the optimized powder revealed that moisture content increased significantly at 60 days ($F=9.50$) and 90 days ($F=15.05$) of storage at 5% probability level. Thus irrespective of packaging material, banana powder could be stored upto 30 days without deterioration in quality.

Reducing sugar depicted a non significant increase in all the three types of packaging materials across storage. However, total sugar content of the banana powder depicted a significant increase at 90 days ($F=4.08$). Acidity of the powder declined non significantly across storage whereas browning too depicted a non significant increase in all the three types of packaging material.

Organoleptic properties in terms of taste and flavor did not have significant effect in all the three types of packaging materials across storage. Colour had a significant effect ($F=5.56$) on the storability of the banana powder at 90 days of storage. Texture of the optimized banana powder showed a significant change from 30 days of storage in all the three types of packaging materials ($F=6.33$).

As of microbiological assay, significant increase in the microbial load was evident in the sample from 30 days of storage at 5% probability level upto 90 days. At 0 days though, the microbial count depicted non significant increase among all the three types of packaging materials. At 30 days, microbial load was found to increase significantly ($F=4.7931$) from 0 to 0.40×10^{-6} cfu/ml at 5% probability level in all the 3 packaging materials, aluminium foil laminated pouch being the best packaging material owing to low cfu count of microorganism. Significant increase in microbial load was observed at 60 days ($F=7.8876$) and 90 days ($F=3.4059$), where AFLP too exhibited low microbial count. It can therefore be concluded that aluminium foil laminated pouch was the best packaging material owing to lower microbial count. However, comparing with the FSSAI standards for permissible limits of microbial count for dehydrated products, the microbial load in the present study was much higher than the FSSAI standard of 40,000 cfu/ml. It could be therefore concluded that good quality banana powder was produced with the optimised parameters by using maltodextrin as a drying aid. The optimised banana powder was rendered edible for a period of one month. Beyond one month, caking started in all the three packaging materials. Browning started in HDPE and LDPE packaging materials beyond 90 days. Microbial load was beyond the permissible limit in all the three types of packaging materials except for AFLP, which showed lower microbial count in the initial period of storage study.

Impact of parental value and gender socialization on intergenerational relationship during adolescence

Krishna Baruah

Parents try to mould their children as per their own wishes. During upbringing they transmit their values, skills, attitudes to children through the process of gender socialization. In the process of transmission of parental messages to their offspring lack of resemblance persists occasionally between the parents and adolescence. Conflict or problem arises when difference of opinion occurs between these two generations. The present investigation was an attempt to investigate the impact of parental value and gender socialization on intergenerational relationship during adolescence. Assessment of parental value hierarchy, pattern of gender socialization and perception of parental value by adolescence were considered to see the impact on intergenerational relationship during the period of adolescence. The study was conducted in Jorhat district of Assam. One hundred and eighty eight adolescents age ranges from 16 yrs to 18 yrs and their parents were selected for the study. To make the sample representative equal numbers of boys and girls from both rural and urban areas were selected. Seven human values which were considered important by the parents while upbringing their adolescent children were selected out of 140 values. Three stories based on real life situations, each covering seven identified values were developed to measure the parental value. Two sets of questionnaires were developed to measure adolescents' perception of parental value and also to measure the relationship between the parents and adolescents. A self report questionnaire was developed and standardized by Blackmore and Hill was used to measure the gender socialization pattern. Another questionnaire by O.P. Aggrawal was used to collect the background information. Parents' responses to the stories were analyzed to identify the parental value hierarchy. All the parents irrespective of their locality and gender of their children consider health as most important value followed by honesty, knowledge, discipline, punctuality, respect for others and patriotism. In the area of gender socialization no distinction has been observed. In case of parental attitude towards their children playing with different toys, parents expressed favourable attitudes for dolls, toy jewellery set for their daughters. Playing with Toy gun was not favoured for both son and daughter. In case of choice of occupation professions

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Department : Human Development and Family Studies (H.Sc)

Major Advisor : Dr. (Mrs) Juri Boruah

like doctor, engineer and teacher are preferred for both son and daughter. Parents do not prefer their son to become beautician and daughter to become an electrician. In case of violent outburst and talking loudly parents do not have any distinction between their sons and daughters. None of the parents like their adolescent boy to dress or act like girls. Results of the present investigation showed that parental values are accurately perceived by their adolescents. Adolescent's perception of all the seven parental values was found to be significant. Socio- economic status of parents showed significant role in perception of parental value by adolescents. Parental values have impact on intergenerational relationship during adolescence.

Screening, evaluation and chemical analysis of some indigenous Plants for production of natural dyes

Minti Gogoi

The most striking and attractive aspect in the world is obviously the rainbow colours created by nature which is full of marvel and many of us yet to understand the wonderful phenomenon of colour. A global awareness is already in place favoring the use of green technology. The natural dyes are environmentally sound and can protect the Earth from pollution and ecological imbalances. The use of exotic art and a complex branch of science the natural dyeing is aimed at safeguarding human health from most harmful UV ray and providing us a feel of superior quality sensory experiment in contrast to the carcinogenic effect of synthetic dyes. Recently the most delightful textiles of natural dyes becoming an important branch in fashion design. There have been international calls for returning back to the nature for protecting human race. The present investigation entitled on “Screening, Evaluation and Chemical analysis of some indigenous plants for production of natural dyes” is being carried out with the following objectives:

1. To explore and select dye yielding plants of North East Region with special reference to Assam.
2. To optimize the dyeing condition of the selected dyes.
3. To study dyeing behavior of selected dyes on cotton, silk and wool yarn.
4. To analyze the chemical composition of the selected dye compounds.

To carry out the study, indigenous plants namely Indian willow and False daisy were selected. The optimum dyeing conditions of both the plants in respect of dye material concentration, dyeing time, dyeing temperature, mordant concentration were determined. Optimum dye material concentration were found to be 4-5 per cent at 80°-100°C for 45 minutes for Indian willow and False daisy. By using two eco-friendly mordants, different shades of colour variations brown for Indian willow and greenish tint for False daisy were found on cotton, silk and wool yarn.

The Qualitative Chemical Analysis, the isolation and purification of coloured compounds present in two plant extracts, have been carried out through TLC (Thin layer Chromatography) and Column Chromatography. The isolated compounds were further

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Department : Textile and Apparel Designing (H.Sc)

Major Advisor : Dr. (Mrs) Bulbul Baruah

analyzed for identification of the main classes of active dye constituents of the plants through analytical techniques such as Infra Ray (IR), Ultra violet/ visible (US/VS), Nuclear Magnetic Resonance (NMR), Mass Spectroscopy (MS) and Element analysis. From the said plants five coloured compounds were characterized as Salicin ($C_{13}H_{18}O_7$), β -Sitosterol ($C_{29}H_{50}O$) from Indian willow and Wedelolactone ($C_{16}H_{10}O_7$), Luteolin ($C_{15}H_{10}O_6$) and Apigenin ($C_{15}H_{10}O_5$) from False daisy. The literature survey revealed that Salicin identified from Indian Willow and the bio active constituent of False daisy has many medicinal properties besides there colour producing capacity.

To move with the ecological movement in the earth with sustainable products the study of various natural dyes are highly acknowledged in colouration of yarn and fabrics. In the field of Textiles, characterization of chemical nature of coloured components are useful to know the solubility and mordanting power of natural dye as well as its hypochromic and bathochromic shift of main hue. It is also helpful in structural modification of some groups present in dye molecules to obtain quality dyeing for commercialization of different values added textiles products which can fetch a high economic growth to the country.

Antimicrobial effect of herbal plants on cotton fabrics

Swapna Choudhury

The study comprises of an investigation on antimicrobial effect of herbal plants on cotton fabric. Antimicrobial finish on textiles is a large research focus in the textiles industry. The population explosion and the environmental pollution in the recent years forced the researchers to find new health and hygiene related products for the well being of mankind. The nuisance caused by microbes is numerous and the problem is still aggravated in tropical and subtropical regions. Pathogenic microorganisms transfer infectious diseases and develop lung related disorders. Mold and fungi cause staining, discolouration and degradation of textile substrates. The Antimicrobial textiles are becoming important to avoid cross infection by pathogenic microorganisms, especially bacteria to control the infestation by microbes and to arrest metabolism in microbes in order to reduce the formation of odor. Textiles for medical and hygienic use have become important areas in the textile industry. Therefore, to reduce/prevent infections, various antibacterial compounds have been used for all types of textiles. The solutions of disinfectant used are generally active *in vitro*, but, it is also necessary to know the effectiveness of disinfected cloths while in use. In the current study, eco-friendly natural antimicrobial finishes have been prepared from the plant extracts for textile application. Out of 35 plants having antimicrobial properties ten (10) nos. of plants have been selected on the basis of availability as well as knowing its antimicrobial function. The different parts of the plants such as root and leaf were extracted using different solvents like ethanol, methanol, acetone and aqueous solution. These extracts were tested by diffusion method against three isolated bacteria associated with cotton fabrics to confirm the antimicrobial activity. The durability of the fresh and aged extract up to 6 month with their effectiveness against all isolated bacteria were also examined. Finally five herbal extracts from *Achyranthes aspera*, *Adhatoca vasica*, *Ageratum conyzoides*, *Bambusa tulda* and *Chromolaena odorata* with methanol have been applied on cotton fabrics by direct application method. Different concentrations of herbal extracts (100%, 50%, 25%, 12.5%, 6.25% and 3.125%) were applied to 100% cotton material for developing antimicrobial finish on the material. All tests done on organisms showed results up to 25% concentra-

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Department : Textile and Apparel Designing (H.Sc)

Major Advisor : Dr. (Mrs) Ava Rani Phukan

tion except *Adhatoca vasica*, which showed results up to 3.125% concentration (Isolate II) and *Ageratum conyzoides* showed results only at 100% concentration in case of isolate I. All the treatments with methanol extracts showed good antimicrobial properties. The wash durability of the fabrics up to 10(ten) wash cycles against bacteria were done to evaluate the durability of the finished fabrics. The results of the present study showed that the most susceptible bacteria were *Bacillus clausii* bacteria in all standard test methods. It has been observed that there is a decreasing trend on the antibacterial activity of the finish material with every wash cycle. The treated fabrics were then analyzed for physical properties such as stiffness, crease recovery angle, tensile strength, elongation, wicking height etc. Decrease in tensile strength was observed in both warp and weft direction which could be due to the various treatment given to the material. Results showed that the effect of *Adhatoca vasica* extract was stronger than other herbal extract used in the study. It was also observed from the research findings carried out by other research workers that the antimicrobial effect of plant extract varies from one plant to another and also from place to place. This may be due to many factors such as the effect of climate, soil composition, age and vegetation cycle of plant, quality, quantity and composition of extracted product and different bacterial strains

Exploring season related biochemical indices in cross-bred and local cattle

Dr. Mayuri Chetia

The present experiment was conducted to study the significant changes of various physiological, biochemical, hormonal and HSP gene expression profiles in Cross-bred (HF X Jersey) cattle under the agro-climatic condition of Assam and Local cattle of Assam were included in the experiment as reference experimental animals. The experiment was aimed at determining the status of some of the important season related thermal stress biomarkers with an idea to get some clues about the heat tolerance and the adaptability status of the Cross-bred cattles compared to the Local breeds of Assam. The experiment comprised of a total twelve numbers of healthy cattle of ages between 2-3 years, which were divided into two groups each containing six numbers of Cross-bred and six numbers of Assam Local cattle being reared under the semi-intensive system in Instructional Livestock Farm (Cattle) of College of Veterinary Science Khanapara, Assam Agricultural University and Experimental Animal Shed, Department of Veterinary Physiology, College of Veterinary Science Khanapara, Assam Agricultural University. The animals were kept under standard feeding and management.

The monthly ambient temperature ($^{\circ}\text{C}$), relative humidity (%) were recorded from the automatic weather station and temperature humidity index (THI) were calculated during the summer and winter season using standard formula. The physiological parameters such as the rectal temperature, respiration rate and pulse rate were recorded daily twice for the two seasons. The different biochemical parameters such as serum total protein, serum glucose, serum electrolytes - Na^+ , K^+ , Cl^- , Ca^{2+} , P and Mg^{2+} , erythrocytic oxidative enzymes - superoxide dismutase (SOD), glutathione peroxidase (GSH-Px), catalase (CAT), serum Lactate Dehydrogenase (LDH), serum hormonal parameters namely, Cortisol, T_3 and T_4 and mRNA expression profile of HSP 40, HSP 60, HSP 70, HSP 90 genes were studied in both the breeds of cattle.

The Temperature Humidity Index (THI) during the study period was found to be indicative of thermal stress to the experimental animals during the summer season compared to winter season. The different physiological parameters viz. rectal temperature, respiration

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Department : Veterinary Biochemistry
Major Advisor : Dr. . Satya Sarma

rate and pulse rate were found to increase in both the breeds during summer compared to winter season. All the physiological parameters were increased in the evening hours in both the cattle types compared to the morning hours.

The serum total protein and serum glucose concentrations were significantly lower ($P < 0.001$) during the summer season as compared to the winter season in both cross-bred and Assam local cattle. Similarly, the serum electrolytes, such as Na^+ , K^+ , Cl^- , Ca^{2+} , P and Mg^{2+} concentrations were significantly ($P < 0.001$) lower in the summer as compared to winter season in both cross-bred and local cattle types of Assam. A significant difference was observed in serum total protein, serum glucose, serum Na^+ , K^+ , Cl^- , Ca^{2+} and Mg^{2+} concentration between the breeds. The activity of erythrocytes SOD, GSH-Px, CAT and serum LDH was found to be significantly ($P < 0.001$) higher in the summer season in both the breeds compared to the winter season. In addition, a significant ($P < 0.001$) difference on the concentration of different erythrocytic and serum enzymes was observed between the two breeds.

The concentrations of Cortisol, T_3 and T_4 were found to be significantly ($P < 0.001$) different between the seasons in both cross-bred and local cattle of Assam. The cortisol level significantly increased during the summer season in both the breeds compared to the winter season while T_3 and T_4 level significantly decreased in the summer season in both the cattle types. A significant ($P < 0.001$) difference in the hormonal concentration of Cortisol, T_3 and T_4 was found between the breeds.

The present experiment shows a wide variation in the expression of different HSP genes during summer and winter season. The mRNA expression of HSP 40, 70 and 90 genes were significantly higher ($P < 0.01$) during summer season as compared to winter season. The mRNA expression of HSP40, HSP 60, HSP70 and HSP90 was significantly differed between the two breeds of cattle types. HSP 70 has been found to be the potential biomarkers of heat stress in both the breeds of cattle and based on the relative expression, the ranking of genes from higher to lower abundance in cross-bred cattle were in the following order: HSP70>HSP90>HSP40>HSP60 and in local cattle, it is HSP70>HSP60>HSP90>HSP40. All the physiological and biochemical alterations were observed in local and cross-bred animals in the different seasons. However, these alterations were quite more prominent in case of cross-bred cattle in comparison to the local cattle. Hence, the local cattle have better heat tolerance than those of the cross-bred cattle under the agro-climatic condition of Assam.

Evaluation of efficacy of whole outer membrane protein of *salmonella* typhimurium adjuvanted with calcium phosphate nanoparticles as vaccine candidate against salmonellosis in chicken

Dr. Suraksha Subedi Deka

Salmonella sp can infect a broad array of animals, causing diseases ranging from gastroenteritis to life threatening systemic infections. Substantial economic loss is manifested through mortality and poor growth of infected birds. *Salmonella enterica* serovar Typhimurium is the most frequently isolated serovar causing global food-borne outbreaks and chicken alone accounts for 10.4% of the total isolates. The control of salmonellosis can be accomplished either by vaccination or medication. Antibiotic resistance and issue of antibiotic residue is a major hurdle in medication. Thus control through immunization is the most efficient and economic method. The present study was conducted to study the efficacy of whole outer membrane protein adjuvanted with calcium phosphate nanoparticles (CAP-OMP) as vaccine candidate against salmonellosis in chicken.

The study was carried out in Kamrupa birds which are dual purpose breed. The OMP was extracted from *Salmonella* Typhimurium (MTCC - 98) strain and confirmed by SDS-PAGE. CAP-OMP vaccine was then synthesized by method that is based on co-precipitation of calcium phosphate and OMP. The amount of protein entrapped in the complex was determined and the formulation was used to immunise the chicks on 14th day of life followed by booster dose after two weeks. The humoral immune response of the target vaccine was compared with aluminium hydroxide adjuvanted OMP and unadjuvanted OMP by indirect ELISA. Blood was collected from all the birds at 0 before vaccination and days 7, 14, 21, 28, 35 45 and 60 after booster vaccination. Some of the birds from each group were challenged on 60th day with either *S. Typhimurium* or with *S. Gallinarum*. The humoral response of the unchallenged birds was studied from 60th to 90th day.

The CAP-OMP vaccine was able to elicit significantly higher antibody titres compared to other two groups up to 60th day post booster vaccination. However antibody titre level fell

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Major Advisor : Dr. Satya Sarma

thereafter in all the groups. Mortality was not observed in any of the challenged birds but some clinical symptoms were exhibited by the control group. The challenged birds were slaughtered after one week and total CFU of either *S. Typhimurium* or *S. Gallinarum* per gram of liver was determined. It was observed that none of the vaccines gave total protection against challenge organisms but the *Salmonella* isolates recovered from the birds immunized with target vaccine was significantly lower than that of control group. The other two formulations *viz*; aluminium hydroxide –OMP vaccine and unadjuvanted OMP vaccine also decreased the bacterial count in liver tissue. Some important serum biochemical parameters were also studied from the vaccinated birds and it was found that the total protein and globulin content was significantly higher in CAP-OMP vaccinated group than the control groups. Creatine kinase level was significantly higher during first 21 days post booster vaccination birds given Aluminium hydroxide -OMP indicating some tissue damage at the site of injection caused by Aluminium hydroxide. Other parameters like alkaline phosphatase and creatinine showed non-significant fluctuations throughout the experiment. From this study, it can be concluded that CAP-OMP (*S.Typhimurium*) vaccine can be an effective vaccine candidate against salmonellosis.

Dynamics of market intelligence for quality pork in Assam

Dr. Biju Borah

Assam has a meat marketing scenario which projects a very poor self-sufficient image and so to understand the pork market; to determine the current and future needs and preference, attitude and behaviour of the consumers; and to assess changes in the business environment that may affect the size and the nature of market in future, dynamics of market Intelligence for quality pork was studied in Assam. Data were collected from a total of 400 respondents through a pre-tested, reliable and valid interview schedule. The respondents comprised of three categories: hundred pig producers, 100 pork consumers and 200 pork retailers. The result showed that the majority of the respondents were of middle age group with a medium size of families and with medium educational qualification. Except producers, a large majority of the consumers and retailers were male. Majority of the producers, consumers and retailers primary occupation was agriculture & livestock rearing, service and trade & commerce respectively and belonged to ST caste. Majority of the respondents maintained medium pig herd size and reared for fattening purpose. The average annual income from pig rearing was Rs.28135/- and from pork retailing was Rs.75656/-. The average gross income of producers, consumers and retailers were Rs.85870/-, Rs.146560/- and Rs.1013220/- respectively. The average sale price of piglet was Rs.2249/- and of pig selling price was Rs.11610/-.

The processing of pork was done by 46 per cent of the producers and 18 per cent of the consumers for their own consumption. Roasted pork was the commonly found processed pork in the locality and was mostly available in the Ethnic festival shops. Storage problem, practicing in less quantity and costing related to processing were the factors which affecting the commercialization of traditional process pork. The preference of pork by the consumer was highest followed by chicken, duck, mutton/ chevon and beef. The order of overall reasons for pork preference by the respondents consumers were taste/ versatility and availability, season, affordability, habituation, nutritional value, locality and tradition. Agricultural seasons

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Department : Extension Education
Major Advisor : Dr. A. Borgohain

were the first factor which influenced the consumption of pork and its products. Majority of the respondents consumed pork twice a month with somewhat increase in trend of pork consumption pattern since last 5 years. An overwhelming majority of the respondents procured pork from the road side butcher by judging the freshness and quality of the pork.

The order of demand for meat out of total meat markets was for pork followed by broiler, mutton/ chevon, duck and beef. The trend of demand for pork over the last five years was increase almost by double and the increase in percentage of average number of pork shops was 65.84 per cent and also expanded by 50 per cent over the last five years. There were 47 per cent and 49 per cent of pork outlets out of total daily and weekly meat market respectively. The existing potential pork customers were both tribal and non-tribal, both male and female and younger age groups and from same locality. The trend of numbers of pork consumer was increased by 50 per cent with a decreased in the trend of quantity of pork sold per retailer over the last five years. By giving quality assurance (Buzz marketing) was the main of strategy for sale promotion to achieve pork buyer concentration. The most prevailing marketing channel for producers and retailers was Producer- Retailer- Consumer. The increase in percentage of pork price in between the years 2010 to 2015 and 2005 to 2010 was 41 per cent and 76 per cent respectively and the price of pork did not vary in winter, spring and autumn but it reduced during summer and increased during monsoon and during festive seasons. From the study it was revealed that Season, festival, disease outbreak, natural calamities were the main indicators of differential quantum, price, exchange and distribution.

Growth performance of pigs in response to seasonal stress under varying dietary energy levels

Dr. Prasanta Kumar Pathak

Eighteen weaned piglets (at 56 days) from each of the two different genetic groups viz. Hampshire and Hampshire x Local irrespective of sex were selected and randomly divided into three dietary groups viz. Gr.I, Gr.II and Gr.III consisting of 6 animals of almost similar body weight in each experimental group for winter months in 1st phase and summer months in 2nd phase to find out the status of important season related thermal stress biomarkers as well as most suitable germplasm in terms of growth performance under the agro-climatic condition of Assam. The experiment was also aimed to study the role of different level of energy ration in the growth performance of pigs in different seasons.

A total of 3 rations were prepared for grower and finisher stage as per the NRC feeding standard for pig (NRC, 1998). The ration having 110, 100 and 90 per cent energy of NRC (1998) designated as high energy (HE), medium energy (ME) and low energy (LE), respectively. The ME, LE and HE treatment were represented three dietary groups of pigs i.e. Gr.I, Gr.II and Gr.III, respectively for both winter and summer. The Gr.I (ME) was considered as control group for both winter and summer season.

Temperature-Humidity Index (THI) was calculated out from the data of ambient temperature and relative humidity (RH). The physiological parameters such as respiration rate (RR) and rectal temperature (RT) were recorded following conventional methods in two phases in a month *i.e.*, consecutively for three days in a week in each animal and twice daily at 8:30 A.M. and 5:30 P.M. for a period of 12 months. About 5 ml of blood was collected from each experimental animal aseptically at 15 days interval for the whole experimental period. The level of thermal stress related blood hormones such as triiodothyronine (T₃), thyroxine (T₄) and cortisol were estimated by Radioimmunoassay (RIA) technique. The animals were weighed in the morning before feeding and watering at fortnightly intervals. The linear body measurements of the animals were recorded at monthly intervals. The feed intake, feed conversion efficiency and economics of feeding were also recorded.

Abstract of Ph.D. Thesis

Department : Livestock Production And Management

Major Advisor : Dr. Roychoudhury

The ambient temperature was significantly ($P<0.01$) higher in the evening (23.60-29.51 °C) than in the morning (20.02-28.03 °C). The present experiment indicated that average ambient temperature during summer months (27.33-29.51 °C) were above the comfort zone for pigs (22 °C). The significantly ($P<0.01$) higher RH (%) was recorded in outdoor environment (87.26-91.10%) and in the morning time (86.60-91.10%). The THI during the study period was found to be indicative of thermal stress to the experimental animals during summer (79.55 – 82.56) as compared to the winter seasons. Physiological parameters *viz.*, RR and RT were significantly ($P<0.01$) higher in summer season (43.75-72.12 breaths/min. and 102.29-103.23 °F/min.) than the winter season and non-significantly higher values were recorded in Hampshire as compared to Hampshire x Local during summer season. It was also found that the significantly ($P<0.01$) lower RR as well as RT was recorded in the pigs fed with high energy (HE) ration during summer season. Serum T_3 and T_4 concentrations were significantly ($P<0.01$) lower during summer as compared to winter in both Hampshire and Hampshire x Local pigs, while both the genetic groups showed significantly ($P<0.01$) higher concentration of serum cortisol during summer season. It was also observed that thyroid hormone and cortisol concentrations were maintained in groups of pig fed HE diet during summer. The average body weight was significantly ($P<0.01$) higher in winter and Hampshire pigs attained higher body wt. but observed that Hampshire pigs shed more body wt. in summer as compared to crossbred. It was also recorded that energy level of diet had significant ($P<0.01$) influence on the body weight gain and minimizes the production losses in terms of body wt. gain during summer. The coefficient of correlation of linear body measurements with the body weight of experimental pigs was found to be positively correlated and found that linear body measurements were in progressively increasing trend along with increase in body weight. The study also revealed higher FCE during winter season and Hampshire x Local pigs had higher FCE. The lower feed intake and higher FCE was recorded in HE incorporated group. The present study revealed that the cost of concentrate feed decreased along with reduction in the energy level of the diet. The cost of feeding per kg body weight gain was higher in summer than winter season and lower cost of feeding per kg gain was recorded in HE incorporated group. On the basis of this finding it can be concluded that winter is the best time for raising growing-finishing pigs. During summer most of the time the state remains under tropical high heat and humid dominance which may drastically affect the production and eventually economy of pig farming. From the present observation, it is suggested that Hampshire x local pigs may rear economically in the agro-climatic condition of Assam and increasing the energy density of diet can also help to minimize the effects of thermal stress during summer.

Characterization of beta-2 toxin producing *Clostridium perfringens* isolated from animals, foods of animal origin and human

Dr. (Mrs) Shahnaz Haque

The present work was undertaken with a view to study the prevalence of *C. perfringens* in animals, birds, foods of animal origin and human. A total of 661 samples were collected from different sources, viz. animal faecal samples (433), bird faecal samples (93), human stool samples (49) and food of animal origin (86), which revealed 119 isolates of *C. perfringens*. The isolates were confirmed by the detection of *C. perfringens* alpha toxin (*cpa*) gene and were characterized in respect to beta 2 toxin (*cpb2*) gene and beta 2 toxin (CPB2). Sample wise distribution of *C. perfringens* was 16.17, 27.96, 32.65 and 8.14 percent in animals, birds, human stool and foods of animal origin, respectively. Irrespective of health status, isolation of *C. perfringens* was done from different animal and bird species. However, none of the samples collected from buffalo and horse yielded any *C. perfringens* isolate. All the human stool samples positive for *C. perfringens* were found to have a history of diarrhoea. Characterization of *C. perfringens* isolates in respect to the major toxin genes revealed presence of *cpa* (alpha), *cpb* (beta), *etx* (epsilon) and *éA* (iota) toxin gene, either alone or with different combinations. Based on distribution of major toxin genes, a total of 25 isolates were identified to be of type A, one isolate as type B and 93 isolates to be of type C. Among them, type A was isolated from animal (16), birds (7) and human (2), while the only type B isolate belonged to animal. The remaining type C isolate of *C. perfringens* were recovered from animal (53), birds (19), human (14) and foods of animal origin (7). In addition to the major virulence genes, a total of 86 isolates of *C. perfringens* were found to be positive for beta2 (*cpb2*) toxin gene, while only 6 were found to bear the enterotoxin (*cpe*) gene. Out of the *cpb2* positive isolates, 39 (55.71%) belonged to animals and 24 (92.31%) to birds. All the isolates of *C. perfringens* recovered from human and foods of animal origin were found to possess *cpb2* gene. Among the *cpe* bearing isolates, 2 (2.86%) were of animal origin, 1 (3.85%) of birds, 2 (12.5) of human and 1 (14.29%) of foods of animal origin. Four randomly selected *cpb2* positive *C. perfringens* isolates representing different sources were studied for their genetic diversity by PFGE, PCR-

Abstract of Ph.D. Thesis

Department : Veterinary Microbiology

Major Advisor : Dilip Kumar Bhattacharyya

RFLP and gene sequencing. The PFGE of the *cpb2* positive isolates of *C. perfringens* representing different sources revealed that the isolates of foods of animal origin and poultry faeces were closely related. On the other hand, the isolates of human stool and poultry faeces were found to be unrelated. Similar type of genetic diversity was observed between *C. perfringens* isolates of human stool and foods of animal origin. However, the human stool and animal faeces were found to be possibly related. The PCR-RFLP results revealed that isolates belonging to foods of animal origin and animal faeces were of same type. Similar restriction pattern was also exhibited by the *cpb2* positive *C. perfringens* isolates recovered from poultry faeces and human stool. Gene sequencing results revealed that the *cpb2* positive isolates of *C. perfringens* representing different sources were clustered into four main clusters. Cluster I contains *cpb2* positive *C. perfringens* isolated from various sources. Similar is the case with the other two clusters. The fourth cluster contains only a faecal sample of poultry origin from NCBI. This indicates that *C. perfringens* have no specific host specificity and there may be interspecies transmission of the organisms. Protein profiling of the partially purified beta-2 toxin of randomly selected *cpb2* positive strains of *C. perfringens* representing different sources was done to detect the presence of *C. perfringens* beta 2 toxin (CPB2) in the culture supernatant. The result revealed the presence of 28 kDa protein in all the isolates representing different sources besides the presence of various other protein bands. The presence of 43 kDa protein represents the alpha toxin and the presence of 35 kDa protein represents the beta toxin in all the isolates. Western blotting of the *cpb2* positive *C. perfringens* isolates revealed that all the isolates were immunogenic.

Development of user friendly diagnostics and cell culture adapted vaccine candidate for duck plague

Dr. Samsun Neher

Duck plague or duck viral enteritis is an acute and contagious viral disease of ducks, geese swan and other species of the order Anseriformes. The disease is responsible for significant economic losses in duck husbandry due to heavy mortality, condemnation and decrease in egg production in duck. Besides clinical and postmortem findings, laboratory diagnosis is essential to confirm the disease in cases of outbreaks. Conventional diagnostic methods are labour intensive, time consuming and less sensitive. There is an urgent need for development of rapid, sensitive and cost effective in house as well as user friendly diagnostic test so as to confirm the disease at clinical phase in the field itself. Again, vaccination is the only available option for prevention and control of the disease.

The present study was undertaken to develop user friendly diagnostics and potent cell culture adapted vaccine to control duck plague virus (DPV) infection. During the study period a total of 29 outbreaks of duck plague were attended. Various clinical and post mortem samples were processed for detection of viral DNA by PCR and viral antigen by S-ELISA. Serum samples collected from different districts were tested for presence of antibody by I-ELISA and Dot-ELISA. Duck plague virus was isolated in duckling, duck egg and DEF primary cell culture from the field tissue sample. Sequence and phylogenetic analysis of local DPV isolate and a vaccine strain was done to see the circulating virus in Assam. A cell culture adapted vaccine was developed, and safety and potency test was conducted to see the efficacy of the vaccine.

In sero-epidemiological study, among the 445 serum samples tested by I-ELISA 348 (78.20%) were found positive for DPV antibody, however in Dot-ELISA 149 (33.48%) were found to be positive. A total of 380 samples were collected from clinically affected (107) and dead ducks (273). S-ELISA showing positive results in 25 (23.36%) in clinical samples and 188 (68.86%) post mortem samples, however in PCR a total of 231 (84.61%) post mortem samples and 68 (63.55%) clinical samples showed positive for duck plague virus specific nucleic acid. The present study showed that PCR is the suitable and reliable

Abstract of Ph.D. Thesis
Department : Veterinary Microbiology
Major Advisor : Dr. S. K. Das

test for detection of duck plague virus. Among different tissue samples collected from dead birds, liver and spleen were found to be most suitable. In cases of clinical samples ducks whole blood was found to be preferred sample than the cloacal swabs and tracheal swab. However, due to simplicity of collection, cloacal swab may be the choice of sample from large flock.

Reviving of field isolate in primary host followed by isolation in duck embryo and duck embryo fibroblast (DEF) cell culture made 100% recovery of virus. However, the DEF cell culture was found to be more suitable than embryonated duck egg for isolation. Sequence and phylogenetic analysis of the local isolates and a vaccine strain showed a close relationship among the local isolates with the vaccine strain. Local isolates also showed a significantly high degree of sequence identity with other DPV isolates from China, Vietnam, Korea and Germany.

A highly virulent local strain was selected as vaccine candidate and adapted in CEF primary cell culture, whereas standard vaccine strain was adapted in CEF primary cell culture as well as in vero cell line. In safety and potency test of the CEF cell culture adapted DPV vaccine strain, ducklings were vaccinated with 0.5 ml of 10^3 , 10^4 and 10^5 TCID₅₀/ml dose of vaccine virus. All doses of vaccine were found to be safe and optimum for eliciting protective immunity in the vaccinated ducklings, and conferred 100% protection of ducklings challenged with 1 ml of 100 DID₅₀ of virulent DPV. Thereby, the minimum dose containing 1 ml of 10^3 TCID₅₀/ml of vaccine virus can be considered as optimum vaccine dose for providing protection, which can be further used for protection of ducks from duck plague.

The present study clearly showed that duck plague is endemic in Assam causing high mortality in ducklings as well as in growing and adult ducks. Diagnostic tests I-ELISA, S-ELISA and Dot-ELISA along with molecular technique PCR could be companion diagnostic tools for confirmation of DPV as well as assessment of virus antibody. Significantly development of cell culture adapted vaccine and conferring of 100% protection can be an achievement of the study.

Prevalence, pathology and molecular diagnosis of pox in domestic birds

Dr. Nayanjyoti Pathak

In the present investigation a total of 29 nos. of fowlpox (FP), 13 nos. of pigeonpox (PP) and three nos. of duckpox (DP) outbreaks were recorded, where highest morbidity and cause specific mortality in case of FP was recorded at 0-8 weeks (19.63 % & 23.60 %) followed by 9-20 weeks (5.57 % & 14.43 %) and above 20 weeks (1.39 % & 11.11 %), respectively. Likewise, in PP highest morbidity was recorded at above 20 weeks (35.08 %) followed by 9-20 weeks (30.68 %) and 0-8 weeks (11.11 %). Highest cause specific mortality was recorded at 9-20 weeks (37.03 %) followed by above 20 weeks (30.00 %) and no mortality was recorded at 0-8 weeks. In case of DP outbreaks, highest morbidity was recorded at 0-8 weeks (10.00 %) followed by above 20 weeks (6.66 %), where no mortality was recorded among the ducks.

During sero-surveillance study of FP, 27.88 % positive cases were detected by AGID, whereas 77.88 % positive cases were detected by ELISA. Similarly in case of pigeonpox and duckpox 26.82 % and 26.41 % positive cases were detected by ELISA, respectively but no positive cases were detected by AGID.

Gross lesions during external examination revealed erosions, crusts and several small, multifocal to coalescing wart-like nodules on various parts of the affected fowls and pigeons, whereas in case of ducks lesions were mostly confined to bill and eye regions. During post-mortem examination of dead birds no any remarkable gross lesions were seen in various visceral organs where in few birds showed fibroncrotic lesions on mucous membrane of the oral cavity and upper respiratory tract.

Microscopic lesions revealed varying degrees of hyperplasia and ballooning degeneration of the epithelial cells of the epidermis where most of the cells contained large eosinophilic intracytoplasmic inclusion bodies. During ultrastructural study, intracytoplasmic inclusion bodies were seen in the skin epithelium, which consist of numerous, dumbbell-shaped bodies typical of pox virions.

During molecular diagnosis, out of 29 FP, nine PP and three DP suspected samples 86.20 %, 77.77 % and 100 %, respectively were found positive by polymerase chain reaction.

Abstract of Ph.D. Thesis
Department : Veterinary Pathology
Major Advisor : Dr.G. K. Baruah

Inoculation of fowlpox virus (FPV) in embryonated chicken eggs and inoculation of duckpox virus (DPV) in embryonated duck eggs for isolation showed positive results during the first passage itself, whereas pigeonpox and duckpox viruses in embryonated chicken eggs required 2-3 initial passages to get the positive results. Out of the various field isolates, 10 nos. of FPV and six nos. of pigeonpox virus (PPV) were adapted on chorioallantoic membrane (CAM) of developing embryonated chicken eggs, whereas the virus isolated from ducks (n=3) were adapted on CAM of embryonated duck eggs.

All total eight nos. of APV isolates were molecular biologically characterized. On phylogenetic analysis it was observed that all the isolates of APV of the present study were clustered along with other APVs corresponding to their species reported from different parts of the world. However, one isolate from duck was clustered along with the isolates of FP, which indicates natural adaptation of FPV in ducks.

From the experimental study it was observed that all the chicks inoculated with FPV developed characteristic pox lesions (pustules) within 7-9 days post infection. Similarly, when pigeons were inoculated with PPV then all the pigeons developed pox lesions within 5-9 days. Again in case of ducklings all the ducklings inoculated with DPV developed pox lesions (nodular lesion) within 5-6 days. For comparative study when FPV, PPV and DPV were inoculated into heterologous hosts no lesions were developed.

In seroconversion study of experimental birds by ELISA, all the infected birds (chicks, pigeons and ducklings) inoculated with species specific avipox virus showed presence of antibody. Antibody was also detected in 40 % pigeons and 60 % ducklings inoculated with FPV, 60 % chicks inoculated with PPV and 40 % chicks inoculated with DPV.

The scab samples of experimentally infected chicks, pigeons and ducklings showed positive results by PCR but the biopsy samples collected from the inoculated site of the heterologous hosts showed negative results by PCR.

Haematological studies in case of avipox infected fowl, pigeon and ducks from both field and experiment cases revealed low levels of haemoglobin, total erythrocyte count and total leucocyte count. In differential leucocyte count, lymphocyte and monocyte percentages were increased, whereas heterophil percentage was decreased in pox infected birds.

From the experimental study it could be concluded that though the FPV, PPV and DPV field isolates of this study were host specific but if several passage done on heterologous host then it may adapt the virus and produce characteristic lesions in it. Further study will require to confirm host specificity of APVs

Molecular pathomorphology and immunodiagnosis of ppr in goats in Assam

Dr. Mahmuda Malik

Peste des petits ruminants is an acute viral disease of small ruminants caused by genus *Morbillivirus* and family *Paramyxoviridae*. The disease is characterized by fever, oculo-nasal discharges, stomatitis, diarrhoea and pneumonia. The present study was undertaken to observe the detailed pathology of the disease in natural cases with application of different diagnostic techniques viz., gross pathology, histopathology, ultrastructural study, histoenzymic study, cell culture study, indirect immunofluorescence antibody test and PCR technique. An experimental study was also conducted to study the progression of the disease in goats. In the present study a total of four outbreaks of PPR was attended and the experiment of the diseases was conducted in twelve animals, of which six were kept as control and the rest were treated with PPR antigen.

Animals suspected of PPR in field condition showed various clinical signs, like oculo nasal discharge, erosive lesion at the muco-cutaneous junction, dyspnea, greenish diarrhoea and heavy mortality. A thorough necropsy examination revealed gross erosive lesions in the oral cavity, congestion and consolidation of the lungs, linear haemorrhage in the intestine, petechial haemorrhage on the spleen, swollen edematous lymph nodes and congestion in the brain.

Histopathological study revealed necrosis, desquamation and ulcer formation on the epithelium lining the tongue and lips. Degeneration and depletion of lymphoid cells in the follicles of lymph node and spleen with presence of syncytia formation. Lungs showed broncho-interstitial pneumonia characterized by thickening of inter alveolar septa with infiltration by macrophages, lymphocytes, fibrosis and a few giant cells. Hyperplasia of the bronchial epithelial epithelium with presence of both eosinophilic intracytoplasmic and intranuclear inclusion bodies in the hyperplastic cells and in the desquamated bronchial and alveolar epithelium. Denudation of the intestinal villi with presence of infiltrating cells, glandular necrosis and depletion of peyer's patches were present.

Ultra structural study showed loss of the normal cell architecture with margination of chromatin in the nucleus. At higher magnification a large number of virion-like particles

Abstract of Ph.D. Thesis
Department : Veterinary Pathology
Major Advisor : Taibur Rahman

which appeared as electron dense bodies with a clear halo surrounding them were seen in the cytoplasm of cell.

Histoenzymic study revealed mild lactate dehydrogenase activity in the degenerated cells of lymph node, spleen and in the tip of the hyperplastic bronchial epithelium. While intense alkaline phosphatase activity was seen in the affected lung and follicles of lymph node.

Cell culture study showed development of cytopathic effects viz., rounding of cell, syncytia formation and elongation in a few cells with presence of intracytoplasmic inclusion bodies.

Indirect immunofluorescence antibody test showed emission of apple green fluorescence emitting from the cytoplasm of the affected cells.

Experimental studies of PPR infection in goats showed development of clinical sign viz., oculo-nasal discharge, fever, coughing, diarrhea, emaciation and eventually death. Gross and histopathological changes were almost similar to the lesions observed in natural cases. The ultra structural, histoenzymic, cell culture and indirect immunofluorescence studies were performed and the results observed were also similar to that of the natural cases. The haemato-biochemical study of the experimental animals revealed a lower level of total serum protein, with higher level of serum ALT and AST. Haematological study showed an increase in TEC, Hb and PCV, and a decrease in TLC and DLC.

Epidemiology of leech infestation and evaluation of anti leech effects of some locally available plants

Dr. Pallabi Pathak

An epidemiological study was conducted to record the prevalence of aquatic and terrestrial leech species in fifteen districts of Assam. Out of 1991 number leeches collected five aquatic e.g., *Hirudinaria manillensis* (57.86%), *H. granulosa* (11.85%), *H. javanica* (2.71%), *Whitmania laevis* (2.61%) and *Hemiclepsis marginata* (0.80%) and one terrestrial leech e.g., *Haemadipsa sylvestrus* (24.16%) was found prevalent in the study area. Molecular identification of *H. manillensis* based on *coI* sequence was done. Phylogenetic analysis showed 95.5% sequence similarity with *P. manillensis* (Accession No: KT693108.1) and lowest with *H. manillensis* (GQ368747.1). The sequence was submitted into the GenBank, and assigned the Accession No. GenBank KX579976. Bionomics of *H. sylvestrus* was studied in laboratory conditions. The incidence of leech infestation in man and animal in different leech infested areas was conducted using interview method by means of questionnaire. Total protein concentration of crude antigen of *H. granulosa*, *H. sylvestrus* and *H. manillensis* was found to be 4.14g/dl, 4.05g/dl and 3.6g/dl. Total protein concentration of E/S antigen of *H. manillensis*, *H. granulosa* and *H. sylvestrus* was 3.39g/dl, 3.44g/dl and 3.4g/dl, respectively. Discontinuous gel electrophoresis revealed protein profile of crude antigen of *H. manillensis*, *H. granulosa* and *H. sylvestrus* being almost same. The number and size of peptides varied from 9-10 and 12.5 to 96 kDa, respectively. The number of peptides of E/S antigen for *H. manillensis*, *H. granulosa* and *H. sylvestrus* were 5 and size varied from 14-96 kDa. PAS staining of glycoprotein antigen could not be detected for E/S product for all three species. Two glycoprotein antigens could be detected in crude *H. manillensis* and *H. granulosa* and three in *H. sylvestrus* which ranged from 12.5-26 kDa. A total of two immune-reactive peptides were detected for *H. manillensis* and *H. granulosa* crude antigens and one in E/S product of *H. sylvestrus*. Hirudinicidal effect of aqueous and methanolic extracts of leaves of *Nicotiana* sp., seeds of *Camellia sinensis* and stems of *Carica papaya* was evaluated against *H. manillensis* and compared with ivermectin and nicotine. The methanolic extract of *Nicotiana* sp. and *C. sinensis*; aqueous extract of *Nicotiana* sp. and *C. sinensis* possessed effective hirudinicidal properties. While the concentration and

Abstract of Ph.D. Thesis
Department :Veterinary Parasitology
Major Advisor : Dr.Saidul Islam

extraction procedure was considered, the aqueous extract of *Nicotiana* sp. at 5000 mg/ml and 2500 mg/ml showed faster killing effect. While the method of extractions and the level of concentrations were considered against time of repellency, it was found that barring the methanolic extract of *C. papaya* at the concentrations of 50 mg/ml and 100 mg/ml, all the other extracts at different concentrations showed highly significant ($p < 0.001$) leech repellent effects. Expression of HSP was evaluated by Dot-ELISA in stressed organism using a panel of monoclonal antibodies which comprised of HSP-60, HSP-70 and HSP-90. After application of pure compounds (nicotine and ivermectin) and extracted products (methanolic and aqueous) of *Nicotiana* sp., *C. sinensis* and *C. papaya*, HSP-60, HSP-70 and HSP-90 were detected in excretory and secretory (E/S) product of leeches. HSP-60, HSP-70 and HSP-90 were also detected both in crude and excretory and secretory (E/S) products of the cold stressed leeches. Extracts of *Nicotiana* sp. and *C. sinensis* were subjected to *in vitro* cytotoxicity studies on Vero cell lines using MTT assay. Two fold dilution of the extracts were used from 10.00 $\mu\text{g}/\mu\text{l}$ up to 0.0096 $\mu\text{g}/\mu\text{l}$. Both the aqueous and methanolic extracts of *Nicotiana* sp. and methanolic extract of *C. sinensis* had more per cent viability of Vero cells than the aqueous extract of *C. sinensis*. In no case the per cent viability was below 70. The efficacy of extracts against *H. sylvestris* and aquatic leech was evaluated on human volunteers. The methanolic extract of *C. sinensis* failed to exhibit minimum 50% leech repellent effect. Aqueous extract of *C. sinensis* exhibited inconsistent effect with 45.83% repellent effect at 20% concentration, but 26.19% effect at 30% concentration. Both the methanolic and aqueous extract of *Nicotiana* sp. exhibited 100% repellent effect at all the three levels of concentrations which was comparable with DEET (12% concentration).

Studies on *indoplanorbis exustus* and its associated schistosomes

Dr. Kamal Hashan Bulbul

A study on ecology, biology and bionomics of *Indoplanorbis exustus* along with its associated schistosomes was undertaken for a period of two years i.e. from March 2014 to February 2016 in Barpeta, Nalbari and Kamrup district of Assam. A total of 12 aquatic macrophyte species were recorded from the study area. The highest frequency percent (f %) relative frequency percent (RF %) of different macrophytes was found to be 86.67% and 19.70% respectively. Population density of *I. exustus* in terms of f% and RF% and man hour collection per meter square area (MHC/m²) showed an increasing trend from July to September and then gradually declining towards November.

While the snails were reared in biologically balanced aquarium at constant temperature of 15°, 20°, 25°, 30° and 35°C and room temperature (20.02-31.75C), all the snails died before attainment of sexual maturity at 15°C. The growth rate in terms of shell diameter and body weight attained maximum size 10.63±0.162 mm and 435.83±23.367 mg, respectively at room temperature at 6th week of age. Egg to egg cycle ranged from 50 days at 30°C and 125 days at 20°C. Room temperature was found to be more conducive for fecundity wherein as many as 22833 numbers of eggs were hatched out from 1033 numbers of egg capsules. The temperature, pH, DO, free CO₂ and total alkalinity of ambient water had direct bearing on population density of snails. The ANOVA of physicochemical properties of water was highly significant (p<0.01) between months and areas of water bodies.

Out of 161500 numbers of snails collected in two years showed incidence rate of cercariae of *Schistosoma spindale* (0.72%), *S. indicum* (0.50%) and *S. nasale* (0.17%). The cercariae were identified on the basis of morphological and molecular method. The RS data indicated that the distribution of cercariae of *S. indicum* group was more in the northern bank of Brahmaputra compared to the Southern bank.

By means of molecular dissection, brevifurcate cercaria was identified as *Trichobilharzia* sp. and the longifurcate as *Alaria alata* with 87-88% clonal relationship with Denmark, Lithuania and Germany isolates.

Abstract of Ph.D. Thesis
Department : Veterinary Parasitology
Major Advisor : Dr. Manoranjan Das

A total of 420 cattle, 179 buffaloes and 171 goats slaughtered at local abattoirs revealed visceral schistosomosis in 37.38, 35.20 and 12.28%, respectively. In regards to coprological examination it was 14.52, 12.85 and 4.68% in order of same sequence as above. The incidence rate in terms of adult parasites present and faecal examination was the highest in monsoon season and the lowest in pre-monsoon season. Concentration of eggs was more in liver (45.45%) followed by ileocaecal junction (37.50%), caecum (25.97%) and small-intestine (18.18%). Based on worm count methods, mild types of intensity was found to be highest followed by moderate and heavy intensity in slaughtered animals.

The incidence of nasal schistosomosis was highest in July (18.92%) and lowest in December (2.70%) when nasal swab was examined for the presence of eggs in 363 cattle irrespective of sex and age. Like visceral schistosomosis, nasal schistosomosis also had a higher infection rate in monsoon season and in animals above 8 years of age.

The second internal transcribed spacer (ITS2) sequence of *S. spindale*, *S. indicum* and *S. nasale* were found to be amplified showing different repetitive band patterns. While the mitochondrial cytochrome c oxidase subunit 1 (CO1) genes and the ribosomal gene repeat, part of the 28S RNA gene (28S) were amplified on 372 bp and 1225 bp when subjected to PCR. Phylogenetic analysis of *Schistosoma indicum* group based on nucleotide sequences of COI and 28S genes revealed Assam isolates of *S. indicum* showed a clonal relationship with Bangladesh isolates and *S. spindale* and *S. nasale* with Nepal isolates. RAPD-fingerprinting using different random primers showed specific polymorphic markers for susceptible and non-susceptible *I. exustus* to *Schistosoma* infection due to genetic variability.

Biomolecular expression on melatonin and vitamin-e supplementation during summer and winter in pig

Dr. Arindam Chakraborty

The present experiment was conducted to study the changes of various physiological, haematological and hormonal parameters including expression of HSP70 gene in the crossbred pigs (Hampshire × Local) under the agroclimatic condition of Assam. The experiment included a total of 36 numbers of crossbred weaned female pigs. Eighteen (18) animals were subjected to treatment separately during summer and winter. The selected animals were divided into three groups with six pigs in each group consisting of the control group (Treatment 1), one group was fed melatonin @3 mg/animal (Treatment 2) and the other group was fed Vitamin E @ 100 mg (Treatment 3) for both the seasons. The animals were maintained at AICRP on Pig, College of Veterinary Science, AAU, Khanapara, Guwahati-22.

The physiological parameters such as body temperature, pulse rate and respiration rate were recorded following standard methods. Temperature-Humidity Index was calculated out from the data of ambient temperature and relative humidity by using standard formula. About 5 ml of blood was collected from each experimental animal aseptically at 15 days interval for the whole experimental period. The haematological parameters viz. Haemoglobin (Hb), Packed cell volume (PCV), total erythrocyte count (TEC) and total leucocyte count (TLC) were estimated from fresh blood by using MS4 Automated Haematological Cell Counter. The enzyme superoxide dismutase (SOD) and Lactate dehydrogenase (LDH) were estimated by using SOD and LDH assay kit manufactured by Cayman Chemical Company, USA as per manufactures protocol. Growth hormone and Progesterone were estimated by ELISA technique using Elisa kits procured from LDN Immunoassays and services. Melatonin was estimated by ELISA technique using Elisa kits procured from, Genway, Biotech Inc. The level of thermal stress related blood hormones such as triiodothyronine (T₃), thyroxine (T₄) and cortisol hormones were estimated by Radioimmunoassay (RIA) technique. The relative expression of HSP 70 gene was done by Real time PCR.

Abstract of Ph.D. Thesis

Department : Veterinary Physiology

Major Advisor : Mrs. Anubha Baruah

The Temperature Humidity Index (THI) during the study period was indicative of thermal stress to the experimental animals in the summer as compared to winter season. Physiological parameters *viz.*, body temperature, respiration rate and pulse rate were found to be positively correlated with THI. All the physiological parameters showed significant difference ($P < 0.01$) between summer and winter seasons irrespective of treatments. Haematological parameters *viz.* Hb, PCV, TEC was significantly lower during summer while TLC concentration was significantly higher during summer season as compared to winter in all the treatment groups. The mean body weight in the experimental pigs was significantly higher ($P < 0.01$) in winter compared to summer. Serum T_3 concentrations was significantly ($P < 0.01$) lower during summer as compared to winter in all the treatment groups. Serum T_4 concentration showed significant difference between treatment, between season and also between treatment and season. Serum cortisol concentration showed significant difference between treatment, between season and also between treatment and season. The serum cortisol concentration was found lowest in the melatonin and vitamin E supplemented group in both the seasons as compared to the control group. Significant difference ($P < 0.01$) was found in the mean GH values between season with significantly higher values in the winter season. Statistical analysis revealed significant difference ($P < 0.01$) in the mean progesterone concentration between treatment and between season. Significant difference ($P < 0.01$) was found in the mean age at puberty between treatment with lower age at puberty in the melatonin supplemented group followed by vitamin E supplemented group and control group with highest age at puberty. There was also significant difference ($P < 0.01$) in the mean age at puberty between season with lower age at puberty in the winter compared to summer. There was also significant difference ($P < 0.01$) between day and season. Serum LDH activity was significantly higher ($P < 0.01$) during summer as compared to winter season. The serum SOD activity was found to differ significantly ($P < 0.01$) higher between treatment and between season and also between treatment and season. The serum progesterone concentration showed significant difference ($P < 0.01$) between treatment and between season. There was also significant difference ($P < 0.01$) between day and season. The mean melatonin concentration showed significant difference ($p < 0.01$) between groups with significantly higher melatonin concentration in the melatonin supplemented group in both the season. Similarly serum vitamin E concentration was significantly higher ($p < 0.01$) in the vitamin E supplemented group than the other two treatment groups in both the seasons. The normalized expression for HSP70 during summer shows that the animals with Melatonin treatment had 1.98 fold lower expression than the animals of control group. Likewise, animals with Vitamin E treatment showed 0.56 fold lower expression than control animals during summer season. During winter, the animals with Melatonin treatment showed 0.70 fold higher expression compared to control animals. Similarly, animals with Vitamin E treatment showed 1.28 fold higher expressions than control animals.

Total intravenous anaesthesia with propofol and ketamine in atropine and xylazine premedicated dogs

Dr. Basanta Saikia

The study was conducted in eighteen clinical cases of dogs of either sex. The animals were randomly divided into three groups with six animals in each group. Atropine sulphate @ 0.04mg/kg b.wt. i.m. and xylazine HCl @ 0.5mg/kg b.wt. i.m. route were administered as premedicants in all the three groups. In group-I, propofol @ 5mg/kg body weight, in group-II, ketamine @ 5mg/kg body weight and in group-III, ketofol @ 4mg/kg body weight was administered intravenously for induction after 15 minutes of preanaesthetic administration. Surgical anaesthesia was maintained for 90 minutes in all three groups viz. group-I, group-II and group-III with propofol @ 2.5mg/kg. b.w., ketamine @ 2.5mg/kg b.wt. and ketofol @ 2mg/kg b.wt. respectively by intermittent bolus injection (IBI) technique. Clinical studies like induction time, quality of induction, duration of analgesia, degree of analgesia, duration of recumbency and quality of recovery showed better results in ketofol group than propofol and ketamine group.

Physiological parameters like rectal temperature, heart rate, respiratory rate, blood pressure and spO_2 were evaluated before administration of anaesthetic agent (0 minute) then at 15, 30, 60 and 90 minutes during and after administration of anaesthetic agents. The heart rate initially increased and then decreased gradually towards pre-anaesthetic level in all the three groups. The respiratory rate initially decreased and then increased towards pre-anaesthetic level in all the three groups. Both diastolic pressure and systolic pressure remained in a comfortable zone in group-III animals whereas, high blood pressure was recorded in group-II animals and low blood pressure was recorded in group-I animals. Haemato-biochemical and hormonal changes were evaluated before administration of anaesthetic agent (0 minute) then at 15, 30, 60 and 90 minutes during and after administration of anaesthetic agents. The all three anaesthetic protocols did not bring about any drastic change in the haematological parameters. In all the three groups, group-I, group -II and group-III, initial significant declination was observed in Hb, PCV, TEC which steadily returned to the pre- anaesthetic level at the end of the observation. The values of TLC,

Abstract of Ph.D. Thesis

Department : Surgery and Radiology

Major Advisor : Dr. K.K. Sarma

neutrophils, lymphocyte, monocyte and eosinophil count did not register any significant change throughout the experiment in all three groups.

In biochemical parameters significant increased glucose, BUN, creatinine ALT, AST and GGT values were recorded in all the groups in early phase of observation then showed a declining trend towards the pre- anaesthetic level at the end of the experiment. The magnitude of increasing trend of glucose was higher whereas increasing trend of creatinine, BUN, ALT, AST and GGT was lesser in group-III than group-I and group-II animals. In all the groups, the LDH, sodium and chloride values insignificantly increased but values were found to be within the physiological limits. A decrease in serum potassium level was observed in all the groups but these values were within normal physiological limit.

In hormonal parameters significant increased cortisol values were recorded in all the groups. The cortisol values in group-III animals also increased with time but the magnitude of these changes were least compared to group-I and group-II animals. In the present study, triiodothyronine (T_3) and thyroxine (T_4) values showed a non-significant fluctuation trend within their physiological limits at different time interval of TIVA in all three groups.

The cost of the anaesthesia was least only Rs. 4.68/kg in group-II followed by Rs. 8.30/kg in group-III animals. The cost of the anaesthesia was Rs. 20.02/kg in group-I animals which was found to be highest among the all three groups.

Key words: Dog, Propofol, Ketamine, Ketofol, Xylazine, Atropine, TIVA

Chemical composition and antioxidant activity of bran of a few rice varieties of Assam

Jutika Das

Rice bran has been recognized as an excellent source of vitamins and minerals, but has been under-utilized as human food and has traditionally been used primarily in animal feeds. Research conducted in the last two decades has shown that it contains a unique complex of naturally occurring antioxidant compounds. Assam is endowed with rich diversity of rice cultivars. A few rice varieties of Assam were selected viz., *Ranjit*, *Bokul bora*, *Kola joha*, *Tora bao*, *Tulashi bao*, *Gheu bora*, *Kunkuni joha*, *Birohi* and Black rice with the objective to determine the bran physico-chemical characteristics, extract bran oil and evaluate chemical properties, to analyse the phytochemicals present and determine the antioxidant activity. Moreover, a diversity analysis among the rice varieties was carried out using SSR markers.

A significant variation in chemical composition among the varieties was observed. Moisture content of different rice bran ranged from 9.83-14.75%. The highest (5.87%) reducing sugar found in the variety *Birohi* and lowest (4.67%) in Black rice. Reducing sugar content of the variety *Ranjit* (5.67%) and *Tulashi bao* (5.66%) was at par with *Birohi* (5.87%). Total carbohydrate content varied from 35.80 to 38.80%. The highest total carbohydrate was found in the variety *Birohi* and lowest was found in *Kunkuni joha*. The crude protein content ranged from 12.56 to 15.57%. The highest crude protein was found in the variety *Kola joha* and lowest was in *Birohi*. Crude fibre content of different rice bran ranged from 7.33 to 11.93%. Highest crude fibre content was found in the variety Black rice and lowest was in *Ranjit*.

Ash content was found highest (10.82%) in the variety *Bokul bora* and lowest was in Black rice (6.84%). Iron was found highest (39.63mg/100g) in the variety *Bokul bora* and was lowest in the variety *Ranjit* (26.30mg/100g). Phosphorous was found highest (1.99g/100g) in the variety *Gheu bora* and was lowest (1.18g/100g) in Black rice. The highest (19.74mg/100g) amount of sodium was found in the variety *Birohi* and was low in *Ranjit* (13.55mg/100g). The content of potassium was highest (1.36g/100g) in *Gheu bora* and was

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Major Advisor : Dr. R. Kandali

lowest (1.11g/100g) in *Ranjit*. Calcium was found highest (77.33mg/100g) in *Kola joha* and lowest (63.00mg/100g) was in *Tora bao*. The highest (5.90mg/100g) amount of zinc was found in the variety *Birohi* and was lowest (4.56 mg/100g) in *Gheu bora*.

The rice bran oil content was found to be highest (19.73%) in the variety *Birohi* and was lowest (17.00%) in *Tora bao*. The acid value was highest (1.18mgKOH/g oil) in *Bokul bora* and was lowest (1.00mgKOH/g oil) in Black rice. The iodine value was highest in Black rice (99.00mg I₂/g oil) and was lowest in *Kunkuni joha* (87.00mgI₂/g oil). The saponification value was highest in *Birohi* (187.50mgKOH/g oil) and was lowest in Black rice (183.33mg KOH/g oil).

The phenolic content of the rice bran of different varieties ranged from 430.00 to 852.00mg/100g. The phenol content was highest (852.00mg/100g) in *Gheu bora* and was lowest (430.00 mg/100g) in Black rice. The highest (625.33mg/100g) phytate P was found in the variety *Tuloshi bao* and was lowest (408.00 mg/100g) in the variety *Birohi*. The tannin content was highest (50.43mg/100g) in Black rice and lowest (37.57 mg/100g) was in *Ranjit*.

The DPPH inhibition percentage of the different rice bran ranged from 47.56 to 62.38%. The DPPH inhibition percentage was highest (62.38%) in the variety Black rice and was lowest (47.56%) in *Ranjit*. The DPPH inhibition percentage of *Gheu bora* (61.37%) is at par with Black rice (62.38%).

The rice bran oil of the variety *Kunkuni joha* (83.68%) was highest oleic acid content and lowest was found in the variety *Tora bao* (44.01%) and (*Kola joha* 44.01%). The highest (21.80%) palmitic acid content in the variety *Birohi* and *Tora bao* (18.31%) and lowest in the variety Black rice (11.27%). The linoleic acid content in the variety *Kunkuni joha* was 9.12%.

The diversity analysis by using microsatellite (SSR) markers revealed that these markers had potential for assessing diversity among the rice varieties. For all the twelve primers used in the present study, amplified products were found to be polymorphic, except for the primer RM574. The Jacard coefficient of similarity based on SSR the similarity value ranged from 0.200 to 0.786, showed high genetic diversity among the varieties.

From the results of the present investigation, it can be concluded that, bran of the varieties like *Kunkuni joha*, *Birohi* and *Black rice*, after proper stabilization, can serve as a good source of protein, oil including essential fatty acids, calories, and other nutrients.

Phytochemical Characterization of *Acorus calamus* (L.)

Suman Natta

Medicinal plants are used for thousands of years in Indian health care systems for their biological activities. *Acorus calamus* is commonly known as sweet flag, bosh (Assamese name) etc., originated from India. The plants showed several medicinal properties such as anti-oxidative, anti-spasmodic, carminative, anti-helminthic, anti-diabetic property, hypolipidemic, anticancer, antimicrobial, properties. Rhizomes of *Acorus calamus* possess aromatic, stimulant, antispasmodic, carminative, and anthelmintic properties which are found to be very effective against various disorders like chronic diarrhea, dysentery, intermittent fevers, tympanitis, cough, asthma and glandular and abdominal tumours. The north east region of India is known as a mega biodiversity center and a hot-spot in world for its rich flora and fauna including various medicinal plants.

The present study was carried out to investigate the major secondary phytochemical group in the commonly used part (i.e. rhizomes) of *Acorus calamus* and their antioxidant activity from two different locations (viz. Daranichuk, Jorhat, & Sashtripith, Cholahdara) of Jorhat district following three methods (viz. shade dry, oven dry and sundry). The total phenols content was the highest in shade dry (9.480 mg/g) and lowest in oven dry (3.265 mg/g). The total flavonoid content was the highest in shade dry (8.480 mg/g) and the lowest in oven dry (4.585 mg/g). The total tannin content was the highest in shade dry (5.481 mg/g) and lowest in oven dry (1.615 mg/g). The total alkaloid content was the highest in shade dry (8.570 g/100g) and the lowest in oven dry (5.390 g/100g). Total saponin content was the highest in shade dry (5.880 g/100g) and the lowest in sun dry (4.050 g/100g). The essential oil content was the highest in shade dry (1.185 %) and the lowest in oven dry (0.390 %).

The antioxidant activity (by DPPH, 2, 2-diphenyl-picrylhydrazide) reveals that the activity was the highest in shade dry of location Daranichuk, Jorhat (IC₅₀ value= 923.78) and the lowest in sundry of location Sashtripith, Cholahdara, Jorhat (IC₅₀ value=2002.30).

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Department : Biochemistry and Agricultural Chemistry

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Prospect of Mission Double Cropping - A study in Upper Brahmaputra Valley Zone of Assam

Aakanksha Sonowal

The present study was conducted in Jorhat and Golaghat districts of Upper Brahmaputra Valley Zone of Assam with a view to examine the Prospect of Mission Double Cropping where, 26 per cent of the net sown area of the state is under mono cropping. A multistage stratified random sampling technique was followed to select the samples of the study. A sample of total 120 households were selected out of which 48, 36, 24 and 12 households were marginal, small, semi medium and medium respectively. The study was designed to develop optimal plans for which deterministic linear programming technique was used to optimize resources and net returns across different farm size groups. By examining the existing production plan (P0) certain optimal plans viz. without hiring and borrowing activities (P1) and with hiring and borrowing activities (P2) were developed to maximize farm income and labour employment across different farm size groups. The study revealed that less remunerative crops did not appear in the optimal plans. In most of the optimal plans there had been considerable increase in the cropping intensity, human labour employment, bullock labour employment and farm net income over the existing plan. It was found that in semi medium size group, cropping intensity was more than double i.e. 239.31 per cent in optimal plan P2 which was 111.90 per cent in existing plan. However, in some other groups viz. marginal, small and medium size groups, cropping intensity was increased up to 186.20, 164.28 and 174.09 per cent respectively. The highest net return (Rs. 76,343.91) over P0 (Rs. 40,461.32) was observed under marginal size group registering an increase of 88.68 per cent. Highest increase (87.06%) in labour employment was also observed under marginal size group (258.33 man-days) in P2 over P0 (138.10 man-days).

It was further observed that utilisation of resources viz., land, human labour, bullock labour and capital were increased in most of the optimal plans across different size groups. Under optimal plan P1, highest utilisation of land was observed during *kharif* season covering 1.37 ha with an increase of 55.68 per cent over P0 under semi medium size group. Similarly, highest utilisation of other resources was observed in *kharif* season too. However, in optimal plan P2, highest land, labour and capital utilisation was observed in all the farm size groups in *rabi* season except for medium size group where the highest utilisation of all

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the resources viz., land, human labour and bullock labour was observed under *kharif* season.

The study also revealed some of the major problems in the study area due to which many farmers are not adopting double cropping. Among them non-availability of water supply was the highest ranked problem which was reported by 114 respondents out of 120. It was followed by shortage of labour and problem of stray cattle.

Economics of Production and Marketing of Pineapple in Thoubal District of Manipur

Asem Aruna Devi

The present study was conducted in Thoubal district of Manipur with a view to estimating the cost and returns of pineapple cultivation, identify the marketing channels of pineapple and analyze the marketing margin and efficiency of pineapple marketing. Simple random sampling without replacement technique was used for selection of 120 respondents. Data were collected from both primary and secondary sources. Primary data were collected through personal interview technique administering a structured schedule. The sample households were stratified into three groups as group I (<1 ha), group II (1.01-2.00 ha) and group III (2.01-4.00 ha). The study revealed that on an average the total land holding was utilized for pineapple cultivation by group I was 46.14 per cent, by group II was 42.76 per cent and by group III was 39.22 per cent. The cost of cultivation of pineapple on per hectare basis was highest in group II followed by group I and group III. The corresponding cost of cultivation worked out on per farm basis was highest in group III followed by group II and group I. However, the returns from pineapple on per hectare basis was highest in group II followed by group I and III and on per farm basis group III had the highest returns followed by group II and group I.

Out of the four marketing channels identified in the study area, marketing efficiency and producer's share in consumer's rupee was found to be highest in Channel IV (Producer-Consumer). The marketing costs were directly related to the intermediaries involved in the marketing channel.

Thus, from the present investigation it can be concluded that pineapple was considered to be the major source of income for pineapple growers and they earned more income especially from the ratoon crop.

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Department : Agriculture Economics & Farm Management (BNCA)

Major Advisor : Dr. H. K. Changmai

An economic analysis of production and marketing of rice: a study in the Nalbari district of Assam

Bidyasagar Talukdar

The present study was carried out in the Nalbari district of Assam to analyse production and marketing of rice. Both production and marketing related important factors and constraints were studied. The Nalbari district was selected purposively for the study as the district is a predominantly rice growing district and also from the points of convenience and acquaintance of the researcher. A Multistage Stratified Random Sampling technique was used to select the ultimate sample units i.e., the rice growing farmers from six selected villages of two development blocks, viz, Tihu and Borigog-Banbhag. In total 120 rice growers were selected randomly for the study. Compound Annual Growth Rate (CAGR) was calculated for area, production and productivity for summer, winter and autumn rice. The Cobb-Douglas functional form was used to analyse the influence of various factors towards rice production as well as marketing. Marketing channel was identified and marketing margin, producer's share, marketing efficiency and price spread were calculated. Also production and marketing constraints were identified and ranked.

The area, production and productivity in the state increased marginally during the last decade. Farm wise distribution of land indicated availability of more numbers of small farmers as compared to marginal, medium and large farmers. Also among the autumn, winter and summer rice, the summer rice indicated positive Compound Annual Growth Rate (CAGR) in area, production and productivity against autumn and winter rice which had negative Compound Annual Growth Rate (CAGR) during (2004-15). The FYM, irrigation and human labour affected the production process of autumn and winter rice but in summer rice, seed also affected the production along with FYM, irrigation and human labour. All demonstrated Increasing Returns to Scale but it was higher in case of autumn rice (1.101) as compared to summer (1.052) and winter rice (1.019). The major constraints of production of rice size of land for marginal, insufficient, irrigation for small and medium and availability of labour for the large farmers. In the rice marketing handling, assembling, and transportation, storage and percentage loss affected the rice marketing process badly. In

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Department : Agriculture Economics & Farm Management (BNCA)

Major Advisor : Dr.R.N.Barman

total six number of marketing channels were identified in the district and of which channel-6, (producer-processor-retailer-consumer) was found to be more efficient as indicated value of Modified Marketing Efficiency. The major constraints identified regarding marketing of rice in the study area were unsatisfactory price offered to the producer, unstable price, involvement of superfluous middleman, inadequate storage facility in rural areas and unavailability of good road network. The study indicated that major thrust should be given on making availability of human labour particularly to large farmers, development of irrigation facility, good road network for better transportation, dissemination of new technology, assured input supply and strong marketing support like storage structure, processing facilities in rural areas.

Capital requirement for modernization of rice cultivation in Central Brahmaputra Valley Zone of Assam

Devarun Jyoti Baruah

Rice is the major staple food of Assam. The present study is an attempt to examine the capital requirement to for modernization of rice cultivation in Central Brahmaputra Valley Zone of Assam with the objectives to assess the existing capital use and for modernization of rice cultivation, to study the extent of utilization and repayment of credit for different farm activities and lastly, to examine the effect of capital and credit on productivity of rice, income and employment. The study was carried out in Nagaon district of Assam. A multi-stage random sampling technique was followed to select the ultimate sample unit. A sample of 200 units was selected from Kaliabor and Khagorijan block. Compound growth rate, Cobb-Douglas production function and sensitivity analysis were used to analyse the collected data to achieve at the objectives. The results of the study revealed that there was a decreasing trend in areas under different rice varieties, however, production and yield of different varieties rice showed an increasing trend in the district, most significantly seen in case of Ahu/ autumn rice. The comparative economic analysis revealed that the total working capital needed at the existing level by an average farmer is Rs. 18645.03, Rs. 20605.46, Rs. 21579.94, Rs. 20803.97 and Rs. 25045.24 per hectare of Sali local rainfed, Sali HYV rainfed, Boro HYV irrigated, Ahu local rainfed and Ahu HYV irrigated respectively. However, to achieve the best famer level of technology the average farmer needs Rs. 5871.29, Rs. 5057.54, Rs. 3307.98, Rs.4664.25 and Rs. 9078.23 per hector more capital for Sali local rainfed, Sali HYV rainfed, Boro HYV irrigated, Ahu local rainfed and Ahu HYV irrigated respectively. This amounts to a total of Rs. 141.30 Crores for all rice varieties for the entire district. Further, an amount of Rs. 127.95 Crores is required to achieve the yield if the average farmer follows the package of practices. An analysis of the impact of the production variables on rice productivity revealed that seeds, fertilizers, plant protection chemicals and human labour were found to have a highly significant and a positive impact upon the yield of rice.

The study also showed that 38.50 per cent of the sample farmers avail institutional credit to meet their credit demand. Out of which 71.43 per cent is used for farm activities and the rest 28.57 per cent is diverted to other non-farm activities. It was also found that 14.12 per cent of the credit taken was not re-paid; however, 22.87 per cent was repaid totally.

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Department : Agriculture Economics & Farm Management

Major Advisor :Dr. K. C. Talukdar

Production behaviour of important horticultural crops and their supply response to changes in prices and other determinants

Ebalee Deori

The present study was an attempt to examine the production behaviour and supply response of important horticultural crops in Assam and also to examine their comparative advantage in two sample districts (Jorhat and Golaghat) of the state. Both primary as well as secondary data have been used for the purpose of analysis. The primary data have been collected from the districts of Jorhat and Golaghat using a multistage stratified random sampling technique. A sample of 120 farm households of four size groups, viz., marginal, small, semi-medium and medium were selected for the study. The secondary data have been collected and compiled from various sources Directorate of Horticulture (Govt. of Assam), Economic Survey of Assam, various publications, Assam State Agricultural Marketing Board, Department of Agricultural Meteorology and Department of Horticulture.

An attempt was made to trace out the production performance of the important horticultural crops in terms of their growth rates of area, production and productivity encompassing three broad periods, viz., pre-technology mission period (1980-81 to 2000-01), post-technology mission period (2001-02 to 2013-14) and the whole period (1980-81 to 2013-14) for the state of Assam. The growth of area was found to be decreasing in the post-technology mission period compared to pre-technology mission period. The change in area is thus having impact on the production and yield of the crops. Therefore, the productivity of the crops is yet to attain a satisfactory level in the state.

The supply response analysis revealed, by and large, the farmers of the districts and zones were not found to be price responsive in respect to potato and onion barring the farmers of Jorhat and Tinsukia for onion and farmers of Nalbari for potato, which indicated that the farmers are yet to take up cultivation of horticultural crops commercially.

From the analysis of comparative advantage of the horticultural crops, in the rabi season, onion was found to be economically advantageous over potato. Although, this result indicated that the change in area under crop at district level is not restricted by the principle of relative profitability of the crop.

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Department : Agriculture Economics & Farm Management

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Production and Marketing of Potato in Meghalaya- A case study in East Khasi Hills District

Ehunnisha Suting

Potato is a major food crop, grown in more than 100 countries and according to FAO (2008), it is consumed by over one billion people in the world. Potato (*Solanum tuberosum* L.) popularly known as 'The king of vegetables', has emerged as fourth most important food crop in India after rice, wheat and maize. Indian vegetable basket is incomplete without potato. Potato is a nutritionally superior vegetable due to its edible energy and edible protein. Potato, therefore, is considered to be an important crop to achieve nutritional security of the nation. In Meghalaya potato is one of the important crops in seven districts of the state. Hence, it significantly contributes to the rural agrarian economy of Meghalaya hills. The present area under potato cultivation in Meghalaya is 18,139 ha with a production of 1,91,538 MT and an average yield of 9,535 kg per ha. Potato is predominantly grown in East Khasi Hills and West Khasi Hills district. East Khasi Hill District contributes 63.64 per cent to the total area of Meghalaya by covering 11,543 ha area with a production of 1,28,301 MT and an average yield of 10,036 kg per ha. Hence, this study was carried out in East Khasi Hills district of Meghalaya to study the spatial and temporal pattern of growth and variability in potato production and also to examine the cost and return from potato cultivation and estimate profitability of the farmers and to identify the marketing channels and estimate their marketing efficiency in potato marketing.

The present study was carried out in East Khasi Hills district of Meghalaya. A multi-stage random sampling design was followed to select the ultimate sampling farmers. A sample of 120 households were selected from Myllem block and Mawryngkneng block and categorized into four categories, viz. marginal, small, semi-medium and medium based on their operational land holding.

The results of the study revealed that in East Khasi Hills district the growth rate of area under potato was 0.52 per cent during 1980-2015. In case of production, positive and significant growth rate was observed in the entire period (1980-2015) and it was 1.73 per cent. The district recorded very low and non-significant growth rate of 0.15 per cent in productivity in the entire study period (1980-2015). An analysis of instability as measured

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by coefficient of variation in East Khasi Hills district revealed that in the study period the coefficient of variation in production and productivity recorded high instability whereas area was found to be relatively stable.

The study revealed that the per hectare total variable cost and total fixed cost of potato cultivation during summer season for all farms were Rs. 90,732.97 and Rs. 6,651.10, respectively with variable cost accounting for 93.17 per cent and fixed cost accounting for 6.83 per cent, respectively of the total cost of Rs. 97,384.07. It was observed from the study that both fixed as well as variable cost of potato cultivation increased with the increase in the size group of farmers. All the return estimates made across the size group of farms increased with the increase in size of group of farms. Also from autumn season potato cultivation we observed that the per hectare total variable cost and total fixed cost of potato cultivation for all farms were Rs. 67,147.58 and Rs. 6,411.67, respectively with variable cost accounting for 91.28 per cent and fixed cost accounting for 8.72 per cent of the total cost of Rs. 73,559.25 respectively.

The study also revealed that there were four major marketing channels of potato in the study area viz. Channel I: Producer-Office of BDO-Trader-Retailer-Consumer, Channel II: Producer-Wholesaler-Trader-Retailer-Consumer, Channel III: Producer-Trader-Retailer-Consumer and Channel IV: Producer-Consumer. The total marketing cost was found to be highest in Channel II and total marketing margin was found to be highest in Channel III, the amount being Rs. 7,118.97 and Rs. 7,641.50 per quintal of potato, respectively. The producer's share in consumer's rupee was found to be highest in Channel IV being 100.00 per cent as the producer directly sold potato to the consumer.

The potato cultivators faced various production problems in the study area. Climate change, attack of diseases and pests and use of old varieties of seeds were the major production constraints in East Khasi Hills district of Meghalaya.

Economic analysis of rubber plantation in Tripura

Nabarun Chakraborty

The Plantation sector is important to India's economy and natural rubber plantation is one of the most important plantation crops in India. Rubber plantation provides livelihood to a large number of people employed directly and indirectly in the plantation farming and industry and ancillary activities. India is the fifth largest producer and second largest consumer of natural rubber in the world. The present study is an attempt to analyze the resource utilization pattern, to estimate the costs and returns from rubber plantation, to carry out the investment appraisal and economic viability of rubber plantation and to find out the problems faced by the rubber growers in rubber cultivation in West Tripura, Sepahijala and South Tripura districts of Tripura. A total of one twenty rubber plantations were selected for the study following a multistage random sampling. The selected rubber plantations were stratified into four size groups on the basis of the land holding under rubber cultivation.

The study revealed that out of the total available land of 389.12 hectares, 72.74 per cent was used for rubber cultivation and 16.12 per cent was used for field crops. The average size of holding under rubber plantation was found to be 2.36 ha. On an average the total utilization of labour for one hectare of land during the first six years of establishment period was 487.03 mandays and the highest labour utilization was found in the first year (183.22 mandays/ha) itself and subsequently the consumption of labour declined in the later years of the establishment period. The operation wise analysis of labour utilization showed that during the whole establishment period the highest amount of labour was consumed by the weeding and mulching operation (158.2 mandays/ha). The operation wise labour utilization pattern during the bearing period showed that the tapping and latex collection operation was the most labour intensive operation accounting for 64.09 per cent of the total labour utilization.

The overall total establishment cost of rubber plantation was Rs.293205 per hectare and 38.39 per cent of the total establishment cost was incurred in the first year itself. The average cost of production of rubber was found to be Rs.76864 per hectare and the

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variable cost (Rs.51831/ha) constituted 67.43 per cent, while the fixed cost (Rs.25003/ha) constituted 32.57 per cent of the total cost of production. The average per hectare production of rubber sheet and scrap rubber were found to be 1758.61kg and 142.03kg respectively. The average annual net return from the rubber plantation was found to be Rs.179993 per hectare.

The investment appraisal of rubber plantation revealed positive net present value, internal rate of return greater than the prevailing interest rate of banks and benefit cost ratio greater than unity, thus establishing the financial feasibility of the rubber plantation. The average production and price received in the sample rubber plantations were much higher than their respective break even values revealing the economic viability of the rubber plantations.

The major problems faced by the rubber growers were high cost of input materials, high cost of labour, non availability of skilled tapper, high initial investment cost, theft and security problem, high fluctuation in market price and lack of storage facilities etc.

Economic Analysis of Post-harvest Losses in Food Grains in Assam - A study in Nagaon district

Parinita Dutta

The main challenge of the agricultural sector is to achieve at global food security that is providing food for all. With the growth of the population increasing at an alarming rate, the measurement of agricultural productivity should not only help in locating regional imbalances in production, but also suggests the methods, how production or productivity can be increased to feed the growing millions. Food availability and accessibility can be increased by increasing production, improving distribution and reducing the post-harvest losses. Thus, reduction of post-harvest losses is a critical component of ensuring future global food security. The present study is an attempt to examine the growth and variation in food crop sector of Assam and also to have an account of the status of post-harvest losses in food grains in Assam. The study also determined the factors affecting post-harvest losses at farm level. The study was conducted in Nagaon district of Assam. A multistage random sampling technique was followed to select the ultimate sample unit. A sample of 80 farmers and 30 market intermediaries were selected. The results of the study revealed that the growth rate in area of total food grains had decreased over the periods of 1990 to 2012 which indicated that area under food grain crops was shifted for cultivation of some other commercial crops. The growth of production was positive and significant (3.92) during 1990-2000 which was due to significant positive growth in yield at 3.85 per cent. The growth in production was positive but not significant at 5.05 per cent during 2000-2012 due to a positive growth rate in yield at 7.98 per cent. The coefficient of variation in production of total food grains was 5.28 per cent during 1990-2000 that increased to 15.61 per cent during 2000-2012 which was partly contributed by increased in variation under area (12.69 per cent) and yield (4.56 per cent) during that period. The variation in area and yield of total food grains was observed to be 1.68 per cent and 3.99 per cent respectively during 1990-2000. It had been found that a total post-harvest losses was 7.60 kg/ql and 7.54 kg/ql in rice and pulses respectively. A loss of 7.59 per cent in rice and 7.54 per cent in pulses over production was estimated. It was observed that education (-0.68), threshing machine (-1.77) and transportation (-1.01) had a negative impact on whereas the co-efficient pulse area (3.91) had a posi-

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tive impact on the post-harvest losses in pulses. The co-efficient of rice area (0.09), irrigation dummy (0.08) and threshing machine dummy (0.38) had a positive impact on the post harvest losses. The transportation dummy negatively influences the post-harvest losses in rice. It was observed that the farmers had to challenge a number of problems. Most of the farmers are not aware of the proper post-harvest management practices to be followed. Lack of proper storage, transport facilities was one of the major constraints. The study recommended that both government and private agencies should work together to educate and train the farmers on loss management and in bringing the facilities nearer to them.

Impact of Bringing Green Revolution to Eastern India (BGREI) programme in rice production system of Assam

Pinky Pathok

The BGREI programme was initiated in 2010-11 as a sub scheme of RKVY. The programme intended to address the constraints limiting the productivity of "rice based cropping system" in Eastern India comprising seven states namely, Assam, West Bengal, Orissa, Bihar, Jharkhand, Eastern Uttar Pradesh and Chhattisgarh so that agriculture productivity is reasonably enhanced and stabilized in these areas. The present study was conducted in Jorhat district of Assam to assess the status of BGREI programme and its impact in changing cropping pattern, production, productivity and economics of rice production system and to analyze the post adoption phases of technology intervention. A sample of 120 farmers (80 beneficiaries and 40 non beneficiaries) were selected using Multistage stratified random sampling technique from two different A.D.O. circles namely, Baghchung and Allengmora to examine the impact of BGREI programme.

From the analysis, it was observed that total fund allocation under BGREI programme increased during 2014-15 by around 10 per cent from 2012-13. The site specific activities showed 100 per cent achievement in physical and financial target during 2012-13 to 2014-15. Marginal change in cropping intensity of beneficiaries was observed and in case of non beneficiaries no steady trend was observed. The area, production, productivity and economics were found to be higher in case of beneficiaries as compared to non beneficiaries. The Benefit Cost ratio of beneficiaries was marginally higher than non beneficiaries. Getting of HYV seeds and increase in Net income was found as the major contributing factors to adoption and lack of irrigation facilities and low level of farm mechanization was found major factors hindering adoption.

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Major Advisor :Dr. P. B. Gogoi

An Economic Analysis of Pineapple Production in India

Pradhyut Debbarma

The study was on determinant of income from pineapple production in Tripura. A total number of farmer eighty 80 comprising, 29 marginal, 6 small, 19 semi-medium, 17 medium and 6 large pineapple farmers were selected using multi-stage random sampling techniques. Well structured questionnaire was the main tool for data collection. Descriptive statistical tools, simple tabular and percentage analysis were used to obtain economics of pineapple production along with constraints faced by the farmers in pineapple production and multiple regression analysis was used to see the effect of various factors on pineapple production. Cobb Douglas type of production function was used. The economic analysis revealed that in 2nd year, total gross return 92.53 thousand rupees per ha, total cost 42.97 thousand rupees per ha and net return 49.56 thousand rupees per ha, from the 3rd year, gross return 99.94 thousand rupees per ha, total cost 32.55 thousand rupees per ha and net return 67.39 thousand rupees per ha and from the 4th year, gross return 125.53 thousand rupees per ha, total cost 24.86 thousand rupees per ha, and net return 100.67 thousand rupees per ha were obtained from the pineapple production in the study area in the state of Tripura. Feasibility analysis of pineapple grower revealed that the highest NPW was in large farm 1819.90 thousand rupees per ha and the lowest NPW was in marginal farm 104.39 thousand rupees per ha. The B:C ratio highest in the marginal farm 2.97 percent and the lowest B:C ratio in the medium farm 2.06 per cent. But the IRR highest was in marginal and semi-medium farm 230 rupees per ha and the lowest was in large farm 90 rupees per ha. The different results found in the study revealed that pineapple cultivation practices had a great impact on employment and income generation for the people of the study area and may take this cultivation as profitable business venture.

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Economics of Protected Cultivation of Flowers and Vegetables in Assam- A Case Study

Rekha Moni Chetia

Protected cultivation is a newly emerged technology to boost the agricultural production on and off season in India as well as Assam. The present study was under taken to examine the economics of protected cultivation of flowers and vegetables in Assam. The study was carried out in Kamrup, Nalbari, Darang, Nagaon, Marigaon, Golaghat, Jorhat, Sivsagar, Dibrugarh, Tinsukia districts of Brahmaputra Valley Zone of Assam where flower and vegetable growers using protected structure were available. A sample of 66 growers with protected structure were selected using multistage random sampling technique and categorized into three different categories, viz. Size-I, Size-II and Size-III based on size of the protected structure available.

The study estimated that total investment cost of bamboo made poly house was estimated at Rs. 34,231 per farm and Rs.1,41,449 per 1000 sq.m for Size-I. For Size-II with limited feature like G.I. Pipe, drip irrigation etc, investment cost was Rs. 95,936 per farm and Rs. 1,63,680 per 1000 sq.m The investment cost for semi high tech structure (Size-III) with G.I. Pipe, fogger system was Rs 4,69, 515 per farm which was estimated to be Rs. .4,15,400 per 1000sqm. Total cost of cultivation of flower crops like Gerbera, Anthurium, Orchid per farm was Rs. 22,803, Rs. 36,534, Rs. 31,391 respectively. In case of vegetable, cost of cultivation of tomato, spinach, capsicum and cucumber per farm was Rs. 3,984.65, Rs. 3,123, Rs. 7,073 and Rs. 3,247, respectively. The study also revealed that planting material accounted 38.81 per cent, 87.63 per cent, 88.43 per cent, 6.43 per cent, 18.04 per cent, 27.46 per cent and 36.95 per cent of the variable cost alone for Gerbera, Anthurium, Orchid, Tomato, Spinach, Capsicum and Cucumber, respectively. Though high investment cost, per farm net income over total cost for Gerbera, Anthurium and Orchid was Rs. 38,823, Rs.76,680 and Rs.71,269 respectively. The return over cost (based on gross return) was 2.48, 3.41 and 3.27 respectively, for Gerbera, Anthurium and Orchid. In case of vegetable under protected cultivation Capsicum with net return Rs.18,791 and return over cost 3.52 was found to be more profitable followed by Cucumber with net return Rs 7,442 and return over cost 3.11, Tomato (net return Rs. 8,381 and return over cost 2.90) and Spinach (net return Rs. 7,896 and return over cost 2.84), respectively. The study also identified some problems related to production, marketing, post harvest management and a few social problems. Proper use of technology can ensure flower and vegetable cultivation a remunerative business under cover.

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Conduct and Performance of Primary Wholesale Markets with special reference to Vegetables in Darrang district of Assam

Rekha Rani Nath

The present study was conducted in Darrang district of Assam to study the structure, conduct and performance of vegetable markets considering the importance of vegetables in the state. The study employed multistage stratified random sampling technique and a total number of 40 sample farmers and 70 market intermediaries were selected to examine the marketing of vegetables. The study analysed the level of market concentration, Co-efficient of variation of market arrivals and price. Moreover, marketing margin and efficiency of vegetable market were also estimated. Gini Coefficient and marketing efficiency criterion were used in assessing the efficiency of the market system.

From the analysis it was observed that there is existence of freedom of entry and exit of different market functionaries into the market. There is inequality in the distribution of sales income in the market structure. Gini-Coefficient for producer/sellers, primary wholesalers, secondary wholesalers and retailers in the study area for different crops (*Kharif* and *Rabi*) were 0.79, 0.75, 0.73 and 0.72 respectively indicating high level of market concentration and consequently high inefficiency which reflected the imperfect market structure. The arrival of *Kharif* vegetables was found during the month of March till October- November, whereas *Rabi* vegetables arrival started from November and ended by June-July. Coefficient of correlation between arrivals and price were found negative in all the vegetables except cabbage. Arrivals and seasonal demand were the main factors which determined the price of vegetables in the markets. In the study four different channels were identified for marketing of (*Kharif* and *Rabi*) vegetables viz., a) Channel I: Producer/seller- Consumer b) Channel II: Producer/seller-Primary wholesaler-Retailer-Consumer c) Channel III: Producer/seller -Primary wholesaler- Secondary wholesaler-Retailer- Consumer and d) Producer /seller -Primary wholesaler- Commission agent-Retailer- Consumer. Out of which Channel I was found most efficient. Shortage of labour was found to be the major constraints among the major problems in marketing of vegetables, followed by lack of adequate storage facilities, price instability, transportation problem, presence of unlicensed traders, lack of market information were found to be the other major marketing problems in the primary wholesale market of the study area.

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Prospect of Village Adoption through Institutional Financing in a Lead Bank District of Assam

Sandipa Gogoi

Finance is an essential requirement for every productive activity. Agriculture is no exception to it. In modern agriculture, the high quantum of credit is needed, various short term cash inputs like use of improved seeds, fertilizers, insecticides etc., and medium and long term investments for irrigation, land improvement, machinery etc., are compulsory for increasing agricultural production. Further the modern agriculture also requires co ordinations of various activities like appropriate estimation of credit, timely and adequate supply of inputs, repayment arrangements favourable to farmers, efficient machinery for recovery of loans and adequate marketing accomodations. Such requirements under traditional agriculture often could not be met. So in modern agriculture introduction of institutional channel of credit is necessary. The present study was conducted in Sivasagar district of Assam to study the prospect of village adoption through institutional financing. The study employed multi-stage random sampling technique and a total number of 120 sample farmers were selected to examine the prospect of village adoption. The study analysed the structural changes in farmers resource availability and utilization including their prospect of development through effective borrowing. Capital and credit requirements of the different categories of farmers were estimated to ensure maximum level of financial inclusion in the adopted villages. The study observed different problems faced by the farmers in obtaining and using credit.

From the analysis it was observed that in those six partially adopted villages very few farmers were availing credit to meet their working capital requirements. No significant structural changes were observed among the marginal and small farmers. However, in case of semi-medium and medium farmers, there was a positive change in their farm structure. Farmers borrowed credit mainly for purpose of growing vegetables (43.88%) and Sali rice (28.33%) in the study area. Assets acquisition was more in case of semi-medium and medium farmers.

Per hectare credit requirements were estimated for different major crops grown in the study area. Then credit needs was calculated for different villages after deducting total

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capital available from total capital requirements. Total capital availability was higher for medium farmers followed by semi-medium, small and marginal farmers.

Certain problems such as procedural difficulties, inadequacy of loans, lack of proper supervision in credit obtaining and utilization were identified by the borrower farmers in the study area. Majority of marginal farmers (91.83%) opined that borrowed amount was not adequate for meeting their farm expenses. Large number of small farmers (92.85%) preferred to get the loan in cash and as high as 81.39% medium farmers expected intense technical guidance from the banking institution.

Supply chain analysis of major vegetables: a study in the Darrang district of Assam

Utpal Baruah

The present study was conducted to analyze the supply chain of major vegetables in the Darrang district of Assam. Both input and out put supply chains for selected vegetables are studied. Compound Annual Growth Rates (CAGR) for Area, Production and Productivity for vegetables were estimated. Input supply chain and marketing channels were identified and marketing margin, price spread, marketing efficiency and producer's share were calculated. The Cobb-Douglas functional form was used to analyze the influence of various factors towards vegetable marketing and supply chain in the study area. The important vegetables selected were brinjal, bottle gourd, tomato and cabbage for detailed analysis. Two important markets viz., Kharupetia and Besimari were selected and from the surrounding villages of each market from which bulk of products come to the market, three villages were selected randomly. A simple random sample of 20 percent was drawn without replacement from marginal, small, medium and large categories of farmers from the selected villages.

In case of kharif vegetables, the annual growth rate in area was 2.96 percent per year 5.912 percent per year in production and 2.86 percent in productivity where as in case of rabi vegetables the annual growth rate in area was 2.67 percent per year, in production and 2.86 percent per year and productivity in 2.42 percent per year. The increased CAGR have been due to the initiatives taken by the Government and State Agriculture Department by providing various financial and technical supports to the farmers. Majority of the farmers (72.50 %) preferred their input source as local dealer.

For brinjal six numbers, for bottle gourd five numbers, for tomato six numbers and for cabbage four numbers of marketing channels were identified. Among the farmers 27.43 percent of brinjal growers, 32.16 percent of bottle gourd growers and 22.68 percent of tomato growers sold their produce through channel no-5 and 34.1 percent of cabbage growers sold their produce to the wholesaler through channel no-3.

The produce's shares in consumer's rupee were highest as expected in the first chan-

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nels for all vegetable growers because these were the direct channels. Channel-1 of all vegetable growers indicated producer's share in consumer's rupee value of 100 (percent). The MME value was highest in brinjal and bottle gourd in channel-6 with values of 3.72 and 3.3 respectively. In case of tomato grower MME value of 5.4 was highest in channel-2 and lowest in channel-4. In case of cabbage the Modified Marketing Efficiency (MME) was highest in channel-3 and lowest in channel-4

In case of brinjal post-harvest loss cost had significant (P value < 0.01) influence on total marketing cost of vegetables. Handling and storage cost significantly influenced (P value < 0.05) total marketing cost of bottle gourd in. Storage, post-harvest loss and packaging cost contributed significantly (P value < 0.05) towards total marketing cost of tomato and 88.5 percent of variation in the dependent variable was described by the explanatory variables included in the regression model. Packaging and storage cost was found to have significant (P value < 0.05) influence on total marketing cost of cabbage.

The study identified major marketing problems such as assembling, handling, storage, transportation, post-harvest loss and packaging. Proper storage facilities for vegetables should be created in the two markets viz. Kharupetia and Besimari markets considering the volume of wholesale and retail transactions. As the two markets are the important vegetables trading centers not only for the Darrang district but also for others part of the state hence the identified problems need to be tackled through appropriate policy measures.

Consumer Buying Behavior of Processed Food Products in Jorhat city

Ahmad Sear Bazgeh

A rapidly rising population and greater levels of urbanisation over the past few years, has significantly increased the demand for processed food products in India. Considering the importance of study on processed food products, the present study was attempted to examine the market arrivals of different processed food products in Jorhat city, customer's preference among various brands and satisfaction levels on processed food products.

The present study was conducted in Jorhat city on purposively selected six retail outlets and 20 randomly selected customers of processed food products from each retail outlets thus, comprising a total 120 nos. of respondents for the study. It was observed that the majority of the respondents (39.17%), customer of processed food products were found to be businessman followed by salaried job (29.17%). Out of the sample customers 85.83 per cent were found non-vegetarian and the remaining 14.17 per cent were vegetarian.

From the research study it was revealed that among all other brands of jam & jelly and sauces & ketchup, Kissan is the highest selling brand in Jorhat city with a share in total market arrival of these products of 43.84 per cent and 40.70 per cent for jam & jelly and sauces & ketchup, respectively. Similarly, with 59.18 per cent and 43.48 per cent, Nilons and Tropicana are the highest selling brands of pickles and fruit drinks respectively in Jorhat city. It was also found that 55 per cent of the sample customers get information about processed food products from TV advertisements followed by 21.67 per cent from display of retail outlets. Most of the customers prefer the brand Kissan with a mean score of 63.41 per cent and 66.32 per cent for both jam & jelly and sauces & ketchup, respectively. Similarly, the brand Nillon is mostly preferred (63.22%) for pickles and Tropicana is preferred with a mean score of 66.32 per cent for fruit drinks and squash. Among different factors influencing the brand preference of the customers, quality and availability of products were found most influential with a mean score of 64.32 per cent and 61.11 per cent, respectively. From the study of customers satisfaction level with the processed food products it was found that

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52.50 per cent customers were satisfied with price, 50.83 per cent highly satisfied with quality, 53.33 per cent satisfied with shelf life and 55 per cent of customers were highly satisfied with the availability of processed foods. The study also reveals that the majority of customers (36.67%) are mostly loyal to the specific brands followed by 26.67 per cent, 20 per cent and 16.67 per cent of respondents always, sometimes and rarely loyal to the brands of processed food products, respectively.

Effects of Television advertisement on children's consumption behaviour in Jorhat city

Antara Bhattasaly

The present study was conducted to examine the effects of Television advertisement on children's consumption behaviour in Jorhat city. Three schools namely K.V. RRL, Don Bosco and Carmel were purposively selected for data collection. A total of 180 children comprising 20 each from 8th, 9th and 10th standards of all the schools and 60 parents were personally interacted and necessary data were collected with the help of a semi-structured questionnaire. Stratified random sampling technique was used in the study.

The result shows that children's increasing interest on Television advertisement has been providing enormous scope for the companies to increase their overall sale. Ninety (90) per cent of the children were identified as the viewers of Television advertisements and number of boys viewing advertisements was slightly more than the girls (82 boys and 80 girls). One third (33.18 per cent) of the children spent a part of their valuable time in viewing Television daily. Almost half of the children (48.77 per cent) spent less than one hour time in Television viewing every day. 24.07 and 21.60 per cent girls and boys preferred to watch Television with their parents respectively. Advertisement influenced 17.90 per cent children to purchase such products which are actually not necessary to them. 33.33 per cent girls dependent on their parents while taking any purchase decisions. There are several factors which influence children's buying behaviour towards a product and 15.43 per cent girls took purchase decision based on its price followed by family member's opinion (14.81 per cent). In case of boys, quality packaging of the product (19.75 per cent) was the prime factor for purchase of a product followed by advertisement effect (11.11 per cent). Both girls (20.99 per cent) and boys (13.58 per cent) mostly preferred chocolates over other confectionary products. The insistence of boys (38.27 per cent) on parents was more than the girls (22.22 per cent) for purchase of products after watching the advertisement. Many tactics such as not taking food, showing anger, pretending illness, emotional blackmail etc. were normally used by the children to fulfill their demands. Boys (30.00 per cent) need more guidance from their parents as compared to the girls (28.33 per cent) while purchasing a product. As per

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parent's opinion 18.33 per cent boys seldom insisted them for buying a product after viewing Television advertisement, whereas 15.00 per cent girls insisted their parents few times. As age increases, majority of the children's frequency of insistence for buying a product tend to decrease slightly. In case of girls 33.33 per cent parents mostly agreed the demands of their daughters, whereas only 23.33 per cent parents convinced with the demands of their sons. The major three problems of Television advertisement faced by the children were increased purchasing habit of the products (27.18 per cent), increasing demand for luxurious life (16.99 per cent) and conflicts arising between parents and children (15.05 per cent) respectively. Insistence for buying a product (17.35 per cent) was identified as the main problem based on the opinion given by the parents.

Effectiveness of Social Media as a Marketing Tool: A Micro Level Study

Dhanjit Dutta

The present study titled "Effectiveness of Social Media as a Marketing Tool: A Micro Level Study" has been conducted for fulfillment of partial requirement for award of the degree of Master of Business Administration (Agri-Business). The recent proliferation and increasing usage of social media websites provides a platform for nurturing brands and influencing people's purchase decisions. Use of social media as a marketing tool has gained tremendous attention from business organization and entrepreneurs alike. Several attempts have been made worldwide to ascertain effectiveness of social media marketing and results of these studies often vindicated the notion that social media marketing is effective as a marketing tool. An attempt has been made to empirically test this perception and also to device strategies for increasing its effectiveness.

The study was conducted in the city of Guwahati, the capital of Assam. For primary data convenient samples were drawn from 150 nos of respondents residing in the city of Guwahati.

Major Findings:

- " Social Media is helpful in increasing awareness for products / services.
- " Social Media do influence buying decisions.
- " Social Media are referred to by majority while making buying decisions.
- " Having positive review in Social Media is very important.
- " Significant amount of time is being devoted to Social Media.
- " Social Media are gaining more prominence over TV and FM.
- " Mobile device is the most widely used gadget for accessing Social Media.
- " Facebook is the clear winner amongst various Social Media sites.

The following recommendation and suggestions can be derived from this study.

- " Creating and maintaining a brand page invariably in Facebook.
- " Maintaining mobile friendly websites and developing suitable applications for mobile devices.

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- " Having a proper Social Media strategy in place backed by ample resource allocation.
- " Concerted efforts at organisational level to generate positive reviews.
- " Avoiding temptation to put up direct advertisement.
- " Using social media marketing in conjunction to the other marketing tool

Production and marketing of CC Tea by The SuiGeneris Inc. in Manipur

Haobam Dimashree Devi

Lemon grass (*Cymbopogon*) is an aromatic tall sedge which grows in many parts of tropical and sub-tropical South East Asia and Africa. In Manipur an organization called The SuiGeneris Inc. is currently having 200 acres of lemon grass plantation and produce a naturally caffeine free herbal tea, CC Tea that is rich in antioxidants.

The present study on the "Production and marketing of CC Tea by The SuiGeneris Inc. in Manipur" of Imphal-West district, broadly examined the organizational structure and job responsibilities vested on different managerial cadres, production and marketing of CC Tea from lemon grass, economics of CC Tea and constraints in production and marketing of CC Tea. The primary data were collected from the organization through personal interview with the help of a schedule and questionnaire.

The result revealed that the organization is headed by the Chief Managing Director, under whom there are three top managers namely, Chief Executive Officer, Chief Finance Officer, and Chief Operating Officer. In 2015, The SuiGeneris Inc. produced 12,00,435 kg of fresh leaves, 2,00,072 kg of dried leaves and 1,00,036 kg of final produce. From the final produce, three variants namely, CC Tea Classic (100gm), CC Tea Regular (200gm) and CC Tea bags (100gm) were produced. Three marketing channels were identified in the study area through which the organization marketed their products. In all the variants of CC Tea, the producer's share in consumer's rupee was highest in channel III. At the same time, this channel marked the lowest price spread for all the three variants. The cost of cultivation of 200 acres of lemon grass was worked out to be Rs.1,20,92,400. Thus the total cost of manufacturing of all the three variants of CC Tea was Rs.3,39,02,588 for 200 acres. The gross income for 200 acres was found to be Rs.12,42,94,730 and net return after deduction of 30% tax was worked out to be Rs.6,32,74,500. Therefore, cultivation of lemon grass is a profitable venture which is being utilize by The SuiGeneris Inc., a privately owned agri-enterprise operating in Manipur since 2010. Major problems faced by the organization were shortage of labour, high price of packaging materials, pests and diseases, inadequate training facility, lack of awareness, frequent bandhs and strikes, fund crisis, and spoilage.

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Major Advisor : Dr. Anup Kumar Das

Consumers' buying behaviour of organic inputs in Jorhat market

Jishnu Jyoti Saikia

With advent of organic agriculture, the demand for organic inputs like bio-fertiliser and bio-pesticide are continuously in rise. In the organic input market, several firms are engaged in production and marketing of different types of organic inputs. Hence, the consumers have more option to choose from. In this context, a study on organic input was designed to understand the brand awareness and preference of different consumers. Understanding the consumer behaviour would help the firms in formulating strategies to cater to the needs of the consumer and thereby increase their market share.

The present study was conducted in Jorhat market of Assam. A random sampling technique was used to draw a total of 40 sample respondents for the study. For convenience, organic inputs were classified as bio-fertilizer and bio-pesticide. A wide variety of bio-fertilizer and bio-pesticides were available in the market. Brand awareness and brand preference of bio-fertilizers revealed that consumers were more aware and preferred the bio-fertilizer products of M/S Rajpriyam. Similarly, consumers were more aware and preferred the bio-pesticide products produced by Orgaman R&D. Most preferred bio-fertilizer products were Essential, M.B. Buffer, Garden Samrat and Vermicompost. In case of bio-pesticide products, Econeem, K-Hume and Orgajin were preferred most by the respondents. Brand, price and quality were the major determining factors for preference of particular bio-fertilizer or bio-pesticide. Bio-fertilizer and bio-pesticides were purchased on monthly basis and on an average Rs 500 - 1000 was spent for purchase of these inputs. The buyers of bio-fertilizers were salaried person revealing the fact that very less per cent of farmers used to purchase organic inputs for commercial cultivation of crops. Organic inputs were mostly purchased for use in the flower garden and cultivation of horticultural crops

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Efficiency of Small Tea Growers in Jorhat District of Assam

Oinam Dineswori Devi

The popularity of tea as beverage in the world is well known. The tea industry occupies an important place in the economy of the nation as a whole and in the state of Assam in particular. The present study was conducted in Jorhat district of Assam as there were more than 5000 Small Tea Growers (STGs) with a view to examine the socio economic background, resource use efficiency of STGs and constraints in management and marketing of tea. A multistage stratified random sampling technique was followed to select the sample for the study. Appropriate tools and techniques were used to analyze the data. It was found that the average family size of STGs was 5.28 in number. More than half of the population was in the age group of 15-59 years. The literacy rate of the sample was 86.76 percent. About 25 percent of the population was engaged in growing tea. In the STGs, 61.15 percent of total area was under tea plantation followed by paddy. In the family labour, male labour is higher than the female labour but in case of hired labour, female labour was higher than the male labour. The Cobb- Douglas production function was used to determine the major factors affecting the total amount of green leaf production. It was observed that the input variables area, family labour, permanent labour, fertilizer used had positive and significant influence on the production of green leaf. The estimated mean technical efficiency indicated that the sample farms were about 75 percent technically efficient. The study also revealed that management of pests and diseases, theft of green leaf, difficulty in managing the estates during festival, payment of wages to workers, cost of inputs and commission by the middlemen were the major constraints in the study area.

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Organization and Management of Youth Volunteer Union Milk Producer Company Limited (YMPC) in Manipur

Sarangthem Sarojranjan Singh

Billions of people around the world consume milk and dairy products every day. Not only are milk and dairy products a vital source of nutrition for these people, they also provide livelihoods opportunities for farmers, processors, shopkeepers and other stakeholders in the dairy value chain. Youth Volunteer Union Milk Producer Company Limited (YMPC) is a company incorporated on 11th December, 2013 and implemented by Youth Volunteer's Union (YVU) situated at Thoubal, Manipur. It was established as a part of the Integrated Dairy Development Project and it is sponsored by TATA Trusts, Mumbai. It is the first milk producer company in Manipur. Apart from providing financial assistance to the members for establishment of home dairy units, the organization also provides other services like SHG formation, training and exposure facilities, procurement of raw milk, processing and marketing of milk, free vaccination to cattle (twice in a year), hands-on training etc. The present study was carried out in Imphal West and Thoubal districts of Manipur. A simple random sampling technique was followed to select the sample respondents. A sample of 50 member respondents and 30 non-member respondents were selected from villages viz. Thoubal Khunou, Tentha, Langmeidong under Thoubal tehsil and Tera Pisak under Kakching tehsil and Iram Siphai and Yumnam hidrom under Wangoi tehsil. The selected respondents were categorized based on number of cows they owned viz. small size (1 - 2 cows) and large size (> 2 cows). The results of the study revealed that due to the availability of sufficient staff in the organization, roles and responsibilities can be properly divided and it helps in efficient management of the organization in all directions. The net profit of YMPC was found to increase from Rs. 2,23,506 (2013-2014) to Rs. 12,54,599 in 2014-2015. It indicates that dairy business has a positive impact on income. The average net income per cow was higher (Rs. 45,388.37) in member respondents than that of non-member respondents (Rs. 39865.79). Average total man days for each respondent per annum were higher (301.12 man days) in members as against (292.76 man days) in non-members. Frequent *bandh* and strike, and regular power cut were identified as the major problems faced by the organization. Whereas, low price of milk and decreasing interest of youths in dairy farming were found to be the major problems in both member and non-member respondents.

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Major Advisor : Dr. (Mrs) Nivedita Deka

A study on the *Ima* Market of Manipur

Sheetalmanjuri Ningthoujam

The *Ima* market also known as Khwairamband Bazaar is situated at the heart of the Imphal city, where there are 3,689 women vendors carrying out their entrepreneurial activities. The uniqueness of the *Ima* market is that all stalls are run by women alone. The Market is divided into three segments according to its location namely Purana bazaar, Laxmi bazaar and New market/Linthoingambi bazaar. One striking features is that goods and commodities sold are mostly local products. This sprawling commercial is a symbol of the economic status and liberty of the Meitei womenfolk. Majority of the women engaged in the market have poor educational background, having no other option for other engagement but for entrepreneurial or marketing activities. With no differentiation to one's caste, community and religion, women from far and remote areas of Manipur come to this market to sell their vegetables, fruits, fishes, local made products, clothes, ritual items etc to support the families. The present study is an attempt to analyse the organisational set up, market structure and the socio economic status of the women vendors with special reference to income and employment. The sampling design followed for the study was random sampling design. A total of 60 women vendors were simple randomly selected for the study. The study revealed that out of 60 women vendors, 41.66 per cent deal with the marketing of agricultural commodities and the remaining 58.34 per cent deal with the non agricultural commodities. Among the agricultural commodities maximum number of vendors deal with the marketing of fruits and for the non agricultural commodities they deal with the marketing of ritual items. Value wise marketing margin among the agricultural commodities is maximum in case of raw fish vendors i.e., Rs. 65,967 and for the non agricultural commodities it is maximum in silk clothes (*Wangkhei phi products*) vendors i.e., Rs. 51,750. About one third of the total population i.e., 28.33 per cent of the women vendors are widow. It shows the employment opportunities to a large extent by the market to the widow vendors. Every women vendor in the market works more than one woman day i.e. more than 8 hours in a day. The women of *Ima* market have faced challenges before and will continue to do so in future, but the market will survive though changes in its structure and dynamics are inevitable.

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Impact of weather parameters on winter rice productivity in the Upper Brahmaputra Valley Zone of Assam

Athar Nishat Islam

The present research work intended at probing the impact of rainfall, rainy days, maximum and minimum temperature, morning and evening relative humidity and bright sunshine hours on winter rice productivity at Jorhat and Dibrugarh in the Upper Brahmaputra Valley Zone (UBVZ) of Assam through statistical analysis over a dataset of 31 years from 1984 to 2014. The association between the yield and weather parameters was obtained by applying Karl Pearson's correlation technique and the identification of major weather parameter affecting the yield of rice was attained by using multiple regression studies for both the locations. Intra and inter seasonal weather variability affecting the yield of winter rice was obtained by undertaking a detailed analysis of the deviation of weather parameters from the normal over the past decade (2005-2014) for both the selected locations. The association between yield and weather parameters in Jorhat revealed significant positive correlation ($r = 0.365$ and 0.366) with bright sunshine hours during the vegetative and total growth phase respectively. The association with morning relative humidity quantified significant positive correlation ($r = 0.365$) during the vegetative phase, whereas, significant negative relation ($r = -0.499$) with rainy days during the ripening phase. Correlation studies in Dibrugarh between Sali rice yield and weather parameter exhibited significant positive correlation ($r = 0.378$) with bright sunshine hours during the vegetative phase. The association with maximum temperature during the vegetative and total growth phase quantified significant positive correlation ($r = 0.360$ and 0.368) respectively, whereas, evening relative humidity during the ripening and total growth phase revealed significant negative correlation ($r = -0.471$ and -0.381 respectively). The coefficient of variation was found to be highest for rainfall and rainy days precisely during the ripening phase for both the location. Multiple linear regression studies revealed that in Jorhat and Dibrugarh, out of 21 generated weather variables, 11 were selected which explained 70.37% and 68.79% of the total variation in the yield of the respective locations and exhibited highest Adjusted R² of 53.21% and 50.71% respectively.

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Effect of intra and inter seasonal weather variability on Sali rice grain yield revealed that, higher amount and well distributed rainfall during the vegetative and reproductive phase of the crop coupled with higher amount of bright sunshine hours than normal in the entire season, precisely during the vegetative and ripening phase, might probably the main factors for the increase in the Sali rice yield at Jorhat and Dibrugarh in the high yield years.

Recent trend of extreme rainfall events in the Brahmaputra valley of Assam

Bikash Jyoti Gharphalia

The present study investigates the changes in characteristics of rainfall in the Brahmaputra valley of Assam during 1986-2015 based on the observed daily rainfall data of 25 locations. The analysis was performed for the Brahmaputra valley as a whole as well as for its three parts (upper, central and lower) to see the spatial pattern of changes in the extreme events. Theil Sen's slope method was used to detect the trends of monthly, seasonal and annual rainfall as well as different extreme indices. Mann-Kendall rank test was applied to understand the statistical significance of the trends. Altogether 15 extreme rainfall indices were calculated with the help of RCLimDex software, developed by the Expert Team on Climate Change Detection Monitoring and Indices (ETCCDMI). Results revealed that the annual rainfall in the Brahmaputra valley decreased by 66.6 mm/decade during 1986-2015. Similar trends were also found for monsoon rainfall due to statistically significant decrease of September rainfall in the upper (39 mm/decade) and central (35 mm/decade) parts and July rainfall in lower (77 mm/decade) part of the valley. The decrease of monsoon rainfall in the valley (53.4 mm/decade) was mainly influenced by the significant decrease in extreme rainfall fractions due to extreme wet days (R99p), very wet days (R95p) and moderate wet days (R75p). Rainfall during post-monsoon season found to decrease by 17.9 mm/decade due to significant decrease in rainfall fraction due to very wet days and moderate wet days. Maximum 1-day (Rx1-day) rainfall showed increasing trend during monsoon in the upper and lower part of the valley indicating a high probability of occurrence of flash flood situation. Results indicated that the contribution of maximum 1-day rainfall to the monsoon total rainfall was increased and to pre-monsoon and post-monsoon rainfall was decreased during the study period. On the contrary, maximum 5-day rainfall (Rx5-day) showed decreasing trends by 8.7 mm/decade due to significant decrease in the central part. In the valley as a whole, rainfall fraction due to extreme wet days (R99pTOT) exhibited a decreasing trend (28 days/decade) due to its significant decrease in the central (59 days/decade) part. Similar decreasing trends were observed for rainfall fraction due to moderate wet days (R75pTOT),

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very wet days (R95pTOT) and extreme wet days (R99pTOT) in each part of the valley. It has been observed that the reduction of extreme rainfall frequencies played a major role in the reduction of monsoon and annual rainfall during the recent 30-year period in the Brahmaputra valley. Threshold-based indices (R75mm, R100mm and R125mm) showed decreasing trends in all the seasons. Consecutive dry days (CDD) increased by 6.5 days/decade in the Brahmaputra valley due to its statistically significant increasing trend in the upper part of the valley. On the contrary, consecutive wet days (CWD) showed significant decreasing trend in the valley due to its corresponding significant decrease in the upper and lower parts. Based on the findings of the study, few adaptation strategies on agriculture were suggested so as to minimize the adverse effects of extreme rainfall events.

Simulating plant growth parameters and yield of rice using CERES-Rice model in Upper Brahmaputra Valley Zone (UBVZ) of Assam

Kuldip Medhi

A field experiment was carried out during Kharif, 2015 in the Instructional-cum-Research (ICR) Farm of Assam Agricultural University with two cultivars of rice viz. Luit and TTB-404 grown in different micro-climatic regimes created by manipulating the sowing dates. Both the cultivars were sown on four different dates at fifteen days interval starting from 27 June, 2015 upto 10 August, 2015 following factorial RBD with recommended agronomic practices. Occurrence of different phenological events was recorded along with periodic LAI, biomass, grain yield and yield attributing characters. Agroclimatic indices viz., growing degree day (GDD), heliothermal unit (HTU), phenothermal index (PTI) and heat use efficiency (HUE) for attaining different phenological stages of both the cultivars were also computed.

It was observed that from maximum tillering to 50% flowering (leaf development stage) of Luit sown on later dates (26 July and 10 August) were exposed to daily higher maximum temperature ($>32^{\circ}\text{C}$) as compared to early sowing dates (27 June and 11 July). Heading and flowering stage of TTB-404 sown on later dates were exposed to declining daily minimum temperature of less than 15°C , which resulted in spikelet sterility and lower grain yield. Maximum LAI of 4.9 and 7.0 were recorded during heading to flowering stage in Luit and TTB-404, respectively. Above ground biomass production in different dates of sowing varied from 23.0 to 29.2 g/hill and 40.5 to 43.7 g/hill in Luit and TTB-404, respectively. Grain yield was relatively lower in Luit as compared to TTB-404, which varied from 2.4 to 3.3 t/ha and 4.2 to 5.3 t/ha in Luit and TTB-404, respectively. Comparatively higher grain yields were recorded in the crops sown on 11 and 26 July in Luit, while in TTB-404 that was recorded in the crop sown on 11 July. Reduction of grain yield in later sowing dates in case of TTB-404 in spite of higher biomass production might be due to substantial decrease of biomass partitioning towards grain as compared to that in early dates.

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Accumulated GDD at physiological maturity in different dates of sowing were relatively higher in TTB-404 which varied from 1563 to 1940oC, while in Luit it varied from 1263 to 1455oC. As sowing was delayed, accumulated GDD for attaining any phenological events in both the cultivars were also decreased. However, no definite increasing or decreasing trend of accumulation was observed in case of HTU. The mean values of PTI computed for different phenological stages showed decreasing trend from emergence to maturity in both the cultivars. The phenothermal index at different phenophases of the crop sown on different dates varied from 14.5 to 18.5°C/day and 8.8 to 18.0°C/day in Luit and TTB-404, respectively. The calculated HUE for straw ranged from 3.9 to 4.4 kg/ha/oC in Luit and 4.3 to 7.3 kg/ha/oC in TTB-404, while HUE for grain varied from 1.8 to 2.4 kg/ha/oC and 2.5 to 2.9 kg/ha/oC in Luit and TTB-404, respectively. The correlation study showed that grain yield had a significant correlation with LAI (0.98**), GDD accumulation during tillering (0.89**), above ground biomass (0.91**) and grain HUE (0.89**).

The crop model CERES-Rice embedded to DSSAT (v.4.5) was calibrated for two rice cultivars - Luit and TTB-404 with the data generated from the field experiment during kharif, 2015. The calibrated model was then validated with two additional data sets generated during Kharif, 2012 and 2015 in Luit and TTB-404, respectively. The calibrated model predicted anthesis day and physiological maturity day with reasonable accuracy in both the cultivars. The model also predicted grain yield with accuracy of ± 10 per cent and with RMSE and d-stat values of 325 and 0.9, respectively in Luit. The model failed to predict grain yield with reasonable accuracy in case of TTB-404. The lower value of d-stat (0.34) in TTB-404 was due to underestimation of grain yield by the model.

Performance of late sown *toria* in rice-fallow situation under different crop management practices

Bebi Gogoi

A field experiment entitled "Performance of late sown *toria* in rice-fallow situation under different crop management practices" was carried out at the Instructional-cum-Research farm, Assam Agricultural University, Jorhat during the *rabi* season of the year 2014-2015 and 2015-2016 with a view to study the performance of recently developed late sown *toria* var. JT-90-1 (*Jeuti*) in different dates of sowing, seed rates and method of sowing under rice-fallow situation. The experiment was laid out in split plot design with three replications keeping the dates of sowing in the main plots and seed rates and method of sowing in the sub plots. The treatments comprised of four different dates of sowing i.e. D1 = 1st December, D2 = 8th December, D3 = 15th December and D4 = 22nd December, three different seed rates i.e. S1=6kg/ha, S2=8kg/ha, S3=10kg/ha and two methods of sowing i.e. M1= line sowing and M2=broadcasting.

The soil of the experimental site was sandy loam in texture, acidic in reaction (pH 5.2), medium in organic carbon (0.69%), low in available N (125.44 kg/ha), available P₂O₅ (15.90 kg/ha) and medium in available K₂O (188.16 kg/ha). All plots received 40 kg N/ha, 35 kg P₂O₅/ha and 15 kg K₂O/ha in the form of urea, single super phosphate (SSP), muriate of potash (MOP) and compost @ 2 t/ha. The total amount of rainfall received during the crop growth period (48th SMW - 11th SMW) was 30.5 mm in nine rainy days during 2014-15. Total evaporation during that period was 28.9 mm. The corresponding values during 2015-16 were 101.6 mm in 20 rainy days with total evaporation of 27.4 mm.

Experimental findings revealed that for every 7 days delay in sowing of the crop from 1st December lead to a significant reduction in the growth and yield attributing characters that consequently lead to yield reduction. The highest seed yield of 724.33 kg/ha and 742.06 kg/ha, stover yield of 2268.41 kg/ha and 2296.45 kg/ha and seed oil content of 35.13% and 35.17% were recorded in 1st December sown crop which were significantly higher over other dates of sowing in first and second year, respectively. The extent of decrease in seed

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yield was 9.20% to 34.56% and 6.82% to 32.63% for 7 and 21 days delay in sowing from 1st December (D1) in first and second year, respectively. In case of stover yield the extent of reduction was 8.16% to 24.02% and 6.42% to 23.93% respectively. The pooled mean of two years in respect of seed yield were also found to be higher in 1st December (D1) sowing crop. The seed rate of 10 kg/ha (S3) recorded significantly higher yield of seed, stover, seed oil content over that of 6 and 8 kg/ha. In case of sowing method line sowing was found to be better than broadcasting in all growth and yield attributing characters. Seed yield reduced 10.86% and 10.29%, and stover yield reduced 9.62% and 8.51% in broadcasting method than that of line sowing in first and second year, respectively. The pooled mean of two years in respect of seed and stover yield were also found to be higher in line sowing. The crop recorded highest gross return (50223.35 /ha), net return (33013.35 /ha) and benefit-cost ratio (2.92) when sown on 1st December with seed rate of 10 kg/ha in lines made at 25 cm apart.

Potassium management in organic cultivation of scented rice

Dipankar Das

A field experiment entitled "Potassium management in organic cultivation of scented rice" was conducted at the organic block, Instructional-cum-Research farm of Assam Agricultural University, Jorhat during *khariif*, 2015 taking traditional *joha* rice var. *Badshahbhog* as a test crop. The experiment was laid out in a Randomized Block Design (RBD) with three replications. The experiment consisted of 10 (ten) different treatments viz. enriched compost (100% RDK as basal) (T₁), azolla compost (100% RDK as basal) (T₂), vermicompost by banana pseudostem (100% RDK as basal) (T₃), soil application of banana extract (100% RDK as basal) (T₄), 50% enriched compost + 50% vermicompost by banana pseudostem (T₅), 50% vermicompost by banana pseudostem + 50% azolla compost (T₆), 50% vermicompost by banana pseudostem + 50% banana extract spray at PI stage (T₇), 50% azolla compost + 50% banana extract spray at PI stage (T₈), 50% banana extract soil application + 50% banana extract spray at PI stage (T₉) and control (no manure and fertilizer) (T₁₀). The soil of the experimental site was sandy loam in texture with pH 5.26, organic carbon (0.77%), CEC {6.50 c mole (p+)/kg}, medium in available N (287.39 kg/ha), available P₂O₅ (26.58 kg/ha) and low in available K₂O (125.26 kg/ha). The total rainfall received during the crop season was 1168.3 mm. The organic inputs as a whole enhanced the growth and yield attributes, grain and straw yield, physico-chemical, biological properties of soil and uptake of N, P and K along with enhancement of quality parameters of scented rice var. *Badshahbhog*. Among different organic inputs, enriched compost recorded the highest grain and straw yield (2.94 and 6.09 t/ha, respectively) which were associated with higher number of filled grains/panicle, length of panicle and test weight. The quality parameters viz. length and breadth of grain, protein content and aroma intensity were found to be highest in enriched compost followed by vermicompost by banana pseudostem. The total N, P, K uptake by plant was significantly higher with application of enriched compost over control. The highest available N, P, and K in soil after harvest were found in enriched compost. The narrow C:N and C:P ratios in soil were recorded in enriched compost and

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lower C:K ratio was found in vermicompost by banana pseudostem. Soil biological parameters viz. MBC, DH and PMe activity were found highest in case of vermicompost by banana pseudostem remaining at par with enriched compost. The highest net return (₹ 75,865/ha) and benefit: cost (B:C) ratio (2.47) were obtained due to application of enriched compost. However, soil application of banana extract exhibited almost equal B:C ratio (2.46) with enriched compost. The study revealed that application of enriched compost and vermicompost by banana pseudostem were beneficial as potash source in organic cultivation of scented rice under agro-ecological situation of Assam.

Irrigation and Fertilizer Management in Late sown Toria (*Brassica campestris* var. toria) grown after sali rice

Pompy Deka

A field experiment was conducted at Instructional-cum-Research (ICR) Farm, Assam Agricultural University, Jorhat during rabi season of 2014-2015 to study irrigation and fertilizer management in late sown toria (*Brassica campestris* var. toria) grown after sali rice. The experiment consisted of four different irrigation levels viz., Rainfed (I0), 6 cm Irrigation at pre flowering stage (25 DAS) [I1], 6 cm irrigation at siliqua formation stage (50 DAS) [I2], 6 cm irrigation at 25 DAS and 50 DAS (I3) and three different fertilizers levels viz., F1:45-30-30 N-P₂O₅-K₂O kg/ha-1, F2: 60-40-40 N-P₂O₅-K₂O kg/ha-1 and F3:75-50-50 N-P₂O₅-K₂O kg/ha-1. The experiment was laid out in factorial randomized block design (RBD) with three replications. The soil of the experimental site was loamy sand in texture having available N, P₂O₅ and K₂O 259.53, 25.7 and 137.64 kg/ha-1, respectively with pH 5.8 and organic carbon 0.68 per cent. The toria variety "JT-90-1" was sown on 15th December, 2014 and harvested on 11th March, 2015.

The results revealed that irrigation levels influenced growth characters of toria in terms of plant height, total dry weight leaf area, leaf area index, crop growth rate and relative growth rate. 6 cm Irrigation at 25 DAS and 50 DAS (I3) recorded the highest values for all the growth characters. The maximum values for yield attributing characters, seed and stover yield, relative water content, chlorophyll stability index, N, P, K-uptake and consumptive use were recorded under 6 cm irrigation at 25 DAS and 50 DAS (I3). On the other hand, the maximum water use efficiency was observed under rainfed condition (I0). Different fertilizers levels brought about significant differences in plant height, dry matter accumulation, yield attributing characters, seed and stover yield, relative water content, consumptive use, water-use-efficiency, chlorophyll stability index and N, P, K-uptake. For these parameters, the highest values, were recorded under application of 75-50-50 N-P₂O₅-K₂O kg/ha-1 which were statistically at par with 60-40-40 N-P₂O₅-K₂O kg/ha-1.

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The treatment combination of 6 cm irrigation at 25 and 50 DAS (I3) and 75-50-50 N-P₂O₅-K₂O kg/ha-1(F3) produced the highest seed yield (10.22 q/ha-1). This combination of treatment recorded the highest nutrient uptake (40.21, 7.61 and 17.13 kg/ha-1 of N, P and K, respectively) than other combinations.

In terms of economics, the treatment combination of 6 cm irrigation each at 25 and 50 DAS and 60-40-40 N-P₂O₅-K₂O kg/ha-1(I3F2) was the best with net return of Rs. 20780.00/ha and B:C ratio of 2.01 followed by treatment combination embracing 6 cm irrigation each at 25 and 50 DAS and 75-50-50 N-P₂O₅-K₂O kg/ha-1(I3F3).

Integrated Nutrient Management in potato grown by TPS tuberlet and its residual effect on summer green gram

Roji Chutia

A field experiment titled "Integrated nutrient management in potato grown by TPS tuberlet and its residual effect on summer green gram" was conducted during rabi seasons of 2014-15 and 2015-16 at the instructional cum research farm of Assam agricultural university. The experiment consisting of eight treatments viz., 100% RD of N (T_1), 75% RD of N+ 25% N through EC (T_2), 75% RD of N+ 25% N through VC (T_3), 50% RD of N+ 50% N through EC (T_4), 50% RD of N + 50% N through VC (T_5), 50% RD of N + 25% N through EC + 25% N through VC (T_6), 50% RD of N + 25% N through EC (T_7) and 50% RD of N + 25% N through VC (T_8) was laid out in randomized block design with three replications. The soil of the experimental site was sandy loam in texture, acidic (5.66) in reaction, medium in organic carbon (0.72%), available N (290kg/ha), P₂₀₅ (25.78kg/ha) and K₂O (270.89kg/ha).

The experimental findings reveal that T_6 (50% RD of N + 25% N through EC + 25% N through VC) recorded maximum values for most of the growth as well as yield attributing characters viz., plant height, number of shoots per plant, grade wise tuber yield, total tuber yield, dry matter yield of haulm, dry matter yield of tuber, percent dry matter content of haulm and tuber and nutrient uptake by crop, soil pH, soil organic carbon and available N, P and K.

Soil physico-chemical characters were significantly influenced by INM practices of which T_6 (50% RD of N + 25% N through EC + 25% N through VC) recorded the highest values for all the soil parameters viz., soil pH (5.58 and 5.62), organic carbon (OC) (0.96 and 1.08%), available N (405 and 548.15 kg/ha), P (23.20 and 23.96kg/ha) and K (333.89 and 336.55kg/ha) during both the years of experimentation. Soil biological characters were also found to be statistically superior in respect of microbial biomass carbon (335.55 and 367.41 g g⁻¹ soil), dehydrogenase activity (191.29 and 201.19 g TPFg⁻¹124hr⁻¹), phosphomonoesterase activity (356.44 and 382.46 g p-nitrophenol g⁻¹ hr⁻¹), fluorescein di-acetate hydrolysis activity (9.22 and 9.26 g fluorescein g⁻¹ hr⁻¹) at T_6 followed by T_4 (50% RD of N+ 50% N through EC).

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The OC showed strong correlation with MBC ($r=0.794^*$), Dehydrogenase ($r=0.807^{**}$) and Av. N ($r=0.700^*$). Similarly the enzyme phosphomonoesterase established significant correlation with Av. P₂O₅ ($r=0.668^*$) indicating the role of enzyme in releasing the P from organic sources.

Although the highest B:C ratio of 1.83 was obtained at T1 (100% RD of N) but it was followed by slightly lower value of 1.71 at T6 (50% RD of N + 25% N through EC+ 25% N through VC) with highest net return of Rs 2,29,286.00. Considering the positive effects of INM on growth and yield of potato crop and soil health, T6 was found best to reap good economic yield with better quality and sustained soil health reflecting higher yield in succeeding summer green gram.

Irrigation and nutrient management in summer baby corn (*Zea mays* L.)

Sanet Lagachu

A field experiment was conducted at the Instructional Cum Research Farm, Assam Agricultural University, Jorhat during summer season of 2014-15 to study the irrigation and nutrient management in summer baby corn (var. F1 Golden Baby). The experiment was consisted of four irrigation regimes viz., I1-Pre-sowing irrigation, I2-Pre-sowing + IW:CPE=1.2, I3-Pre-sowing + IW:CPE=1.4 and I4-Pre-sowing + IW:CPE=1.6 and four doses of fertilizers viz., F1-45:30:30, F2-60:40:40, F3-75:50:50 and F4-90:60:60, N: P₂O₅: K₂O kg ha⁻¹. The treatments were laid out in split-plot design and replicated thrice with irrigation regimes in the main plot and doses of fertilizers in the sub-plot. The soil of the experimental field was sandy loam in texture, acidic in reaction, medium in organic carbon, low in available N and available K₂O and medium in available P₂O₅.

The data on growth parameters viz., plant height, plant population at 20, 40 DAS and at harvest, days to 50% tasseling and silking and number of barren plants didn't influence significantly by different irrigation regimes, except plant height recorded at 40 DAS and at harvest. The plant height at 40 DAS and at harvest increased with increasing intensity of irrigation and significantly the highest values were recorded with I4. The yield attributing characters like number of cobs/plant, length of cob with and without husk and weight of individual cob with and without husk were differed significantly due to different irrigation regimes. In all these cases significantly higher values were recorded with I4 over its lower irrigation regimes, except weight of individual cob without husk, which was statistically at par with I3. Significantly the highest cob yield with and without husk, weight of husk, green fodder yield, cob equivalent yield and harvest index were also recorded under I4 over its lower irrigation regimes, but in case of green fodder yield it is statistically at par with I3 treatment. Similar trend of results were also observed on per cent content in and uptake of nutrients- N, P and K by the crop. However, different irrigation regimes didn't bring about any significant changes in available N, P₂O₅ and K₂O of soil at harvest.

Application of different doses of fertilizers didn't bring about any significant changes

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on growth parameters, except plant height at 40 DAS and at harvest. The yield attributes and yield of baby corn like number of cob/plant, length and weight of cob with and without husk, cob yield with and without husk, weight of husk, green fodder yield, cob equivalent yield and harvest index of the crop were significantly influenced by different doses of fertilizers. In these respects, significantly the highest growth, yield attributes and yield of the crop were recorded with 90-60-60 N-P₂O₅-K₂O kg/ha over rest of the treatments.

The per cent content in and uptake of nutrients- N, P and K were also significantly higher with 90-60-60 N-P₂O₅-K₂O kg/ha over rest of the treatments. Similar trend of results were observed in case of available N, P₂O₅ and K₂O of soil at harvest.

The total water used, increased with increasing levels of irrigation regimes and as such the water use efficiency was considerably higher under I1 and the lowest was recorded under I2.

In terms of economics, the highest net return and benefit : cost ratio were observed under irrigation regime I4 and fertilizer dose of 90:60:60 N:P₂O₅:K₂O kg ha⁻¹.

Nutrient management of direct seeded autumn rice under various irrigation schedules

Santosh. K. Gadad

A field experiment was conducted at Instructional-cum-Research (ICR) Farm, Assam Agricultural University, Jorhat during autumn season of 2015 to study the nutrient management of direct seeded autumn rice under various irrigation schedule. The experiment consisted of four irrigation schedules viz., I₁ (No irrigation), I₂ (Irrigation at tiller initiation (T₁) + boot leaf stage (BL)), I₃ (Irrigation at T₁ + panicle initiation (P₁) + BL), I₄ (Irrigation at T₁ + P₁ + Grain filling stage (GF)) and three nutrient management practices viz., F₁ (100 % RDF + 2t/ha FYM), F₂ (50 % RDF +1.5 t/ha enriched compost), F₃ (50 % RDF + 1.5 t/ha Vermicompost). The experiment was laid out in split plot design with three replications. The soil of the experimental site was sandy loam in texture having available N, P₂O₅ and K₂O of 216.63, 20.28 and 126.71 kg/ha, respectively with pH 5.6 and organic carbon 0.68 per cent. The rice variety "Inglongkiri" was sown on 24th February, 2015 and harvested on 14th June, 2015.

The results revealed that irrigation schedule I₃(Irrigation at T₁ + P₁ + BL) recorded significantly the highest growth characters of rice in terms of plant height, number of leaves per plant, and dry matter accumulation per running meter. The maximum values for yield attributing characters, grain and straw yield, N, P, K-uptake and consumptive use were recorded under irrigation schedule I₃ (Irrigation at T₁ + P₁ + BL). On the other hand, the maximum water use efficiency was observed under irrigation schedule I₁ (No irrigation). Different nutrient management practices brought about significant differences in plant population per running meter, dry matter accumulation per running meter plants, panicles per running meter, grain yield, straw yield and N, P, K-uptake. The highest values for these parameters were recorded under application of 50% RDF along with 1.5 t/ha enriched compost and this was statically *at par* with F₁ (100% RDF + 2 t/ha FYM).

The treatment combination of irrigation schedule I₃ F₂ (Irrigation at T₁ + P₁ + BL with 50 % RDF + 1.5 t/ha EC) produced the highest grain and straw yield of 23.25 and 43.57 q/ha respectively. This combination of treatment also recorded the highest nutrient uptake

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(12.57 and 69.77 kg ha⁻¹ of P and K, respectively) than other treatment combinations.

In terms of economics, the treatment combination of irrigation schedule, I₃ F₃ (Irrigation at T₁ + P₁ + BL with 50 % RDF + 1.5 t/ha VC) was the best with net return of Rs. 21945.74 with B: C ratio of 1.71 followed by treatment combination of irrigation schedule I3F1 (Irrigation at TI + PI + BL with 100 % RDF + 2 t/ha FYM) with net return of Rs. 21154.80 with B:C ratio of 1.65.

Inter cropping of rapeseed with pea on rice fallows as influenced by integrated nutrient management practices and its residual effect on summer green gram

Yugendra Turkar

A field experiment on "Inter cropping of rapeseed with pea on rice fallows as influenced by integrated nutrient management practices and its residual effect on summer green gram" was carried out at the ICR farm, AAU, Jorhat during rabi 2014-15 and summer 2015 with a view to study the performance of intercropping of rapeseed with pea after sali rice, under different integrated nutrient management (INM) practices, and its residual effect on greengram. The treatments comprised of four intercropping systems (C) viz., C₁ -Sole Rapeseed, C₂ - Rapeseed: Pea (1:2), C₃ -Rapeseed: Pea (2:1) and C₄ -Rapeseed: Pea (2:2) and four levels of integrated nutrient management practices (M) viz; M₁-100% RDF (Recommended Dose of Fertilizers), M₂- 75% RDF+ 25% N through enriched compost, M₃- 75% RDF+ 25% N through vermicompost and M₄- 50% RDF+ Biofertilizers+ 50% N through vermicompost. The treatments were laid out in a FRBD with three replications. The crops and varieties tested were Rapeseed -TS-67, Pea -Azad P-1 and Green gram -Pratap. The soil of the experimental site was sandy loam in texture and acidic in reaction (pH 5.6), medium in organic carbon (0.58%) and available N (290.75 kg/ha) and low in available P (14.63 kg/ha) and K (120.2 kg/ha). The total amount of rainfall received during the first crop season of 2014-15 was 26.5 mm in 9 days and total evaporation was 1154.7 mm and during the summer 2015, it was 445.0 mm in 29 rainy days as against total evaporation of 235.2mm.

Results revealed that the intercropping systems significantly influenced the number of branches/plant, dry matter/plant, yield attributing characters and seed and stover yield of rapeseed. The number of siliquae/plant and length of siliqua of rapeseed were significantly the highest with rapeseed + pea ratio 2:2. Significantly, the highest seed and stover yield of rapeseed were recorded under sole rapeseed. In pea, the rapeseed + pea ratio 2:2 or 1:2

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Department : Agronomy

Major Advisor : Dr. J. C. Das

systems resulted in at par but significantly higher values of yield attributes and thereby rapeseed + pea ratio 2:2 resulted in significantly the highest seed and stover yield of pea. The percent N, P and K content in seed and stover in both rapeseed and pea though not significant, the uptake of these nutrients were significantly highest under rapeseed + pea ratio 2:2. Thus the highest REY was recorded under rapeseed + pea ratio 2:2 (18.37q/ha) and the lowest was under sole rapeseed.

The growth parameters of rapeseed remained unaffected by different INM practices. However, siliquae/plant, length of siliqua, seeds/siliqua, under 75% RDF + 25% N were influenced significantly which ultimately resulted in producing significantly the highest seed and stover yield of rapeseed under 50% RDF + biofertilizers + 50% N through vermicompost over 100% RDF. Similar trends of results were also observed in pea. Significantly higher values of uptake of N, P, and K by seed and stover of rapeseed as well as pea were also observed under the same treatment. Thus, 50% RDF + biofertilizers +50%N through vermicompost produced significantly the highest REY of the rapeseed and pea followed by 75% RDF +25% N through vermicompost both being statistically at par but significantly superior to 100% RDF .

Physiological performance of some banana (*Musa* spp.) germplasm with special reference to moisture stress

Amarjit Saikia

A field experiment was conducted at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during the year 2014-2015 with ten germplasm of banana viz.. Gobin Tulchi (AAB), Bogimonohar (ABB), Manohar (AAB), Agnisagar (AAA), Barjahaji (AAA), Kachkal (ABB), Assamese Malbhog (AAB), Chenichampa (AAB), Bharatmoni (AAB) and Jahaji (AAA) to assess the physiological performance of these banana (*Musa* spp.) germplasm with special reference to moisture stress. Total area of the experimental site was 108 square metre and the various parameters were recorded at 5th, 7th and 9th months after planting. The mean monthly temperature during the crop growing season ranged from 10.8°C to 29.8°C, the rainfall was 0.0-42.7 mm and the relative humidity ranged between 55-97 per cent. The soil of the experimental field was acidic, well drained and sandy loam in texture with low available N and K and medium available P content. Moisture stress progressively reduced the values of relative leaf water content, total soluble protein content, free amino acid content, leaf area, osmotic potential, root biomass, chlorophyll content (a,b, total & a/b ratio), SOD activity, specific leaf weight, fruit length, fruit circumference, duration of fruit filling, number of hands per bunch, number of finger per bunch, pulp-peel ratio and bunch weight while the contents of proline in leaf tissue increased under moisture deficit. The germplasm Barjahaji was found to be higher yielder followed by Bogimonohar and Agnisagar whereas the cultivar Kachkal and Assamese Malbhog were found to be the lowest performer in this regard. The cultivar Barjahaji recorded higher values for various physiological, biochemical and yield characters namely relative leaf water content, proline content, total soluble protein content, free amino acid content, leaf area, osmotic potential, root biomass, chlorophyll content (a,b, total & a/b ratio), SOD activity, specific leaf weight, number of hands per bunch, number of finger per bunch and bunch weight followed by Bogimonohar and Agnisagar. From the above, it can be concluded that

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Department : Crop Physiology

Major Advisor : Dr. Prakash Kalita

the cultivars Barjahaji, Bogimonohar and Agnisagar are physiologically more tolerant. The per cent increase in relative leaf water content, proline content, free amino acid content, osmotic potential, root biomass, chlorophyll a content, chlorophyll b content, total chlorophyll content, SOD activity, specific leaf weight of leaf and bunch weight in Barjahaji were 5.51 per cent, 2.03 per cent, 7.97 per cent, 2.95 per cent, 1.03 per cent, 5.62 per cent, 4.08 per cent, 2.68 per cent, 2.30 per cent, 2.42 per cent, 2.53 per cent and 4.53 per cent than Bogimanohar.

Comparison of Carbon sequestration potential in conventionally grown tea (*Camellia sinensis* L.O. Kuntze) and in a tea based cropping system with Arecanut (*Arecanut catechu*) shade

Shamim Alom

The experiment was conducted at the Experimental Garden for Plantation Crops, Department of Tea Husbandry and Technology, AAU, Jorhat during the year 2014- 2015 in different plantation viz., Single Tea bushes, tea-arecanut and tea-albizzia. Result showed that highest total biomass was found in tea and albizzia plantation (70.7 kg plant⁻¹) followed by the tea and arecanut plantation (23.6 kg plant⁻¹) and lowest in tea plantation (9.30 kg plant⁻¹). The similar trend of highest total carbon stock was found in tea and albizzia plantation (35.35 kg plant⁻¹) followed by the tea and arecanut plantation (11.8 kg plant⁻¹) and lowest in tea plantation (4.65 kg

plant⁻¹). The different soil chemical and microbial properties are also enhanced by shade intensity and also due to the litters of shade tree in the different tea plantations. The available NPK, cation exchange capacity, organic carbon and microbial biomass was highest in tea and albizzia plantation (233.91 kg ha⁻¹, 46.47kg ha⁻¹, 153.4 kg ha⁻¹, 3.19 cmol(p⁺)100 g⁻¹ soil, 24.42 ton ha⁻¹, 146.53 X 10⁵cfu g⁻¹, respectively) followed by tea and arecanut plantation (216.574 kg ha⁻¹, 44.42 kg ha⁻¹, 142.4 kg ha⁻¹, 2.51 cmol(p⁺)100 g⁻¹soil, 21.64 ton ha⁻¹, 134.48 X 10⁵cfu g⁻¹, respectively) and lowest in tea plantation (203.54 kg ha⁻¹, 41.03 kg ha⁻¹, 120.8 kg ha⁻¹, 2.51 cmol(p⁺)100 g⁻¹ soil, 21.29 ton ha⁻¹, 125.33 X 10⁵cfu g⁻¹ respectively). The pH of the tea plantation gradually decreases in tea plantation followed by tea and arecanut plantation and tea and albizzia plantation (4.84, 4.78 and 4.74, respectively). Our study results suggest that tea-albizzia intercropping followed by tea-arecanut intercropping were not only superior to the tea monoculture in sequestering atmospheric carbon dioxide by increasing the soil organic carbon. But also in the both system help to

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Major Advisor : Dr. Ranjan Das

enhance the soil quality in terms of increasing the NPK content and yield related parameters. The different physiological parameters which related to carbon sequestration were also studied and found that there were significant difference in these parameters under different plantation in terms of leaf temperature, stomatal conductance, photosynthetic rate, RLWC and chlorophyll pigment. Present study reveals that among the different tea plantations, tea-albizzia and tea-arecanut plantation showed superior performance with respect to volume production, biomass accumulation and carbon sequestration.

Allelopathic effect of jatropha (*Jatropha curcas*) on chilli (*Capsicum annum*) and green gram (*Vigna radiata*)

Ujjal Baruah

Experiments were carried out during September 2015 to March 2016 in the Department of Crop Physiology, Assam Agricultural University, Jorhat-13, to determine the possible allelopathic effects of jatropha (*Jatropha curcas*) on chilli (*Capsicum annum*) and green gram (*Vigna radiata*). In one experiment, aqueous extract of jatropha leaf at 5%, 10%, 15% and 20% (W/V) concentrations were bio-assayed against germination and seedling growth of chilli and green gram. In both the crops, germination percentage, germination index, plumule and radicle length, fresh and dry weight of plumule and radicle were appreciably reduced by aqueous extract of jatropha leaf in a concentration dependent manner. However, germination of green gram seed was found to be more sensitive to jatropha leaf extract. In one pot culture experiments aqueous extract of jatropha leaf at 5%, 10%, 15% and 20% (W/V) concentrations were applied into soil to determine the allelopathic activity of jatropha on growth and development of chilli and green gram. Plant growth of green gram in terms of plant height, leaf number, leaf area, root volume, shoot and root dry weights were reduced significantly by aqueous extract, particularly at higher concentrations. Relative leaf water content, total chlorophyll content and leaf N P K content of green gram were also reduced by the aqueous extract. Moreover, pronounced negative allelopathic effects of jatropha on yield and different yield attributing parameters of green gram were recorded. Similar type of inhibitory effect of jatropha were recorded in chilli at early vegetative growth stage. However, no significant growth and yield reduction were recorded in chilli with extract of jatropha leaf at maturity. From this investigation, it can be suggested that chilli may be grown as an intercrop with jatropha.

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Major Advisor : Dr. K. Das

Role of habitat manipulation on natural enemies of cabbage pests

Daizy Sarma

A field experiment was carried out in the Experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat during *rabi* 2014-15 and 2015-16, respectively to study the role of habitat manipulation on natural enemies of cabbage pests.

The different treatments were cabbage intercropped with mustard and cowpea (T₁), intercropped with mustard and oats as border crop (T₂), intercropped with cowpea and oats as border crop (T₃), oats as border crop (T₄) and cabbage as sole crop (T₅).

Major insect pests recorded during the crop season were cabbage aphid, *Brevicoryne brassicae* (L.), diamondback moth, *Plutella xylostella* (L.), cabbage butterfly, *Pieris canidia* (L.), cutworm, *Agrotis ipsilon* (Hfn.), cabbage looper *Trichoplusia ni* (Hubner) and flea beetle, *Monolepta signata* Oliv, which persisted on the crop right from the seedling stage to the harvest of the crop with abundant numbers, while three species of predators were viz., *Coccinella transversalis* (F.), *C.septempunctata* (L.) and syrphid, *Episyrphus belteotus* as natural enemies. The incidence of insect pests and natural enemies were observed from 20 DAP. In the present investigation, among different insect pests encountered in the field, *B. brassicae* showed the highest occurrence followed by *T. ni*. The results revealed that out of the five treatments treatment T₁ comprised of cabbage intercropped with mustard and cowpea was found to be more effective treatment in reducing aphid, DBM, cabbage butterfly, cutworm, cabbage looper and flea beetle with 2.62,1.47,2.08,1.10,2.10 and 0.99/plant during 2014-15 and 3.41,1.03,1.56,1.35,1.90 and 1.03/plant during 2015-16, followed by T₃ (cabbage intercropped with cowpea and oats as border crop) with 3.30,1.80,2.35,1.36,2.38 and 1.21/plant during 2014-15 and 3.70,1.20,1.75,1.53,2.09 and 1.18/plant during 2015-16, T₂ (cabbage intercropped with mustard and oats as border crop) and T₄ (cabbage with oats as border crop). The highest population of coccinellid and syrphid was observed in T₁ with 4.08, 3.34 and 3.01 , 2.76/plant during 2014-15 and 2015-16, respectively followed by T₃ with 3.56,3.03 and 2.63, 2.47/plant. The lowest population of coccinellid and syrphid was

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Major Advisor : Dr. D. K. Saikia

observed in T4 with 2.03, 1.71 and 1.36, 1.31/plant during 2014-15 and 2015-16, respectively. The correlation study of different weather parameters indicated that the maximum temperature showed negative significant relationship with the population build up of *B. brassicae* ($r = -0.646$), coccinellid beetle ($r = -0.566$) and syrphid ($r = -0.574$) and minimum temperature showed negative significant relationship with the population build up of *P. canidia* ($r = -0.595$) and *P. xylostella* ($r = -0.743$) during 2014-15. Similarly, during 2015-16, the correlation study of different weather parameters indicated that the maximum temperature was the most dominant factor which showed negative significant relationship with the population build up of *B. brassicae* ($r = -0.637$), *P. canidia* ($r = -0.586$), *P. xylostella* ($r = -0.731$), *M. signata* ($r = -0.776$) and coccinellid beetle ($r = -0.616$), syrphid ($r = -0.654$) during 2015-16. As regards to yield, the highest yield was recorded in treatment T₁ (212.78q/ha and 177.94 q/ha) followed by T₃ (205.28q/ha and 174.92q/ha) as against 176.24 q/ha and 162.54 q/ha in the untreated control plots during 2014-15 and 2015-16, respectively.

Efficacy of *Jatropha curcas* and *Ocimum sanctum* leaf extracts against *Sitophilus oryzae* and *Tribolium castaneum*

Kota Sathish

Rice weevil, *Sitophilus oryzae* and rust-red flour beetle, *Tribolium castaneum* are two of the most destructive coleopteran storage insect-pests. Management of these insects are very important for reducing the post harvest loss of cereals. The present investigation was carried out to study the efficacy of *Jatropha curcas* and *Ocimum sanctum* leaves extracts as grain protectants of wheat against these two insect-pests. Leaves extracts were prepared from *Jatropha curcas* and *Ocimum sanctum* by using different solvents (acetone, hexane, methanol & petroleum ether) and were tested for their efficacy on rice weevil and rust-red flour beetle. The result showed that the highest adulticidal activity of *Sitophilus oryzae* was found in *Jatropha* methanol (47.02 to 63.64%) across different months after storage, followed by *Tulsi* acetone extract (44.44 to 54.73%). In *Tribolium castaneum* highest adulticidal activity was found in *Tulsi* acetone (37.50 to 46.88%) followed by *Jatropha* petroleum ether extract (27.63 to 38.68%). Per cent weight loss due to infestation by *S. oryzae* was lowest in *Jatropha* methanol (2.78 to 9.47%), followed by *Tulsi* acetone extract (3.24 to 10.79). In *Tribolium castaneum*, lowest per cent weight loss was observed in *Tulsi* acetone (2.81 to 7.39%), followed by *Jatropha* petroleum ether extract (3.24 to 7.95%). Per cent weight gain over control was found to be highest in *Jatropha* methanol (10.21 to 12.84%), followed by *Tulsi* acetone (9.77 to 11.87%) in *Sitophilus oryzae* infestation study. In the infestation study of *Tribolium castaneum*, per cent weight gain over control was found to be highest in *Tulsi* acetone (10.28 to 12.39%), followed by *Jatropha* petroleum ether (9.84 to 11.99%). The deterrent effect of plant extracts against *Sitophilus oryzae* was found to be highest in *Jatropha* methanol (34.88 to 64.09%), followed by *Tulsi* acetone (28.72 to 59.35%). In *Tribolium castaneum* highest deterrent effect was observed in *Tulsi* acetone (43.05 to 63.98 %) followed by *Jatropha* petroleum ether extract (40.12 to 59.57%). The highest mortality of *Sitophilus oryzae* was found in *Jatropha* methanol (zero to 83.33%), followed by *Tulsi* acetone (zero to 73.33%). The highest mortality of *Tribolium castaneum* was recorded in *Tulsi* acetone extract (zero to 70.00%), followed by *Jatropha* petroleum ether (zero to 56.67%).

The present study revealed that the *Jatropha curcas* and *Ocimum sanctum* leaves extracts have various degrees of efficacy in managing *Sitophilus oryzae* and *Tribolium castaneum* during the storage of wheat.

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Department : Entomology

Major Advisor : Dr. P. Patgiri

Pest complex of Gerbera and organic approaches for their management

Nilofar Altaf

An investigations was carried out in the experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014 and 2016 on the Pest complex of gerbera and organic approaches for their management

Incidence of pest complex was observed during the experiment. Among different insect pest aphid (*Aphis gossypii*), Thrips (*Scirtothrips dorsalis*), Mealy bug (*Planococcus citri*) and the false spider mite (*Breviplapus californicus*) were observed. Out of these, *A. gossypii* and *B. californicus* were recorded as major pests. Incidence of *A. gossypii* was found to be maximum in the third week of March, 2015 with a mean population of 9.02 number per plant and first week of March 2016, with a mean population of 9.21 per plant. Incidence of *B. californicus* was found maximum in the first week of January, 2015 and 2016 with a mean population of 10.54 and 10.56 per plant, respectively. Incidence of major pest was correlated with meteorological parameters and it was found that aphid showed positive significant correlation with temperature and false spider mite showed positive significant correlation with morning relative humidity.

Different botanicals were used to find their efficacy against the major pest. Different treatments were like Datura leaf extract (*Datura stramonium*)5%, Basil leaf extract (*Ocimum basilicum*)5%, Curry leaf extract (*Murraya koenigii*)5%, Wood apple (*Aegle marmelos*)5%, *Patharua bihlangani*, (*Polygonum hydropiper*)5%, Neem (*Azadirachta indica*), 3ml/l product as check. Out of these botanicals *P. hydropiper* gave the best result showing upto 94.06% and 94.26% reduction in aphid population in five days after application in the year 2015 and 2016. Similarly, in case of false spider mite *P. hydropiper* gave the best result showing upto 95.59% and 96.17% reduction in 5 days after application in the year 2015 and 2016.

For the Mass multiplication of the predatory mite *Neoseiulus longispinosus* and its prey *Tetranychus urticae* were cultured using French bean as host crop. Different treatments such as 10, 20, 30, 40, 50 predators were released to determine the feeding potential

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of *N. longispinosus* on false spider mite. Percent reduction of false spider mite was calculated and found that treatment with 20 predators showed highest reduction upto 98.35% and 98.38% in seven days after release in the year 2014 and 2015.

Biology of the false spider mite was studied and found that life cycle consist of four distinct stages larva, protonymph, deutonymph and adult. Between, each active stage there is a quiescent developmental stage that is sessile but physiologically active. It undergoes thelytokous reproduction, only female is present. The total life cycle completed in 49.5-72.5 days.

Efficacy of certain botanicals against *Bandicota bengalensis* (Gray)

Rashmi Rekha Tamuli

An investigation was carried out at the Animal House cum Rodent Laboratory, Department of Entomology, Assam Agricultural University, Jorhat during 2014-16, to find out the effect of botanicals viz., *Carica papaya*, *Solanum khasianum*, *Ananas comosus*, *Moringa oleifera*, *Azadirachta indica* on growth and development of *Bandicota bengalensis*. To evaluate efficacy of the botanicals against *B. Bengalensis*, a choice and no-choice feeding trials were conducted. The consumption of treated bait by the rodent of both the sexes under choice test was reduced in comparison to no-choice test because of availability of an alternate plain food along with the treated bait.

The antifeedant index of *M. oleifera* against both the sexes of *B. bengalensis* was significantly higher i.e. (65.58% in male and 64.62% in female) followed by *S.khasianum* (62.90% in male and 62.86% in female) under choice feeding trial. The highest antifeedant index (80.91% in male and 84.71% in female) was also recorded with *S.khasianum* treated bait followed by *M. oleifera* (73.97% in male and 75.18% in female) under no-choice feeding trial. The lowest acceptance percentage was also recorded with *M. oleifera* (17.20% in male and 17.68% in female) followed by *S. khasianum* (18.71% in male and 18.56% in female) under choice feeding trial. Under no choice test, the lowest acceptance percentage (10.54% in male and 8.03% in female) was also recorded with *S. khasianum* followed by *M. oleifera* (14.95% in male and 14.16% in female). Botanicals viz. *M.oleifera* and *S. khasianum* had shown promising antifeedant property against both sexes of *B. bengalensis* under both choice and no choice feeding trials.

The body weight of the animals kept on botanicals was significantly reduced in comparison to that of untreated animals. However, the weight of the reproductive and accessory organs related to botanical treatment were a non significant reduction in case of both male and female of *B. bengalensis*. The results obtained during present investigation reveal that in case of female rodent kept on *C. papaya*, the breeding success was 16.66% followed by *A. comosus* (33.33%). No successful breeding was observed in female kept on *S. khasianum*, *M. oleifera* and *A. indica*.

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Major Advisor : Dr. R. K. Borah

Effect of honeybee, *Apis cerana* F. (Hymenoptera: Apidae) pollination on seed set and yield of coriander, *Coriandrum sativum*

Siddhartha Sankar Saikia

Investigations on the diversity of insect visitors and the effect of *Apis cerana* pollination on coriander were carried out at the Apiary, Department of Entomology, Assam Agricultural University, Jorhat during rabi season, 2015 and 2016. The treatments consisted of pollinator exclusion (PE), open pollination (OP), bee pollination 1 (BP1) @ 3 hives/ha, bee pollination 2 (BP2) @ 4 hives/ha and bee pollination 3 (BP3) @ 5 hives/ha. Among the different insect visitors of coriander, *A. cerana* was the most dominant visitor comprising 51.65 per cent followed by *A. mellifera* (10.20%), *A. dorsata* (4.24%), *Xylocopa fenestrata* (5.32%), *X. leucothorax* (4.28), *Polystis habrious* (5.31%), *Vespa Mangifera* (3.75) *Papilo demoleus* (7.32%), *Musca domestica* (3.49%), and *Monomorium indicum* (3.45%). Besides these, other insect visitors which were found in less number were lady bird beetle, syrphid fly etc. The subsequent study on the next year also showed the similar pattern of results. The study on the foraging behaviour of *A. cerana* revealed that 1000-1100 hours was the peak period of visit on coriander flower. The number of *A. cerana* per square meter per minute was recorded to be maximum (10.65 ± 1.51) during 1000-1100 hours and minimum (3.60 ± 1.10) during 1500-1600 hours. The number of flower visited per minute was found to be maximum (23.65 ± 1.71) in between 1000-1100 hours and minimum (2.95 ± 1.34) at 1300-1400 hours of the day. The maximum time spent per flower was recorded to be 3.80 ± 1.25 seconds during 0900-1000 hours while the minimum was found to be 1.90 ± 0.72 seconds during 1300-1400 hours of the day. The number of flower visited per trip was found to be maximum (265.45 ± 4.73) in between 1000-1100 hours and minimum (134.00 ± 4.64) during 1300-1400 hours of the day.

The seed setting and yield of coriander crop was found to be higher in *A. cerana* pollinated treatments over OP and PE. The highest per cent of seed set (78.01%) was

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recorded in BP3 and the lowest (20.28%) was in PE. The BP2 treatment was found to be at par with BP3 treatment. There was 331.79 per cent yield increase of coriander in BP3 treatment over PE treatment.

The various meteorological factors influenced the foraging activities of *A. cerana*. Bright sunshine hours and temperature showed positive correlation with foraging behaviour. On the other hand, relative humidity showed negative correlation with foraging behaviour of *A. cerana*.

Efficacy and Relative Toxicity of Some insecticides against Cowpea aphid *Aphis craccivora* Koch

Singatham Bagavathi Manjarika

Field and laboratory experiments were conducted in experimental farm, department of Horticulture, Assam Agricultural University, Jorhat and department of Entomology, Assam Agricultural University, Jorhat during 2014-15 to determine the efficacy of some insecticides viz., clothianidin 100 g *a.i./ha*, bifenthrin 80 g *a.i./ha*, imidacloprid 20 g *a.i./ha*, spinosad 45 g *a.i./ha*, thiacloprid 100 g *a.i./ha*, flubendiamide 60 g *a.i./ha*, flonicamid 60 g *a.i./ha* and dimethoate 450 g *a.i./ha* along control against cowpea aphid, *Aphis craccivora* Koch on cowpea crop (variety long yard bean) and also to determine LC50 value and relative toxicity of these insecticides against *Aphis craccivora*.

All the insecticidal treatments were found to be significantly superior over control (untreated). On an average of both the seasons, among all the insecticides the lowest incidence and the highest population reduction of aphid population was obtained with dimethoate 450 g *a.i./ha* 7.81, 5.13, 3.89, 4.49 numbers and 63.80, 76.25, 81.99, 79.19 per cent after one day, three days, seven days and ten days of spraying, respectively. After ten days of spraying dimethoate 450 g *a.i./ha* was followed by flonicamid 60 g *a.i./ha* and imidacloprid 20 g *a.i./ha* with maximum reduction of aphid population. There were no significant difference among the treatments of imidacloprid 20 g *a.i./ha*, thiacloprid 100 g *a.i./ha* and dimethoate 450 g *a.i./ha* at three, seven and ten days after spraying. On an average of both the seasons the highest mean yield was obtained from dimethoate 450 g *a.i./ha* (13.08 q/ha) followed by imidacloprid 20 g *a.i./ha* (12.25 q/ha). The highest benefit was obtained from the treatment imidacloprid 20 g *a.i./ha* with a benefit-cost ratio of 8.72:1 followed by dimethoate 450 g *a.i./ha* and flonicamid 60 g *a.i./ha* with benefit-cost ratio of 6.68:1 and 3.25:1, respectively. The least benefit was obtained with the treatment of spinosad 45 g *a.i./ha* with a benefit-cost ratio of 0.37:1.

The order of toxicity to *Aphis craccivora* with respect to LC50 values was as flubendiamide (0.027 ppm) > clothianidin (0.031 ppm) > thiacloprid (0.042 ppm) > dimethoate (0.057 ppm) > imidacloprid (0.063 ppm) > flonicamid (0.079 ppm) > bifenthrin (0.117 ppm) >

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spinosad (0.912 ppm) after 24 hours while it was flubendiamide (0.017 ppm) > thiacloprid (0.028 ppm) > clothianidin (0.029 ppm) > imidacloprid (0.44 ppm) > dimethoate (0.047 ppm) > bifenthrin (0.063 ppm) > flonicamid (0.068 ppm) > spinosad (0.246 ppm) after 48 hours of exposure period. The comparison of relative toxicity revealed that after 24 hours clothianidin 1.83 times, thiacloprid 1.35 times, flubendiamide 2.11 times more toxic than dimethoate while spinosad (0.06) was the least toxic insecticide. After 48 hours flubendiamide 2.76, thiacloprid 1.67 times, clothianidin 1.6.2 times and imidacloprid 1.06 times more toxic than dimethoate while the other tested insecticides were less toxic. The order of toxicity on the basis of relative toxicity was flubendiamide > clothianidin > thiacloprid > imidacloprid > flonicamid > bifenthrin > spinosad, at 24 hours, while flubendiamide > thiacloprid > clothianidin > imidacloprid > bifenthrin > flonicamid > spinosad at 48 hours by taking dimethoate as unity.

The information needs and information seeking behaviour of farmers of Nalbari district of Assam with reference to climate change adaptation

Dipankar Kalita

The present study entitled "The information needs and information seeking behavior of farmers of Nalbari district of Assam with reference to climate change adaptation" was carried out with the following objectives:

1. To study the information needs of farmers with reference to climate change adaptation
2. To study the information seeking behaviour of farmers with reference to climate change adaptation
3. To identify the factors influencing the information needs and information seeking behaviour of farmers
4. To identify the constraints, as perceived by the farmers, in meeting their information needs

The present study was conducted in four villages of Nalbari district where NICRA Project has been implemented since 2013. A purposive-cum-random sampling technique was followed for selection of 120 respondents which constituted the sample for the study. The data for the study were collected by personal interview method with the help of a structured schedule. Keeping in view the objectives of the study a set of 16 independent variables and 2 dependent variables were selected in the study. Two dependent variables selected for the study were information need and information seeking behaviour of farmers. In order to identify the factors influencing the dependent variables, 16 independent variables were included in the study, namely- age, educational level, family size, family type, institutional linkage, training exposure, farm size, annual income, social participation, farming experience, management orientation, innovation proneness, farm mechanization, economic motivation, level of aspiration and risk preference. The statistical techniques and tests used in the study for analysis and interpretation of the data were frequency distribution,

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percentage, arithmetic mean, standard deviation, co-efficient of variation, co-efficient of correlation and t- test.

Findings of the study revealed that that majority of the respondents (65.83%) were in the middle aged group followed by 17.50 percent of respondents in old aged group. Majority of them had (27.50%) middle school level of education followed by 25.00 percent respondents with high school level of education. Majority of them (55.00%) were having nuclear family followed by 45.00 per cent with joint family. Majority of the respondents (68.33%) had big family size. Majority of them (47.50%) maintained regular linkage with NGOs operating in the study area. Majority (52.50%) of them maintained linkage with KVK sometimes. Majority of them (64.17%) had no exposure to training of any type followed by 26.67 per cent respondent with exposure to training of 3-7 days duration. Majority of them (80.00%) were marginal farmer followed by 19.17 per cent of small farmers. Only one respondent (0.83%) belonged to the semi-medium category with farm size between 2 and 4 ha. Majority of the respondents (73.33%) were with medium annual income. Majority of them (40.00%) had no involvement in any formal organization. Half of the respondents (50.00%) had medium social participation followed by 40.00 per cent of respondents with low social participation. Majority of them (68.33%) had medium level of management orientation followed by 19.17 per cent with high management orientation. Majority of them (70.00%) had medium innovation proneness. Majority of them (78.33%) were in medium mechanization category whereas 13.33 per cent of them were in high farm mechanization category. Majority of them (45.00%) had medium economic motivation followed by 43.33 per cent with high economic motivation. Majority of the respondents (45.83%) had high level of aspiration followed by 38.33 percent with medium aspiration level. Majority of the respondents (48.33%) had medium farming experience followed by 38.33 per cent of respondents with high farming experience.

Among 'mostly needed' areas of information, majority of the respondents (93.33%) expressed that they needed information on diversification of farming system or enterprise, followed by 89.17 per cent of respondents with the need for information on double cropping and 84.17 per cent of respondents with the need for information on integrated pest management. Among 'needed' areas of information, majority of the respondents (74.17%) expressed that they needed information on crop varieties for different climatic conditions, followed by 72.50 per cent of respondents with the need for information on use of organic manures (vermi-compost/compost) and 64.17 per cent of respondents with the need for information on growing of alternate crops for dry spell management. Findings indicated that that majority of the respondents (75.00%) had medium degree of information need followed by 16.67 per cent of respondents with high degree of information need. The rest 8.33 per cent of respondents had low degree of information need.

Majority of the respondents (94.17%) used friends/ relatives/ neighbours/ fellow farmers/ input dealer as source of information followed by 72.50 per cent of respondents who received information from progressive farmers and 65.00 per cent of respondents who received information from VLEW. Among the mass media sources, majority of the respondents (80.00%) used News Papers as source of information. A small proportion of them

(16.67%) used Mobile Phones as source of information. No respondent was found to use Internet as source of information. Findings revealed that majority of the respondents (70.00%) had medium extent of information seeking behaviour followed by 15.83 per cent of respondents with low extent of information seeking behaviour. The rest 14.16 per cent of respondents had high extent of information seeking behaviour.

Correlation analysis indicated that 7 independent variables, viz., Educational level, Family type, Farm size, Social participation, Management orientation, Innovation proneness and Economic motivation had significant positive relationship with the information need of farmers at 0.01 level of probability. While annual income showed significant positive relationship with the information need of farmers 0.05 level of probability, farming experience showed significant negative relationship with the information need of farmers at 0.05 level of probability. On the other hand, 3 independent variables, viz., Institutional linkage, Innovation proneness and Level of aspiration had significant positive relationship with the information seeking behaviour of farmers at 0.01 level of probability. The variable training exposure showed significant positive relationship with the information seeking behaviour of farmers 0.05 level of probability.

Majority of the respondents (63.33%) reported that 'Lack of Awareness about existence of different sources of information' was the major constraint they faced in meeting their information needs pertaining to climate change adaptation which was ranked first. 'Lack of awareness and knowledge on impacts of climate change on agriculture' and 'Untimeliness of agricultural programme in Radio and TV' were the 2nd and 3rd ranked constraints they faced in meeting their information needs pertaining to climate change adaptation.

Impact of Agricultural innovation Adoption behaviour on poverty Alleviation of Small and marginal farmers of Assam

Jaheda Begum Barbhuiya

Agricultural innovations are seen as an important route out of poverty in most of the developing countries. However the rate of adoption of agricultural innovations remained low in most of these countries. This study aims at shedding some light on the potential impact of agricultural innovations on poverty alleviation of small and marginal farmers of Assam. The study pursues a targeted evaluation of whether innovation adoption causes small and marginal farmers to increase their farm income and decrease poverty.

The present study was conducted in three districts of Assam viz. Cachar, Karimganj and Silchar selected purposively for the study. A total of 120 respondents were selected randomly for the study. Data was collected by administering structured schedule. The statistical tools such as frequency, percentage, mean standard deviation and multiple regression analysis had been adopted to draw the reference from the study.

The study revealed that the majority (27.50%) of the respondents belonged to the age group of forty one to fifty years and majority of the respondents (97.50%) were male and the respondents (19.17%) were literate without formal education. It is also seen that the majority (60.00%) of the respondents had a small family having upto 4 members. Regarding the operational land holding the majority (95.83%) of the respondents were marginal with major occupation (55.00%) as cultivation. The most of the respondents (87.53%) had low level of extension contact. It was found that most the respondents (40.83%) had received one day training from some source. With regard to the material based innovation it was found that majority of the respondents (65.83%) had high level of extent of adoption of innovations in the year 2014 as compared to that of the year 2010 which was 41.66 per cent whereas with regard to knowledge based extent of adoption of innovation it was found only (43.33%) of the respondents had high level of extent of adoption in the year 2010 which had increased to 86.66 per cent in the year 2014. Regarding food availability it was revealed that the food availability of majority of the respondents (50.83%) was surplus in the year 2014

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from that of the year 2010 which was 45.00 per cent. The study also revealed that the annual farm income of the majority of the respondents (38.33%) during the year 2010 had upto Rs. 30000 which had increased to Rs. 30001 to Rs. 60000 for 35.00 per cent of the respondents. The study also revealed that the majority (55.00%) of the respondents had low level of social status during the year 2010 which had improved during the 2014 and majority of the respondents (55.83%) had medium level of social status. The study finally revealed that the rate of material based innovation adoption is faster than knowledge based innovation. The respondents readily accepted the material innovation which could be applied in field situation more faster than knowledge based innovation.

This study revealed that there is potential impact of agricultural technology adoption on poverty alleviation. It finds a robust and positive effect of adoption of agricultural innovation on farm household suggesting that there is a large scope for enhancing the role of agricultural innovation adoption contributing to poverty. However more efforts should be made to educate and enlighten the rural farm households on the benefits of these innovations. In this respect agricultural extension services should be strengthened to provide training to the respondents to unlock their natural talents and enhance their ability to understand and evaluate the new agricultural innovations leading to increase their farm income with concomitant reduction in poverty.

A study on the farmers' preference of High Yielding Varieties of rice released by Assam Agricultural University in Jorhat District of Assam

Jyotishna Baruah

Assam occupies a special place in the rice production area. Farmers of the state cultivate paddy in three seasons i.e., it is traditionally grown throughout the year viz., winter (*sali*), autumn (*ahu*) and summer (*boro*) rice. The state has been consistently making innovative efforts by using science and technology to increase the production of rice. Assam Agricultural University is also putting its effort in conducting researches to provide the best rice cultivars to the farmers of the country. Many high yielding varieties of rice have been released by the University till date, with the motive of increasing the production as well as the productivity of rice. But it has been reported by many researchers that the traditional varieties are still cultivated by the farmers' in a large scale in comparison to the HYVs of rice. Therefore, was found necessary to know the farmers' preference of the HYVs over the traditional varieties of rice along with the attributes which were considered by the farmers while selecting the rice varieties. In light of the above reasons, the present study entitled "A Study on the Farmers' Preference of High Yielding Varieties of Rice released by Assam Agricultural University in Jorhat district of Assam" was undertaken.

The four major agro-ecological situation of the district were selected purposively for the study. One village from each AES was selected randomly. Total number of 120 respondents were surveyed with the help of an appropriate schedule. To find out the preference of the rice varieties PRA technique (village mapping and matrix ranking) was carried out with the participation of the farmers.

The study revealed that the area under the HYVs was less in comparison to the traditional varieties of rice in the district. The cropping intensity of the district was found to be medium. The study revealed that most of the farmers never go for seed replacement. Some other characteristics of the farmers like education, family type, family size, occupation of family, training exposure, extension contact, annual income of the family, operational

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land holding, land type, availability and accessibility of inputs, availability and accessibility of credits were also studied.

PRA tools were used to analyse farmers' preference towards rice varieties in different AES. Farmers of the district mainly cultivated *sali*, *bao* and *ahu* rice, whereas, boro rice was cultivated only in some pockets. The study revealed that the variety Ranjit was the mostly cultivated HYV in Jorhat. The attributes considered by the farmers while selecting the rice varieties were identified to be "high yield", "higher market price", "fertilizer efficiency", "right growing duration", "maximum tillering", "stress tolerance", "flood tolerance", "cooking qualities", "taste", "pest tolerance", "disease tolerance" etc. It was observed from the study that few attributes perceived by the farmers varied in the different AES of the district.

The major problems faced by the respondents were also studied and the constraints like high cost of inputs, lack of conviction in the new technology, weak extension activities at village level, and high cost of seeds of HYVs stood at the highest position

A Study on the Livelihood Options and Attitude of Tribal Rural Youth towards Farming in Assam

Moonsun Borosa

Youth is one of the vital and potential segments of human resource. Large population of rural youth relies on agriculture and allied activities to meet their livelihood need. Though agriculture is contributing in a big way to the Indian economy by providing livelihood to majority of the population in the country, the traditional inheritance of farming is no more charming to youths. If rural youth are provided with proper opportunities to build their livelihood on their own terms, then they can improve their living standard. For that purpose, the present study was conducted at Jorhat district and Kokrajhar district of Assam in the year 2015 with a view to determine the existing livelihood options and attitude of Tribal rural youth towards farming of the district. Multi stage purposive and random sampling technique was used for selection of respondents to make a total sample size of 150 respondents. Data were collected adopting the personal interview technique administering a structured schedule. Relevant statistical tools were employed to analyse the data.

The study reveals that majority of the respondents (80%) belonged to 25-29 years of age having educational qualification up to high school level (35.33%). Majority (52.66%) of respondents had small size of land holding with annual income ranging from Rs. 30,640 - 79,360. More than 90 per cent of respondents not only view farm TV programme but also read newspaper. Fellow friends are main extension agent for all sample respondents. Majority (67.33%) of the respondents reported that made contact to develop socio-political awareness and to discussion about farm related aspects. In case of technical skill majority (50.66%) of the respondents can operate farm implements. Majority of the respondents had medium level of achievement motivation (73.33%) and marketing orientation (74.00%). Medium level of economic motivation (53.33%) scientific orientation (67.33%), risk preference (69.33%) and decision making ability (80.66%) for majority of the respondents. The result further reveal that majority of the respondents (67.33%) had more favourable attitude towards farming. From the correlation analysis, it was observed that education, land holding, marital status, and extension contact had significant and positive relationship with attitude towards farming.

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The study reveals that major farm livelihood options for tribal rural youth field crops (82.00%), followed by piggery (68.67%), cultivation of bamboo (68.00%), poultry rearing (62.67%) and cultivation of plantation crops (50.00%) while nonfarm livelihood options as wage earner (17.33) and business activities (15.33). Out of the total 12 different combination of livelihood options "Field crop + Horticultural crop + Poultry + Livestock + Bamboo cultivation" (23.33%) followed by "Field crop + Horticultural crop + Poultry + Livestock + Wage earner" (17.33%) were practised by majority of the respondents. Regarding the tribal rural youth migration 100 per cent respondents reported search for job and in acquisition of skills was the main reason. Major problems faced by the respondents in taking up farming as livelihood option included lack of irrigation facility, unavailability of inputs in time and lack of credit facilities etc. Since most of the livelihood option was practiced traditionally so imparting skills on improved technologies along with creation of necessary infrastructure and facilities by concern organizations is essential to attract tribal rural youth to agriculture sectors.

Extent of participation of rural youths in farming: A study in Jorhat district of Assam

Moromi Buragohain

The study entitled "Extent of participation of rural youths in farming: A study in Jorhat district of Assam" was carried out in Jorhat district of Assam, following Ex-Post-Facto research design. A total of 200 respondents were selected by using multistage purposive cum random sampling technique. The data were collected by means of personal interview schedule during 25th Feb, 2016 - 3rd April, 2016. Descriptive statistics, Karl Pearson's correlation coefficient and multiple regression statistical techniques were also used. The findings revealed that majority (49.50%) belonged to the age group of 25-29 years and educated up to middle school level (26.50%) with single type of family (72.00%) and most of them (47.50%) had marginal operational land holding. The main occupation of majority (56.00%) of the respondents' families was farming and annual income for highest percentage of respondents (35.50) ranged between Rs. 160001 - Rs. 260000. The findings revealed that mostly heavy machineries were hired by the respondents (30.00%) which include tractor and power tiller. The majority of respondents (57.50%) received one day training related to agriculture and majority (94.50%) of respondents had more favourable attitude towards farming and the majority (68.00%) of respondents had medium level of mass media exposure. It was found that majority (52.00%, 49.50% and 49.50%) of respondents had medium level of participation in farm operations, management activities and decision making respectively.

In farm operation, correlation table revealed a positive and significant relationship between age, size of family, size of operational land holdings and attitude towards farming. Educational level and occupation of parents showed significant association with extent of participation in farm operations. In management activities, correlation table revealed a positive and significant relationship between age, size of operational land holdings, size of family, annual income of the family, training exposure, attitude towards farming, and mass media exposure. Occupation of parents showed significant association with extent of participation in management activities. For decision making, correlation table revealed a positive and

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significant relationship between age, size of family, size of operational land holdings, annual income of the family and attitude towards farming. Educational level and occupation of parents showed significant association with extent of participation in decision making. The independent variables age, educational level: higher secondary, diploma/certificate course, graduate, sources of farm machineries and farm implements, training exposure and attitude towards farming fitted into the regression equation could explain together 63.20 per cent to the total variation on the extent of participation in farm operations. For extent of participation in management activities and decision making age, sources of farm machineries and farm implements and attitude towards farming could explain together 62.40 % and 55.50% to the total variation respectively.

The first three ranked problems mentioned by the respondents were lack of proper knowledge in technical know-how (Rank I), complex process of credit facilities (Rank II), problems of timely information/advice relating to agriculture (Rank III). The first three needs expressed by the respondents were promoting youths involvement in community decision making relating to agriculture development (Rank I), enhancing intensive network of extension agents for motivation and training of rural youths for agripreneurship development (Rank II), adequate subsidy of loan for farm implements and inputs (Rank III).

Readiness of farmers towards organic farming of paddy -a descriptive study in Assam

Nataliya Natasha Handique

Organic farming and its market has been coming up in a booming way in the recent times. The Government of India has taken steps towards organic farming and has identified the North-East as a potential organic hub. It opens an opportunity to the farmers of Assam for capturing the ever increasing organic market for their economic development. The State Department of Agriculture, Assam has been trying to popularise organic cultivations in Assam through programmes like Rashtriya Krishi Vikash Yojana (RKVY). For accepting such a new approach, farmers must be prepared for it. Therefore, the study was designed to determine the level of readiness of farmers of RKVY project areas toward organic farming on paddy; it would lead to adoption of the practices. The study was conducted in four constituencies, viz., Golaghat, Sorupothar, Howraghat and Bokajan. Multistage sampling procedure was followed to select 100 from beneficiary farmers and 100 from non-beneficiary farmers under RKVY. Data were collected from 200 respondents by adopting personal interview technique administering a pretested structured schedule.

The study showed that 93.00 per cent of beneficiary respondents and 85.00 per cent of non-beneficiary respondents had medium level of readiness towards organic farming of paddy. The findings also revealed that beneficiary farmers had high level of readiness towards knowledge and attitude; medium level of readiness in terms of labour and low level of readiness in terms of infrastructure and market for organic farming of paddy. Whereas, non-beneficiary farmers had medium level of readiness in terms of knowledge and attitude; low level of readiness in terms of labour, infrastructure and market for organic farming of paddy.

The study revealed that the mean age of beneficiary respondents were 31.28 years and that of non-beneficiary respondents was 33.08 years; the mean operational land holding of the beneficiary respondents was 1.27 ha and that of non-beneficiary respondents was 1.12 ha; mean average monthly income was Rs.7,351.00 for beneficiary farmers and for non-beneficiaries it was Rs. 6,941.00. Non-beneficiary respondents had less training exposure on organic paddy and had low Government extension contact than the beneficiaries.

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The study also revealed some problems as perceived by some of the respondents in relation to organic paddy.

The study suggested that apart from giving trainings, demonstrations and other extension services on organic farming of paddy; interventions are to be taken in relation to assured marketing and infrastructure facility. Extension support should also be provided to non-beneficiary farmers to draw their attention towards organic paddy. Researchers should provide recommended package of practices of organic paddy urgently.

A study on training needs of ATMA Extension Functionaries of Assam

Priyanka Das

Today's agriculture routinely uses sophisticated and advanced technologies. It allows agriculture to be more profitable, efficient, safer and environmental friendly. However, most of the Indian farmers are lacking in knowledge and skills on advanced technologies. The rate of adoption of modern technologies in agriculture is considerably low till now. To achieve greater milestones in agricultural production, it is necessary to transfer the relevant technologies from the research system to the ultimate users, the farmers.

ATMA at the district level has been considered increasingly responsible for all the technology dissemination. In the process of transfer of agricultural innovation, the position of ATMA Extension Functionaries is very crucial. They act as the nervous system in the process of communicating the latest scientific knowledge from 'lab to land'. It is therefore, important that their professional competence can pay rich dividends to win the confidence of the farmers and motivate them to adopt appropriate technologies. So, it is essential to periodically update their knowledge and skill in the concerned task areas through systematic and continuous in service training programmes. Training for training sake may not be useful but they need to be need based and in due consideration of field problems of farmers. Therefore, the present study was conducted to identify the training needs of ATMA Extension Functionaries of Assam with the following objectives:

1. To study the socio-personal characteristics of ATMA Extension Functionaries
2. To determine the training needs of ATMA Extension Functionaries.
3. To study the relationship of different characteristics of ATMA Extension Functionaries with their training needs.
4. To identify the problems faced by ATMA Extension Functionaries in carrying out their responsibilities and pool their suggestions thereof.

The study was conducted in the year 2015-16. Four districts of Assam viz. Jorhat, Sivasagar, Golaghat and Dibrugarh were selected purposively for the present study. The respondents were ATMA Extension Functionaries and the sample size was 120. Respondents were personally interviewed with a prepared schedule. The frequency, percentage,

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mean, standard deviation, coefficient of correlation and t-test were used in analyzing and interpreting the data.

The study reveals that most of the respondents (54.17%) were in the age group of 35 and below. Study shows that most of the respondents were graduate degree holders (65%). Highest percentage of respondents i.e. 62.5% had less than 10 years of service experience. Majority of the respondents (61.67%) had less than 9 years of service experience in the place, where they were at the time of data collection. Majority of the respondents (89.17%) were satisfied with their job. Decision making pattern of cent per cent respondents were satisfactory with an average score of 48.01 and with standard deviation of 3.53. However, the Attitude towards agricultural profession was found unfavorable for majority (60.83%). About 51.67 per cent respondents had low motivational profile and almost half (48.33%) of the respondents had medium level of motivational profile.

The findings revealed that, for individual sources, ATMA Extension Functionaries depend on senior officers' instructions and other officials. In case of group sources, functionaries mainly depend on group discussion with seniors. On the other hand, for mass sources, they mostly depend on departmental circulars and information booklets.

From the findings it was also revealed that maximum number of respondents (43.33%) had attended either four or more trainings during their tenure of service and subsequently it was found that a large number of ATMA Extension Functionaries (73.33%) were having medium level of training needs.

Correlation analysis had shown that educational qualification, service experience, length of service in present place of posting and training exposure had a negative and significant correlation with the training needs. Hence, before conducting any training programme for the Extension Functionaries these variables should be considered.

Age, motivational profile and decision making pattern had significantly and positively correlated with training needs of the ATMA Extension Functionaries.

Job satisfaction, attitude towards agricultural profession and sources of information had not significantly and positively correlated with the training needs of the respondents.

The major problems faced by the ATMA Extension Functionaries related with extension and training were 'lack of training on new technologies'(66.67%) and 'lack of knowledge on efficient and appropriate methodologies in extension activities'(70.83%). In case of management aspect problems faced by the respondents were 'lack of cooperation from senior colleagues' (79.17%) and 'delay in availability of funds/ salary' (70.83%). Problems faced by respondents related with technical aspects were 'lack of orientation training for newly recruited staff' (65.83%) and agricultural inputs were not available at an affordable price was the problem related with input supply.

The number of suggestions has been offered for improving the role performance of the ATMA Extension Functionaries related with extension and training problems were 'provide training on new technologies' (66.67%) and 'proper programme planning should be prepared' (70.83%). In case of management aspect a majority (79.17%) of the respondents were suggested that 'internal organizational structure should be developed' that is closely related to 'provide funds/ salary in time' (70.83%).

An Assessment of the Socio-economic Impact of Interventions of the NICRA Project on the Participant Farmers in Lakhimpur district of Assam

Sobnam Sultana

The present study entitled "An Assessment of the Socio-economic Impact of Interventions of the NICRA Project on the Participant Farmers in Lakhimpur district of Assam" was carried out in Chamua village of Lakhimpur district with the following objectives:

1. To study the level of awareness and knowledge of participant farmers on climate resilient agro-technologies,
2. To study the extent of adoption of climate resilient agro-technologies in the study area,
3. To study the impact of NICRA interventions on selected socio-economic variables.

The study was conducted in Chamua village (a cluster of four villages, namely, Chamua, Rangajan, Orang and Borkhet) of Lakhimpur district where NICRA Project has been implemented since 2011. For comparison purpose another set of four villages were selected in the non-project area. From the four project villages, a sample of 80 participant farmers was selected following a random sampling method. From the four non-project villages, another sample of 80 non-participant farmers was selected following random sampling method. The data for the study were collected by personal interview method with the help of a structured schedule.

Altogether 7 background variables, viz., age, education, family type, family size, size of operational land holding, availability of working capital and economic motivation and 2 descriptive variables, viz., knowledge level on climate resilient agro-technologies and extent of adoption of climate resilient agro-technologies and 9 socio-economic factors as impact variables, viz., institutional linkage, exposure to training, information exposure, perceived input availability, farm mechanization, degree of commercialization, cropping intensity, annual farm income and productivity of selected crops were included in the study. The extent of adoption was measured by using the scale developed by Sangle (1984). The statistical techniques and tests used in the study for analysis and interpretation of the data were fre-

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quency distribution, percentage, arithmetic mean, standard deviation, co-efficient of variation and t- test.

Findings revealed that majority of the participant farmers (56.25%) belonged to the young aged category followed by middle aged category (31.25%). Majority of them (25.00%) had higher secondary level of education and an equal proportion of them had graduate level of education. Majority of them (52.50%) belonged to the nuclear family and had small family size (57.50%). Majority of the participant farmers (42.50%) were small farmers followed by 31.25 per cent marginal farmers and 23.75 per cent semi- medium farmers. Most of them (62.50%) had medium level of working capital availability and medium level of economic motivation (76.25%).

Majority of the non-participant farmers (57.50%) belonged to the young aged category with higher secondary level of education (28.75%). Majority of them (56.25%) belonged to the nuclear type of family with small family size (61.25%). Majority of them (47.50%) were marginal farmers followed by 43.75 per cent small farmers. Most of them (63.75%) had medium level of working capital availability and medium level of economic motivation (58.75%).

All the participant farmers (100%) were aware about all the fourteen climate resilient agro-technologies considered in the study, while differential level of awareness was observed among the non-participant farmers. Majority of the participant farmers (56.25%) had medium level of knowledge on climate resilient agro-technologies, followed by 20.00 per cent respondents with high level of knowledge. Among the non-participant farmers, majority of them (83.75%) had low level of knowledge, followed by 16.25 per cent with medium level of knowledge. The mean knowledge level scores of participant farmers was much higher (23.08) than the non-participant farmers (12.85).

Majority of the participant farmers (68.75%) had medium extent of adoption followed by 17.50 per cent with low extent of adoption of climate resilient agro-technologies. Among the non-participant farmers, majority of them (75.00%) had low extent of adoption followed by 17.50 per cent with medium extent of adoption of climate resilient agro-technologies. Result of the t-test indicated that the project interventions had significant positive impact on the extent of adoption of climate resilient agro-technologies by the participant farmers.

Impact of NICRA interventions were examined with respect to 9 selected socio-economic variables. Majority of the participant farmers (67.5%) had membership of 1 organisation, followed by 21.25 per cent with membership of 2 organisations. The majority of the non-participant farmers (42.50%) had membership of 1 organisation, followed by 38.75 per cent with no membership in any institution or organization. All the participant farmers were exposed to training. Majority of the participant farmers (75.00%) received training of 3 days duration, followed by 25.00 per cent who received training of 2 days duration. Among the non-participant farmers, the majority (68.75%) had exposure to training of 1 day duration. Majority of the participant farmers (65.00%) had medium degree of information exposure followed by 16.00 per cent with low degree of information exposure. Majority of the non-participant farmers (61.25%) were found to have low degree of infor-

mation exposure followed by 27.50 percent with medium degree of information exposure. Majority of the participant farmers (53.75%) perceived medium degree of input availability followed by 46.25 per cent who perceived high degree of input availability. majority of the non-participant farmers (77.50%) perceived low degree of input availability followed by 22.50 per cent who perceived medium degree of input availability. Majority of the participant farmers (68.75) had medium level of farm mechanization, followed by 17.50 per cent with high level of farm mechanization. Majority of the non-participant farmers (86.25%) had low level of farm mechanization, followed by 13.75 per cent with medium level of farm mechanization. Majority of the participant farmers (70.00%) had medium degree of commercialization followed by 16.25 per cent with high degree of commercialization. Majority of the non-participant farmers (67.50%) had low degree of commercialization followed by 26.25 per cent with medium degree of commercialization. Majority of the participant farmers (66.25%) had medium level of cropping intensity followed by 18.75 per cent with low cropping intensity. Majority of the non-participant farmers (80.00%) had low level of cropping intensity followed by 20.00 per cent with medium level of cropping intensity. Majority of the participant farmers (68.75%) were in medium farm income category followed by 16.25 percent in high farm income category. Majority of the non-participant farmers (81.25%) were in low farm income category followed by 13.75 per cent in medium income category. Majority of the participant farmers (63.75%) had medium level of rice productivity followed by 26.25 per cent with low level of rice productivity. Majority of the non-participant farmers (63.75%) had low level of rice productivity followed by 36.25 per cent with medium level of rice productivity. Majority of the participant farmers (62.50%) had medium level of productivity of potato crop followed by 20.00 per cent with high level of potato productivity. Most of the non-participant farmers (56.25%) had medium level of productivity of potato crop followed by 43.75 per cent with low level of productivity. Majority of the participant farmers (56.25%) had medium level of productivity of rapeseed crop followed by 27.50 per cent with high level of productivity. Majority of the non-participants farmers (67.50%) had low level of productivity of rapeseed crop followed by 32.50 per cent with medium level of rapeseed productivity. Findings indicated that the project interventions had significant positive impact on the participant farmers with respect to the socio-economic variables considered in the study.

Causes of interstate out migration of rural youth of Assam - an exploratory study

Thatikonda Vinod Kumar

Assam is predominantly a rice centric agricultural state. Recently, a trend has been observed that rural youths of the state are reluctant for farming and looking for alternate livelihood sources. This also leads to large scale interstate out migration of rural youths from Assam. The study on causes of interstate out migration of rural youths of Assam was conducted with 150 respondents. The respondents were rural youths of Assam migrated to Hyderabad and worked in unorganized sector. The Snow ball technique was applied to select the respondents. It was found that majority (66.66%) of the respondents has high level of perception on push determinants of migration. Total 88.67 percent respondents perceived that low return from agriculture was the main reason for out migration. Majority (94.00%) of the respondents had high level of perception on pull determinants of migration. Total 97.33 percent respondents perceived that there is a better earning opportunities in cities than in villages. Majorities (88.67%) of the respondents wanted to leave their present job and was ready to return back to their villages. If the respondents will return back, more than half of the respondents will adopt non-farm activities. For adopting agricultural activities for livelihood, majority of the respondents wanted different Governmental supports like subsidy, irrigation facility, credit etc. For adopting off farm activities, they wanted higher wages like destination, year round guaranteed job in and around the village etc.

The study revealed that at the time of migration mean age was 22.04 years and at the time of interview mean age was 25.64 years. A majority (49.33%) of the respondent's formal education was up to high school level and 89.34 percent were belonged to marginal farmers. The majority (64.00%) of the respondent's nature of job before out migration was farming and after the out migration majority (61.33%) of them worked as security guard under private agencies. The average monthly income of the respondents at destination was Rs. 12,250.00. The half of the respondents was motivated by family members for interstate out migration. On an average they sent Rs.4716.66 per month to their homes.

A majority (56.00%) of the respondents satisfied with their earnings at destination.

Abstract of M. Sc. Thesis
Department : Extension Education
Major Advisor : Dr. U. Barman

Total three fourth (75.67%) of the respondents waited for getting a job after the out migration at destination. A majority (65.34%) of respondents suffered with asthma problem at destination. The mean working hours of the respondents at destination was 10.44 hrs. Most of the respondents living in katcha houses in group to save money. The study revealed that family members of marginal farmers were mostly migrated to other state and pull factors of migrations were more prominent. The study suggested for diversification of farming with economically viable enterprises for marginal and small farmers, skill development programmes for rural youths etc.

Effect of storage on physicochemical, antioxidant and organoleptic properties of developed products from roselle calyces

Hadi Ud Zaman

Present study reports the effect of storage on physicochemical, antioxidant and organoleptic properties of developed products from dried roselle calyces. Jelly was prepared with four different pectin concentrations and syrup was prepared with different sugar concentrations and calyx extracts. Physicochemical analysis showed that dried roselle calyces had considerable amounts of vitamin C, different minerals, total phenols, total flavonoids, total anthocyanins and potent antioxidant properties. Physicochemical and organoleptic properties of developed products were also evaluated at monthly intervals (90 days of storage). Increasing trend of total soluble solids ($^{\circ}$ Brix), reducing sugars (%) and total sugars (%) of the prepared roselle jelly and syrup samples were recorded across storage. Titratable acidity values were found to be decreased and pH values showed an increasing trend across storage. Non-enzymatic browning increased gradually during storage period. Ascorbic acid contents, total phenols, total flavonoids, total anthocyanins and antioxidant properties showed a decreasing trend across storage. The color properties of roselle jelly and syrup samples were determined by CIELab scores. Different CIELab parameters like L^* and a^* values decreased and b^* values were found to be increased during storage period. Texture profile analysis (TPA) of jelly samples were performed by texture analyzer. Different TPA parameters like firmness, gumminess, chewiness, and adhesiveness values were found to be increased across storage. However, cohesiveness and springiness values decreased across storage. Present investigation revealed that the viscosity (Cp) of roselle syrup samples increased significantly during the entire storage period. From the organoleptic study, it was observed that the all sensory attributes and overall acceptability scores decreased slightly during storage period, but the products were acceptable up to 90 days. The highest acceptability was recorded in T2 (Roselle extract 40%+ Sugar 60%+ Pectin 0.5%+ Citric acid 0.5) in case of jelly and T3 (Roselle extract 26%+ TSS 66% +Acidity 1.50%) showed the highest acceptability in case of syrup.

Abstract of M. Sc. Thesis

Department : Food Science and Technology

Major Advisor : Dr. Pranati Das

Comparative analysis of *Garcinia cowa* and *Garcinia pedunculata*

Indira Sagolsem

The present study was undertaken to establish a suitable drying method and biochemical characterization of *Garcinia cowa* locally known as kujithekera and *Garcinia pedunculata* locally known as borthechera fruits using five different drying methods (cabinet drying at 50°C, 70°C and 90°C, sun drying and solar drying) in different slice thicknesses of 0.3, 0.6, 0.9 cm. Higher the temperature, shorter was the drying time. Drying time required was increasing with thickness of slices. Drying methods and slice thickness affected significantly the biochemical parameters studied. The mean crude fat and ash contents were higher in *G. cowa* than *G. pedunculata* while the later was found rich in crude protein and Fe contents. Total phenol contents ranged between 881.31-888.65 and 719.00-736.74 mg/100 g, total flavonoid contents between 89.21-90.06 and 51.00-52.54 mg/100 g and HCA contents ranged between 3.13-3.92% and 1.84-1.99% for *G. cowa* and *G. pedunculata*, respectively. With increased thickness of slices, phenol, flavonoid and HCA were increasing. Free radical scavenging activity was evaluated using DPPH free radical. The methanolic extracts exhibited significant antioxidant activity. With lower IC₅₀ values, *G. cowa* had higher antioxidant activity than *G. pedunculata*. Correspondingly, total reducing power was higher in *G. cowa*. These results showed a good relationship with the higher total phenol and flavonoid contents in *G. cowa* with higher antioxidant activity. Drying was found to lower the nutrient and phytochemical contents of *Garcinia* species. There were varying effects of drying methods on the biochemical composition of *Garcinia* species. Oven drying was found better over sun and solar dryer drying. Thickness of slices was also found to have significant effects. Comparatively, oven drying at 50°C and 0.9 cm material thickness for drying resulted in better retention of total phenolic and flavonoid contents with better antioxidant activities.

Abstract of M. Sc. Thesis
Department : Food Science and Technology
Major Advisor : Dr. S. Baishya

Microbiological and physico-biochemical attributes of Khorisa, a fermented bamboo shoot product

Linda Rajkumari

The present study was undertaken for microbiological and physico-biochemical characterization of fresh and fermented bamboo shoots. Traditional method of preparation was simulated in the laboratory to produce Khorisa. Lactic acid bacteria (LAB) were predominant during fermentation (8.90 ± 0.12 log cfu g⁻¹ on 12d). An increase in LABs and decrease in other aerobic mesophiles were observed across fermentation. Yeast and moulds increased till 6d of fermentation and gradually declined afterwards. Eight LABs were isolated from Khorisa sample and their morphological, cultural, physiological and biochemical characteristics were evaluated. The isolates were rod shaped, catalase negative, gram positive with ability to ferment glucose, lactose, sucrose, mannitol and sorbitol. The isolates grew well at low pH levels (3 and 4) and moderate temperatures (20-30 °C); and were tolerant to 1-6% concentrations of NaCl. Total phenolics and antioxidant activity in Khorisa increased across fermentation. There was an increase in titratable acidity and decrease in pH of Khorisa sample across fermentation. Carbohydrate, protein, fat, ascorbic acid and ash content decreased; while, moisture, iron and phosphorus increased in fermented bamboo shoots. Fermentation caused a reduction in antinutritional factors (oxalate and phytate).

Abstract of M. Sc. Thesis
Department : Food Science and Technology
Major Advisor : Dr. Ananta Saikia

Development of Instant Rice Based Meal

Pinki Malick

An experiment was carried out in the Quality control and Post Harvest and Technology Laboratory of Department of Horticulture, AAU, Jorhat during 2013-2015 to develop an instant rice based meal formulation and to assess the nutritional and sensory properties of the product across storage. Initially five formulations were developed by combining cereal, pulses, vegetables, spices and condiments in varying proportions and named as Base meal, Formulation I, Formulation II, Formulation III and Formulation IV and acceptability trial using 9-point hedonic scale in terms of colour, flavour, taste, texture and overall acceptability was conducted and modification of the meals was done on the basis of sensory evaluation data. Henceforth, the modified formulations were developed and renamed as Base meal (M), Formulation IM, Formulation IIM, Formulation IIIM and Formulation IVM. Out of five formulations, Formulation IVM was selected as the best meal by the panelist in terms of sensory attributes. Five modified formulations were analyzed by nutritional evaluation in terms of moisture, crude protein, crude fat, carbohydrate, crude fibre, total minerals, iron, phosphorous, total carotenoid and energy. Across storage, nutritional parameters and sensory evaluation of Base meal (M) and Formulation IVM were analyzed at monthly intervals for 90 days. Studies revealed that with the increasing storage time, the nutritional parameters and sensory attributes decreased. Based on the above mentioned result, Formulation IVM was found to be highly acceptable with good nutritional and sensory scores. On the basis of cost of the raw materials, processing, packaging and labour cost incurred during the preparation of instant rice based meal, the calculated cost price is envisioned to be reasonable as compared to other commercial instant meals and is suitable for regular consumption.

Abstract of M. Sc. Thesis
Department : Food Science and Technology
Major Advisor : Dr. Ruma Bhattacharya

Development of Functional Pineapple Beverage Fortified with Dietary Fibre

Satisha C. G

An experiment was conducted to development of pineapple beverage fortified with dietary fibre from locally available fruits during 2014-2016 in the Quality Control and PHT Laboratory, Department of Horticulture and microbial Laboratory, Department of Biotechnology, Assam Agricultural University, Jorhat-13.

The present investigation was carried out to assess its suitability as a carrier of dietary fibre, fortified into the developed squash at three different levels. Dietary fibres were extracted from orange (*Citrus reticulata*) bagasse, carambola (*Averrhoa carambola*) pomace, banana (*Musa acuminata*) peel, jackfruit rag (*Artocarpus heterophyllus*) and pineapple (*Ananas comosus*) pomace. The pineapple squash was fortified with 0%, 3%, 4% and 5% dietary fibre obtained from each source. Based on the principal component analysis of sensory evaluation data; carambola pomace fibre (3% CDF, 4% CDF and 5% CDF), pineapple fibre (3% PDF and 4% PDF) and control samples were selected for further studies. Marginal changes in pH, total soluble solids (TSS), acidity, reducing sugar, total sugar, viscosity, total dietary fibre (TDF), soluble dietary fibre (SDF) and insoluble dietary fibre (IDF) were observed across storage. The results of the changes in different parameters were recorded at 15 days intervals till 90 days. TSS (38.0 to 43.50 °Brix), reducing sugar (10.74 to 40.06%), total sugar (34.39 to 53.58%) and titratable acidity (0.86% to 1.28%) increased significantly along with decrease in pH (3.20 to 1.51), viscosity (177.5 to 10.70 cP), TDF (5.01 to 1.58%), SDF (1.89 to 0.69%) and IDF (3.59 to 0.88%) during storage in all the treatments. The bacterial count (5.84 to 6.88 log cfu ml⁻¹) increased in the dietary fibre fortified squashes with absence of yeast, mold and *Escherichia coli* across storage. The control was free of microbial load across storage. On 90 days, the highest increase in L* was observed in control (61.97). The a* value was highest in 4% PDF (8.51) and b* in 5% CDF (29.49). During storage, sensory scores for colour, uniformity, heaviness, slickness, aroma, graininess, appearance, viscosity, aftertaste and overall acceptability declined along with slight increase in astringency and bitterness. However, squash, fortified with up to 3% CDF, had similar ratings as control. Sensory evaluation revealed that all the fortified beverages were acceptable to consumers, although the control scored best. The addition of 3% carambola fibre to squash appeared to be a promising option for increasing fibre intake, with high consumer and healthier option than the control.

Abstract of M. Sc. Thesis

Department : Food Science and Technology

Major Advisor : Dr. Ananta Saikia

Development of wines from locally available fruits of Assam

Smrita Pathak

An experiment was conducted to develop wines from locally available fruits, viz., banana (*Musa paradisiaca* L.), jackfruit (*Artocarpus heterophyllus* Lam), pineapple (*Ananas comosus* L.), Khasi mandarin (*Citrus reticulata*), star fruit (*Averrhoa carambola*), and mulberry (*Morus alba*) during 2014-2016. Feasibility of making wines from the fruits was investigated through biochemical, sensory and microbial examination of the developed wines before and across storage. *Saccharomyces cerevisiae* NCIM 3189 was collected from National Collection of Industrial Microorganisms, National Chemical Laboratory, Pune, which was used for fermenting the must. TSS, temperature and pH were adjusted at 20 °Brix, 28±1°C and 4.5±0.5 respectively. Wines, after development, were stored at two different temperatures, viz., at room (28±1 °C) and refrigerated temperatures (4°C). It was revealed that all the selected fruits were suitable for producing wines with high alcohol content ranging from 7.00 to 11.00% (v/v). The highest alcohol content was recorded in star fruit wine (11.00%) with the lowest in mulberry wine (7.23%). Total sugars and reducing sugars were absent in all the wines except in banana wine which contained 11.84% total sugar and 10.63% reducing sugar. Mulberry wine contained the highest phenol (75.70 mg/100mL) and flavanoid (39.68 mg/100mL). CIE L*a*b* colour values showed that luminosity (L*) was highest in banana wine (96.41). The highest a* was recorded in mulberry (30.38) and b* in mandarin wine (34.80). Viscosity was highest in star fruit wine (2.73cP). The alcohol content increased across storage at room temperature, while, no change was observed in wines stored at 4 °C. Star fruit wine contained the maximum alcohol of 11.45% among all the wines stored at room temperature. During storage under both the conditions, all the wines showed a decreasing trend in TSS and pH with a gradual increase in acidity and microbial load. The sensory scores of wines decreased across storage at both the conditions.

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Department : Food Science and Technology
Major Advisor : Dr. Ananta Saikia

Potato based vegetable sequence with organic nutrition

Ambika Prasad Baral

An experiment entitled "Potato based vegetable sequence with organic nutrition" was carried out in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014-2015 with the objectives to find out an economically viable local potato based vegetable sequence (potato-cucumber-okra) with organic nutrition and sustainability of soil health. The experiment was laid out with six treatments in Randomized Block Design (RBD) with three replications. The base crop was potato followed by cucumber and okra. The treatments that the base crop potato received were T₁: Enriched compost 2t ha⁻¹ + Azotobacter + PSB, T₂: Enriched compost 3t ha⁻¹ + Azotobacter + PSB, T₃: Vermicompost 2t ha⁻¹ + Azotobacter, T₄: Vermicompost 3t ha⁻¹ + Azotobacter, T₅: FYM @ 100 kg N ha⁻¹ and T₆: FYM 20 t ha⁻¹ & RDF @ 120:100:100 kg NPK ha⁻¹. The succeeding crops i.e. both the cucumber and okra only received 100kg N equivalent ha⁻¹ through FYM.

The mean performance for growth and yield characters of potato revealed that treatment T₆ significantly produced the highest plant height of 58.13cm, fresh biomass of 334.53g, dry biomass of 63.74g, haulm mass of 166.33g and haulm dry mass of 37.47g which was reflected by production of higher yield attributes such as tuber size of 5.04cm, tuber yield of 15.90 t ha⁻¹ and marketable tuber yield of 14.85 t ha⁻¹. Among the quality characters, T₆ recorded the highest leaf chlorophyll content of 0.82 mg g⁻¹, highest tuber phosphorus content of 0.20%, and highest moisture content of 84.20%. The highest leaf nitrogen content of 0.56 % recorded by T₄. In respect of other quality parameters of potato, T₃ recorded highest tuber potassium content of 2.52%, T₂ recorded highest starch content of 17.76% and the maximum TSS content of 5.8 °Brix recorded by T₁. The non-marketable tuber yield, tuber-nitrogen content, storage life by physiological weight loss were not significantly affected by different treatments.

Various growth characters of cucumber viz., vine length and number of branches have been found significantly differed. The longest vine length of 2.77m and higher number of branches of 4 numbers produced by T₆ followed by T₅ with vine length of 2.66m and 3

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Department : Horticulture

Major Advisor : Dr. Luchon Saikia

number of branches, respectively. Among the yield characters T_6 produced the longest fruit length of 14.72cm, maximum fruit diameter of 14.50cm, maximum number of fruits of 11 numbers, the highest yield vine-1 of 2.93 kg and yield ha-1 of 78.14 t ha-1 which was closely followed by T_5 with values 14.45cm, 14.07cm, 10 number of fruits, 2.56kg and 68.18 t ha-1, respectively. Among the quality characters, maximum leaf chlorophyll content of 2.18 mg g-1 was observed in T_1 , the highest fruit phosphorus content of 1.11% was showed in T_3 , and T_5 recorded the highest fruit potassium content of 7.23%. The highest loss in respect of moisture of cucumber fruits was recorded in T_4 . Fresh weight of fruit, leaf and fruit nitrogen content were not significantly affected by different treatments.

In okra, T_6 produced significantly maximum numbers of pod plant-1 of 16 numbers, highest yield plant-1 of 362.66g and yield ha-1 of 26.86 t ha-1 which was followed by T_5 . T_2 produced the maximum leaf chlorophyll content of 2.14 mg g-1 and highest pod potassium content of 2.66%. The highest pod phosphorus content of 0.44% was exhibited by T_5 . The plant height, fresh and dry weight of plant, pod length, weight of pod, leaf and pod nitrogen content were not significantly affected by different treatments.

Significant differences among the treatments were noticed in respect of soil parameters. The highest soil aggregates MWD of 2.893mm was recorded by T_5 which was at par with T_2 of value 2.868mm. The minimum bulk density was recorded in T_5 with value of 1.08 g cm-3. T_2 recorded the maximum CEC of 9.87 meq 100g-1. The maximum soil available potassium content of 201.79 kg ha-1 was recorded by T_4 . The maximum MBC content was recorded in T_2 with 597.51 μ g g-1 24h-1 and T_5 with 595.82 μ g g-1 24h-1 with at par results. Among other soil parameters, soil pH, soil organic carbon, soil available nitrogen and phosphorus content were not significantly affected by different treatments.

T_6 recorded the highest benefit-cost ratio of 5.12 in potato among all the treatments due to higher yield and lower input cost of production however, in cucumber and okra, the highest benefit cost ratio was obtained in T_5 with values 16.32 and 8.65, respectively. When the entire cropping sequence was considered it was T_5 which produced the highest benefit cost ratio of 9.61 followed by T_6 of 9.13. There was no loss in crop production as all the treatments produced better benefit cost ratio at the end of the sequence. The benefit cost ratio however varied within a range of 6.06 to 9.61 among all the treatments at the end of the cropping sequence.

With the result of the present investigation, it is concluded that the most efficient fertilizer management practice was found to be application of T_5 (FYM @ 100 kg N ha-1 for potato followed by 100 kg N equivalent each for cucumber and okra) with dual benefit of the highest benefit cost of 9.61 along with final soil health at the end of cropping sequence. Although the existing RDF could produce the maximum yield with the second highest benefit cost of 9.13 but there was no improvement of soil health.

Study on changes in chemical composition of Paniol [Flacourtia jangomos (Lour.) Raeusch] pulp, jam and jelly during storage”

Anuradha Baruah

The present investigation was carried out in the Laboratory, Department of Horticulture, B.N. College of Agriculture, Assam Agricultural University, Biswanath Chariali during 2014-16 in order to “Study on changes in chemical composition of Paniol [Flacourtia jangomos (Lour.) Raeusch] pulp, jam and jelly during storage” with two objectives viz (a) assessment of biochemical changes in paniol fruit pulp during storage and (b) storage stability of jam and jelly prepared from paniol fruits. The experiment was laid out in factorial CRD with two treatments (0.1 per cent sodium benzoate and 0.1 per cent potassium metabisulphite) and two storage conditions (ambient condition and refrigerated condition).

The treatment with preservatives and storage conditions had significantly affected the physico-chemical characteristics of paniol pulp. The results of the investigation revealed that with the increase in storage periods TSS, reducing sugar as well as total sugar showed increasing trend whereas acidity, ascorbic acid and anthocyanin content showed decreasing trend in paniol pulp. The retention of TSS (19.36 %), acidity (1.30 %) and total sugar content (9.43 %) were higher in ambient condition while reducing sugar (7.61 %), ascorbic acid (3.18 mg/100 g) and anthocyanin content (1.09 %) were higher under refrigerated condition.

The comparison between treatment showed that TSS (19.850Brix), acidity (1.25 %), reducing sugar (8.64 %) and total sugar (8.78 %) were higher in P2 (0.1 % potassium metabisulphite). On the other hand, pulp treated with 0.1 per cent sodium benzoate (P1) recorded higher ascorbic acid (5.54 mg/100 g) and anthocyanin content (7.99 mg/100 g). There was no significant effect of preservatives and storage conditions on acidity, ascorbic acid and anthocyanin at the end of storage of 75 days. At 60 days of storage microbial population of 8×10^8 cfu per g of pulp was recorded in sodium benzoate treated pulp while there was no growth in KMS treated pulp. It was observed that microbial population was

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Department : Horticulture, BNCA

Major Advisor : Dr. (Mrs.) Supriya Langthasa

low under refrigerated condition than the ambient condition. The stored pulp was stable till 90 days of storage with permissible limit of microbial population.

The storage conditions and storage duration significantly influenced the physico-chemical characteristics of paniol jam and jelly. The results showed that TSS, acidity, reducing sugar, total sugar were in increasing trend whereas ascorbic acid and anthocyanin content were in decreasing trend with the extend of the storage periods. There was no significant interaction effect of storage duration and storage condition in jam and jelly during the storage period. Microbial growth was not observed till 4 months of storage but at 6 months of storage 4.66×10^7 cfu per g of jam and 4.00×10^7 cfu per g of jelly were observed under refrigerated condition.

Thus from present investigation, it can be concluded that paniol pulp treated with preservatives (0.1 per cent sodium benzoate and 0.1 per cent potassium metabisulphite) could be stored up to 90 days under refrigerated condition whereas under ambient condition up to 75 days. In case of jam and jelly, it could be stored safely till 6 months under refrigerated condition and up to 2 months under ambient condition.

Standardization of sucker management in Malbhog (AAB) banana

Bhusanjyoti Boruah

A field experiment was carried out in the Instructional cum Research Farm, Department of Horticulture, B.N. College of Agriculture, AAU, Biswanath Chariali during 2015-16 in order to standardize the sucker management in Malbhog (AAB) banana. Nine treatment combinations were laid out in the field in Factorial Randomized Block Design with three replications. The treatments were T_1 (Mother plant + one sucker), T_2 (Mother plant + two suckers), T_3 (Mother plant + three suckers), T_4 (Mother plant + four suckers), and Control (recommended practice). Suckers under all the treatments were planted in 2.1 m x 2.1 m (S_1) and 2.5 m x 2.5 m (S_2). Management practices were carried out as per recommended package of practices. Desuckering and management of suckers were done as per technical programme.

The growth of suckers along with the mother plants had great influence on vegetative and yield attributing characters of 'Malbhog' banana plants. With increase in the number of suckers per plant, the values of pseudostem height, girth, phyllochron, production of suckers at harvest, planting-shooting interval, crop duration and yield attributing characters namely, number of fingers per bunch, length, girth, and volume of fingers, bunch weight and yield of the crop remarkably decreased from T_1 to T_4 .

Number of fingers per bunch, length, girth and volume of fingers, number of hands per bunch, weight of second hand and bunch weight considerably decreased with the increase in the number of suckers per plant. All these yield attributing characters were found to be highest in wider spacing (S_2) than in closer spacing (S_1). Though the bunch weight was higher in wider spacing (S_2) than closer spacing (S_1) but the total yield per hectare was lesser in wider spacing (S_2) than closer spacing (S_1) which might be due to the lower plant population in S_2 (1600 plants/ha) than in S_1 (2267 plants/ha). On the other hand, the plants under control produced highest bunch weight (9.76 kg/plant) and highest yield (22.12 t/ha) than the plants allowed to grow with different number of suckers per plant.

There were no significant differences among the treatments in relation to quality parameters such as total sugars, reducing sugars, non-reducing sugars, TSS and titratable acidity. The disease incidence particularly sigatoka was observed in the plants and the infection was highest in four suckers per hill with recommended spacing (S_1T_4).

Abstract of M. Sc. Thesis

Department : Horticulture, BNCA

Major Advisor : Dr. D. N. Hazarika

***In-situ* macropropagation of Malbhog (AAB) banana**

Dorodi Priyom Duarah

An experiment on “*In-situ* macropropagation of Malbhog (AAB) banana” was conducted at Instructional cum Research Farm, Department of Horticulture, B. N. College of Agriculture, Assam Agricultural University, Biswanath Chariali with three objectives - to standardize the production of quality planting materials of Malbhog banana through macropropagation, to standardize the suitable treatment of macropropagation of Malbhog banana and to study the disease incidence in produced planting materials. Ten treatments were laid out in randomised block design with three replications under field condition. The treatments were T1 (Control), T2 (*Trichoderma viride*), T3 (30 g BAP and 30 g *Trichoderma viride*), T4 (0.04 % BAP), T5 (0.04 % BAP + 30 g Enriched Compost), T6 (30 g *Trichoderma viride* + 0.04 % BAP + 30 g Enriched Compost), T7 (200 g *Azospirillum* and 200 g PSB mixed in 10 kg of vermicompost), T8 (50 ppm GA₃), T9 (0.25 % IBA) and T10 (100 g Nitrogen/plant).

BAP (T4) recorded the shortest time for primary sucker emergence (26.25 days), highest number of the functional leaves (5.87), faster rate of leaf production (6.81 days), shortest pseudostem (17.17 cm) and longest root (46.56 cm) and bigger sucker (350.47 g) at the end of hardening. T9 (IBA) produced the biggest pseudostem girth (7.02 cm). The weight of tertiary suckers varied significantly due to the effects of treatments and ranged from 153.12 g (minimum) to 296.09 g (maximum) at the end of hardening period. T3 (BAP + *Trichoderma viride*) produced maximum number of primary suckers (3.07) followed by 2.94 in T4 as compared to 1.0 in T8. Secondary sucker production was observed to be higher in T3 with 5.73 followed by T4 and T5 with 4.82 and 4.53, respectively. As far as tertiary sucker production was compared, T3 produced the highest number of suckers (18.94) followed by T4 (18.40), T9 (16.94), T10 (16.76), T7 (16.11), T5 (16.02), T2 (15.79), T6 (15.87) and T1 (15.20) while the lowest sucker (5.23) was produced by T8.

Abstract of M. Sc. Theses
Department : Horticulture, BNCA
Major Advisor : Dr. D. N. Hazarika

Studies on Biochemical changes of Passion fruit (*Passiflora spp*) juice during storage

Durlove Bora

The present investigation was carried out in the Laboratory, Department of Horticulture, B. N. College of Agriculture, Assam Agriculture University, Biswanath Chariali during 2013-14, in order to “study the biochemical changes of passion fruit (*Passiflora spp*) juice during storage” with three objectives viz. (a) determination of the quality of passion fruit harvested at 75 percent colour turning stage and natural fruit drop stage, (b) Assessment of the biochemical changes in passion fruit juice during storage and (c) Preparation of value added product. The experiment was laid out in two way factorial CRD with three treatments and two storage conditions. The treatments were control (P_0), 0.5 percent (P_1) and 1.0 percent sodium benzoate (P_2) and two conditions were ambient condition and refrigerated condition.

The result of the study revealed that the physical parameters at 75 percent colour turning stage had higher fresh fruit weight (55.12g) and volume (53.22cc) from that of natural fruit drop stage while maximum pulp: peel ratio (1.29) was found in natural fruit drop stage. The acidity (6.74%), ascorbic acid (18.02 mg/100ml) and vitamin A (1.49 μ g / 100g) were higher at 75 percent colour turning stage. Juice percentage (42.63%), TSS (18.33°Brix), reducing sugar (4.28%), total sugar (5.71%) and non-reducing sugar (1.42%) were higher at natural fruit drop stage as compared to 75 percent colour turning stage. At 75 percent colour turning stage is an ideal stage for transportation and for retaining better shelf life while natural fruit drop from vine is suitable for processing.

The chemical treatment and storage condition had significantly affected the physico-chemical character of passion fruit juice. During the storage period TSS, acidity, ascorbic acid and vitamin A was found in decreasing trend where as reducing sugar and total sugar was found to be in increasing trend. The interaction effect of chemical treatments and storage conditions had significant effect on all the qualitative characters during the storage period.

The comparison between the treatment showed that TSS (19.40°Brix), acidity (5.30%), ascorbic acid (17.66 mg/100ml) and vitamin A (1.47 I.U.) were higher in P_1 (0.5 percent sodium benzoate). On the other hand, juice treated with 1.0 percent sodium benzoate recorded maximum reducing sugar (6.13%) and total sugar (7.20%).

Abstract of M. Sc. Theses

Department : Horticulture, BNCA

Major Advisor : Dr. (Mrs.) S. Langthasa

Passion fruit juice treated with sodium benzoate (0.5% and 1.0%) could be stored up to 90 days under refrigerated condition as compared to ambient condition. But there was loss of natural flavour in the juice treated with 1.0 percent sodium benzoate. Thus an inference can be drawn that sodium benzoate @ 0.5% can be used for preservation of passion fruit juice with acceptable quality

Formulation and Quality Assessment of Probiotic Beverages

Francis Dutta

The current investigation was carried out to assess the efficacy of carambola (*Averrhoa carambola*) and roselle (*Hibiscus sabdariffa*) beverages in delivering the probiotic benefits after probiotification with six bacterial cultures, viz., *Lactobacillus acidophilus*, *Lb. casei*, *Lb. plantarum*, *Lb. casei. var. rhamnosus*, *Propionibacterium freudenreishii* and *Bacillus coagulans*, alone and in combination, across storage at 4 °C for 28 days.

Lb. casei showed the most promising traits in both carambola and roselle. The data revealed maximum TSS content (17.24 °Brix), low acidity (0.85%), high pH (3.10), high viscosity (7.41 cp), high sensory score, acceptable color parameters and viable colony growth (7.26 log cfu mL⁻¹) in carambola beverage; and maximum TSS content (17.19 °Brix), low acidity (0.88%), high pH (3.37), high viscosity (8.12 cp), high sensory score, acceptable color parameters and viable colony growth (7.6 log cfu mL⁻¹) in roselle beverage fermented with *Lb. casei* after storing for 28 days at 4 °C. Microbial contamination wasn't observed in either of the beverages. Probiotic bacteria in juices maintained the overall quality of the beverages after 28 days of storage at 4 °C. Carambola and roselle beverages came out as effective matrices in delivering probiotic strains for human consumption.

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Major Advisor : Dr. Ananta Saikia

Morphological and biochemical characterization of Nalkachu (*Colocasia esculenta* *var. stolonifera* L.) genotypes

Mekapotula Ramesh

Assam being a part of North East India is one of the hot spot for biodiversity. It is believed that Assam is the centre of origin for *Colocasia* species. Information on genetic variability in these genotypes is very much essential for utilization in a breeding programme. Genetic correlation coefficient analysis among the useful traits show direction to the breeder for the selection of associated component traits with high heritability instead of selecting directly a complex trait such as caudex yield with low heritability. Keeping these points in view, the present investigation was undertaken for morphological and biochemical characterization of nalkachu genotypes, to characterize the morphological and biochemical analyses of nalkachu genotypes to study the genetic variability parameters among the nalkachu genotypes and characterize the inter-relationship among the nalkachu genotypes.

Work were characterized for morphological and biochemical traits in a trial grown in randomized block design with three replications during *rabi* season 2014-2015 at AAU, Jorhat. Analysis of variance revealed that genotypes differed significantly for all the morphological and biochemical traits under study. Both genetic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were high for number of stolons per plot and caudex yield (t/ha), while it was moderate for plant height (cm). A heritability (h^2) value exceeding 90 Per cent was observed for petiole height, number of stolons per plot, caudex weight (g/plant), length of stolons (cm), caudex yield (t/ha), starch (mg/100g) and crude fibre (%), while it was low for plant diameter (cm). Expected genetic advance as per cent of mean (G_s %) was highest for number of stolons per plot, while low for leaf lamina (cm). Among the biochemical traits, calcium (%) showed high percentage of GCV, PCV. The value of h^2 exceeding 90 per cent was observed for starch (mg/100g) and crude fibre (%). high heritability with high genetic advance were observed in caudex length(cm), number of stolon per plot, length of stolon (cm), weight of stolons (g/plot), stolon yield (t/ha), caudex yield (t/ha), and all the biochemical traits. Among the genotypes, the genotype BCKVST-14

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had the highest stolon yield (16.62 t/ha) which was followed by BCKVST-13 (15.52 t/ha). Among the genotypes, the genotype AAUST-2 had the highest caudex yield (24.63 t/ha) which was followed by AAUST-1 (24.32 t/ha). Association studies at both phenotypic and genotypic levels revealed significant to highly significant correlation of stolon yield with stolon length, stolon diameter (at both phenotypic and genotypic levels). Positive and significant correlation of stolon yield with stolon length was observed. At genotypic level caudex yield was positive and had significant correlation with plant height. However, association of caudex yield with stolon yield was significantly negatively correlated.

Performance of some tomato cultivars and their response to PCPA under naturally ventilated polyhouse

Miss Nishita Dutta

A field experiment was conducted under naturally ventilated polyhouse in the Experimental Farm Department of Horticulture, Assam Agricultural University, Jorhat-785013, during 2015. The objective of this experiment was to study the performance of some tomato cultivars and their response to PCPA under naturally ventilated polyhouse. The experiment was conducted in Factorial Randomized Block Design replicated for three times. There was four tomato varieties *viz.*, Rocky, Chiranjeevi, Nayak and NS-2535 and four PCPA concentrations *viz.*, 25 ppm, 50 ppm, 75 ppm and 100 ppm PCPA along with a control (water spray) treatment were sprayed twice in the flower clusters at 15 day intervals.

Growth and yield attributing characters such as plant height, branch per plant, flower number etc were recorded in different intervals and the highest plant height of 170.51 cm was recorded in 75 ppm PCPA concentration. Interaction effect of varieties and treatment levels showed that the highest branch per plant of 10.17 was found in the treatment 25 ppm PCPA followed by 9.64 in 50 ppm PCPA in the variety Chiranjeevi. The highest flowers per plant of 73.08 was found in variety NS-2535 followed by 72.20 in variety Chiranjeevi in 75 ppm PCPA which were statistically at par. However, the highest fruits per plant of 38.55 were found in variety NS-2535 in 75 ppm PCPA concentration which was significantly superior to other interactions. The highest fruit set percentage of 52.76% was recorded in variety NS-2535 followed by 51.57% in variety Rocky in 75 ppm PCPA concentration. The highest harvesting latitude of 38.40 days was found in 75 ppm PCPA which was statistically at par with 100 ppm PCPA (38.31 days) in variety Chiranjeevi. Tomato hybrid Chiranjeevi recorded the highest 4.0 number of locules per fruit in 75 ppm PCPA concentration. Number of seeds per fruit was reduced with increased level of PCPA concentration. In the present investigation the highest number of seeds per fruit (71.91) was found in variety Chiranjeevi followed by the variety Rocky (60.90) in control treatment, while the minimum of 6.00 seeds per fruit was recorded in variety NS-2535 at 100 ppm PCPA level.

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The highest yield per hectare of 157.17 tonnes was found at 75 ppm PCPA followed by 143.04 tonnes at 50 ppm PCPA in variety Chiranjeevi with a average fruit weight of 140.70 g and 138.87 g respectively.

TSS value of 6.20% was recorded in control plants of the variety Chiranjeevi and in the variety Nayak receiving the treatment 25 ppm PCPA. Regarding Juice pH, the highest value of 4.41 followed by 4.39 was found in NS-2535 in control and 25 ppm PCPA level, respectively. The highest carotene value of 19.48 µg/g was found in 75 ppm PCPA followed by 16.64 µg/g in variety Nayak in 50 ppm PCPA level. Interaction among varieties and treatment levels showed that the highest ascorbic acid content of 20.31 mg/100 g was found in variety Rocky at 100 ppm PCPA followed by 18.88 mg/100g in variety Nayak at 75 ppm PCPA. The highest juice content of 77.34% was found in 75 ppm PCPA followed by 76.67% at 50 ppm of PCPA in variety Nayak which was statistically at par with variety Rocky (76.32%) at 100 ppm PCPA concentration.

In the present experiment the highest B:C of 3.15 was calculated in the variety Chiranjeevi at 75 ppm PCPA level. Hence considering the positive effect on growth, yield, quality and net return, tomato hybrid Chiranjeevi and 75 ppm PCPA concentration considered best for growing off-season under NV polyhouse.

Floral biology and fruit growth pattern of some minor fruits of Assam

Nishita Pathak

An investigation was carried out in the year 2014 to 2016 to study the “Floral biology and fruit growth pattern of some minor fruits of Assam”. Five different minor fruit species viz., ‘*Mirika-tenga*’ (*Parameria polyneura* Hk.f.), ‘*Bogi jamuk*’ (*Syzygium jambos* (L.) Alston), ‘*Ou-tenga*’ (*Dillenia indica* L.), ‘*Amora*’ (*Spondias mangifera*) and ‘*Poniol*’ (*Flacourtia jangomas* (Lour.) Raeus.) belonging to different families were selected for the study. One number of bearing trees was selected for the study for each species in Jorhat district. Data on nature of plant and floral biology were recorded in the field condition and the physical parameters and biochemical constituents of the fruits were recorded in the laboratory.

Parameria polyneura tree was evergreen climbing shrub which was irregular in shape and perennial in nature. The average leaf length and breadth were recorded 13.58 cm and 5.74 cm respectively. The flowering was observed from 21th December to 16th January with a duration of 27 days. The flowers were small with four sepals without any petal. The flower was tubular from the base differentiated into four distinct parts on the upper portion, which were considered as the sepals, triangular to ovate in shape and were measured to be average 0.29 cm in length and 0.19 cm in breadth. The average fruit weight at harvest was 14.68 g, the growth curve representing fruit weight showed a simple sigmoid curve, fruit length was 3.98 cm and breadth was 2.32 cm, the peel colour was red and pulp was blood red in colour, average seed length was 2.66 cm and breadth was 1.23 cm. The average TSS, juice pH, TSS-acid ratio and total soluble sugar were recorded as 9.12°Brix, 3.49, 2.98 and 5.28 per cent respectively.

Syzygium jambos tree was large to medium size, evergreen and perennial in nature. The average leaf length and breadth were recorded 24.32 cm and 4.90 cm respectively. The flowering was observed from 20th December to 12th April with a duration of 115 days. Number of petals were observed to be four, white in colour, cup shaped, average length of the petal was 1.88 cm and breadth was 1.19 cm. Number of sepals were observed to be four, green in colour, somewhat cup shaped, average length of the sepal was 0.71 cm and

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breadth was 1.30 cm. The average fruit weight at harvest was 17.85 g, the growth curve representing fruit weight showed a simple sigmoid curve, fruit length was 5.14 cm and breadth was 3.74 cm, the peel colour was yellow and pulp gave pale yellow colour, average seed length was 1.48 cm and breadth was 1.25 cm. The average TSS, juice pH, TSS-acid ratio and total soluble sugar were recorded as 9.64°Brix, 5.24, 53.59 and 9.02 per cent respectively.

Dillenia indica tree was large to medium size, deciduous and perennial in nature. The average leaf length and breadth were recorded 34.68 cm and 13.24 cm respectively. The flowering was observed from 21st June to 11th July with a duration of 21 days. Flowers were with five petal white in colour, obovate to spatulate in shape, average length of the petal was 8.54 cm and breadth of the petal was 5.26 cm and five sepals light green in colour, fleshy, oval to ovate in shape. They were somewhat cup-shaped, average length of the sepal was 5.42 cm and breadth of the sepal was 4.10 cm. The average fruit weight at harvest was 586.50 g, the growth curve representing fruit weight showed a double sigmoid curve, fruit length was 13.07 cm and breadth was 13.29 cm, peel colour was straw yellow with greenish tinge and pulp was light brown colour at harvest, average seed length was 0.52 cm and breadth was 0.30 cm. The average TSS, juice pH, TSS-acid ratio and total soluble sugar were recorded 8.73 °Brix, 3.26, 7.26 and 5.79 per cent respectively.

Spondias mangifera tree was large to medium size, spreading, deciduous and perennial in nature. The average leaf length and breadth were measured to be 15.90 cm and 8.50 cm respectively. Inflorescence was branched and produced terminal panicle. The flowering was observed from 15th march to 6th April with a duration of 23 days. Flowers were with five petals white in colour, ovate shaped and curved back. The average length of the petal was 0.31cm and breadth was 0.20cm and five sepals whitish green in colour. The average length of the sepal was 0.11cm and breadth was 0.09 cm. The average fruit weight at harvest was 22.04g, the growth curve representing fruit weight showed a simple sigmoid curve, fruit length was 4.42 cm and breadth was 3.28 cm. At harvest peel colour was yellowish green and pulp was light yellow in colour, average seed length was 3.85 cm and breadth was 2.39 cm. The average TSS, juice pH, TSS-acid ratio and total soluble sugar were recorded as 11.77 °Brix, 3.47, 4.05 and 7.02 per cent respectively.

Flacourtia jangomas tree was semi-deciduous of medium size and perennial nature, having spines on the young branches. The average leaf length and breadth were recorded 8.44 cm and 3.98 cm respectively. The flowering was observed from 30th march to 16th April with a duration of 18 days. Flowers were very small, yellowish green in colour and without any petal. The average sepal length was 0.19 cm and breadth was 0.10 cm. The average fruit weight at harvest was 8.69 g, the growth curve representing fruit weight showed a simple sigmoid curve, fruit length was 2.89 cm and breadth was 2.91 cm. The peel colour was reddish to dark brown in colour and pulp colour was yellowish orange in colour, average seed length was 0.86 cm and breadth was 0.74 cm. The average TSS, juice pH, TSS-acid ratio and total soluble sugar were recorded as 14.05°Brix, 3.26, 11.87 and 16.25 per cent respectively.

Performance of knolkhol (*Brassica oleracea* L. var. *gongylodes*) as influenced by organic inputs and microbial consortium

Parkey Gogoi

An experiment was carried out on knolkhol (*Brassica oleracea* L. var. *gongylodes*) during the period of 2014-2015 and 2015-2016 at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat with the objective to assess the “Performance of knolkhol (*Brassica oleracea* L. var. *gongylodes*) as influenced by organic inputs and microbial consortium”. The experiment was conducted in Randomized Block Design and replicated three times. There were eight treatments consisting of T₁ (Rock Phosphate as per SSP dose + Consortium), T₂ (T₁ + Compost 2.5t ha⁻¹), T₃ (T₁ + Compost 5t ha⁻¹), T₄ (T₁ + Vermicompost 2.5t ha⁻¹), T₅ (T₁ + Vermicompost 5t ha⁻¹), T₆ (Enriched compost 2.5t ha⁻¹), T₇ (Enriched compost 5t ha⁻¹) and T₈ (Recommended dose of fertilizer + 10t ha⁻¹ FYM).

Pooled analysis over two years revealed that growth and yield attributing characters were significantly influenced by the application of different nutrient sources. The mean performance for growth characters revealed that the highest plant height of 46.16cm, 24.89 number of leaves, 136.20cm² leaf area and 114.41g leaf weight were recorded at T₈ (Recommended dose of fertilizer + 10t ha⁻¹ FYM) followed by 44.68cm, 23.01, 135.28cm² and 108.65g respectively in T₇ (Enriched compost 5t ha⁻¹). Pooled data over two years revealed that the highest knob yield (191.45q ha⁻¹) and knob diameter (8.41cm) were found in T₈. Among the organic treatments T₇ (Enriched compost 5t ha⁻¹) recorded the highest knob yield (169.73q ha⁻¹) and knob diameter (7.89cm). All the growth and yield parameters were significantly poor in T₁ (Rock Phosphate + Consortium). However, the harvest index (73.22) was found to be highest in T₅ (T₁ + Vermicompost 5t ha⁻¹).

Among the quality parameters, T₈ (Recommended dose of fertilizer + 10t ha⁻¹ FYM) recorded the maximum moisture content (90.43%), crude fibre content (10.13%) and protein content (2.98%). Further, the highest ascorbic acid content (63.54mg 100g⁻¹), carbohydrate content (6.74%), carotene content (4.73µg g⁻¹), calcium content (2.06%), phosphorus content

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(0.69%) and potassium content (4.60%) were observed in T₇ (Enriched compost 5 t ha⁻¹). Besides, the highest ash content of 8.66% was recorded in T₅ (T₁ + Vermicompost 5t ha⁻¹). The lowest physiological loss in weight (19.57%) was found in T₆ (Enriched compost 2.5t ha⁻¹) followed by 19.66% in T₇ (Enriched compost 5t ha⁻¹) during the storage period. Incase of texture, the fibrousness was lowest in T₇ and highest in the inorganic treatment (T₈). Moreover, the highest colour retention was observed in T₇ followed by T₆.

Soil physico-chemical and biological characters showed significant difference among the treatments. The T₇ (Enriched compost 5 t ha⁻¹) recorded the best for all the soil parameters viz., soil p^H (5.62), N (293.82kg ha⁻¹), P₂O₅ (66.91kg ha⁻¹) and K (141.22kg ha⁻¹). However, the highest soil organic carbon content (0.88%) was recorded in T₅ (T₁ + Vermicompost 5t ha⁻¹). Incase of soil biological characters T₇ was found to be statistically superior in respect of microbial biomass carbon (315.94i g g⁻¹ soil 24hour⁻¹), dehydrogenase activity (233.87i g TPFg⁻¹ soil 24hour⁻¹), phosphomonoestarse activity (413.77i g *p*-nitrophenol g⁻¹ soil hour⁻¹), fluorescein di-acetate hydrolysis activity (8.60i g fluorescein g⁻¹ soil hour⁻¹). Similarly, T₇ treatment was obtained with significantly higher bacterial population (9.11× 10⁷ cfu g⁻¹ soil) and fungal population (6.11× 10⁷ cfu g⁻¹ soil) followed by T₆.

The cost economics indicated superiority of T₈ (Recommended dose of fertilizer + 10t ha⁻¹ FYM) with 4.16 benefit cost ratio followed by 3.42 in T₆ (Enriched compost 2.5t ha⁻¹).

Hence, considering the positive effect on growth, yield, quality and soil health, T₆ (Enriched compost 2.5t ha⁻¹) is considered the best for adopting at field level to reap good economic yield with better quality, shelf life, sustained soil health and high return.

Effect of Organic Manures on Production of Tuberose (*Polianthes tuberosa* L.)

Rajpriya Chetia

An investigation was carried out during the period of 2015-2016 to study the effect of organic manures on production of tuberose (*Polianthes tuberosa* Linn.) in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat-13. The experiment was laid out with 18 treatments in Randomized Block Design and replicated 3 times. The treatments were T₁: FYM 5.0 kg/m², T₂: Vermicompost 3.0 kg/m², T₃: Vermicompost 4.0 kg/m², T₄: Enriched Compost 0.5 kg/m², T₅: Enriched Compost 1.0 kg/m², T₆: FYM @ 5.0 kg/m² + Vermicompost @ 3.0 kg/m², T₇: FYM @ 5.0 kg/m² + Vermicompost @ 4.0 kg/m², T₈: FYM @ 5.0 kg/m² + Enriched Compost 0.5 kg/m², T₉: FYM @ 5.0 kg/m² + Enriched Compost @ 1.0 kg/m², T₁₀: Vermicompost @ 3.0 kg/m² + Enriched Compost @ 0.5 kg/m², T₁₁: Vermicompost @ 3.0 kg/m² + Enriched Compost @ 1.0 kg/m², T₁₂: Vermicompost @ 4.0 kg/m² + Enriched Compost @ 0.5 kg/m², T₁₃: Vermicompost @ 4.0 kg/m² + Enriched Compost @ 1.0 kg/m², T₁₄: FYM@5.0 kg/m²+Vermicompost@ 3.0 kg/m²+Enriched Compost@ 0.5 kg/m², T₁₅: FYM@5.0 kg/m²+Vermicompost@ 3.0 kg/m²+Enriched Compost@ 1.0 kg/m², T₁₆: FYM@5.0kg/m²+Vermicompost@ 4.0 kg/m²+Enriched Compost@ 0.5 kg/m², T₁₇: FYM@5.0 kg/m²+Vermicompost@ 4.0 kg/m²+Enriched Compost@ 1.0 kg/m² and T₁₈: Control Check.

The mean performance for growth and yield characters of tuberose revealed that treatment T₁₇ significantly produced the highest plant height of 63.00 cm, 86.67 number of leaves, 80.98 cm² leaf area and 11.07 number of shoots which was reflected by early emergence of spike (119 days), highest spike length of 83 cm, rachis length of 55.83 cm, maximum number of florets/spike (39.17) with highest self life of floret of 7.9 days, 8.33 days vase life of spike and highest fresh weight of spike of 119.77 g. In case of bulb parameters, T₁₇ recorded the highest weight of clump of 469.33 g and 39 numbers of maximum bulbs. T₁₇ recorded the highest leaf chlorophyll content of 0.75 mg/g. Significant differences among the treatments were noticed in respect of soil parameters. T₁₇ recorded highest available soil N content of 321.52 kg/ha, P₂O₅ content of 31.5 kg/ha, K₂O content of 127.06

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kg/ha and 1.27% of soil organic carbon. From economic point of view, T₁₇ recorded the highest B: C ratio of 4.51 against the lowest B: C ratio of 2.98 in control treatment. Hence considering the positive effect on growth, yield, quality and soil health, T₁₇ is considered best for adopting at the field level to reap good economic yield with better quality, sustained soil health and high net return.

Morphological and biochemical characterization of litchi varieties grown under Tezpur condition

Ranjit Borah

The present investigation entitled “Morphological and biochemical characterization of litchi varieties grown under Tezpur condition” was carried out during 2013-15 in the Department of Horticulture, B. N College of Agriculture, AAU, Biswanath Chariali with three objectives *viz* a) assessment of morpho-phenological characteristics of litchi fruit b) assessment of physico-chemical characteristics of litchi fruit and c) assessment of keeping quality of litchi fruit. The experiment was conducted in the laboratory with six varieties *i.e.* Deshi, Bombaya, Bilaiti, Piazi, China and Elaichi.

The study was conducted to evaluate the litchi varieties for leaf colour, leaf size, rachis length, petiole length, seed colour, seed weight, fruit size, fruit weight, pulp weight, TSS, acidity, ascorbic acid, reducing sugars, total sugars and also keeping quality of postharvest life.

The present investigation showed variation among the cultivar in respect to morphological and phenological characters. The newly emerged leaf colour varied from pinkish green to reddish while mature leaf varied from brown and green to dark green. Amongst the varieties, maximum leaf length was recorded in China (17.37cm) and minimum leaf length (11.63 cm) was found in Bombaya. The leaf width was maximum in Bilaiti (5.60 cm) and minimum in Deshi (4.07 cm).

The variety Bombaya depicted maximum fruit weight (24.78 g) and Elaichi recorded minimum fruit weight (14.60 g) and fruit length (2.48 cm). The maximum fruit circumference was recorded in Bombaya (11.90 cm). The highest aril weight was found in Bombaya (18.33 g) and the lowest aril weight was observed in Elaichi (6.83 g). The variety Bombaya recorded the highest aril-stone ratio (7.08). The aril-stone ratio of Elaichi (3.24) was significantly lower than all other varieties. Maximum juice content per fruit was recorded in Bombaya (58.82 %) and minimum juice content was recorded in Piazi (31.43 %). The shape of litchi fruit varied from oval to oblong. The colour of the litchi fruit at maturity varied from yellowish red to dark red. Similarly, greyish white colour aril was observed in Bombaya, China and Deshi, while creamy white in Bilaiti, Elaichi and Piazi.

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The variety China showed maximum seed weight (2.64 g), while Piazi recorded maximum seed length (2.74 cm). Similarly, minimum seed weight (2.07 g) and seed length (1.96cm) was observed in Elaichi. Bombaya produced minimum seed diameter (1.20cm) whereas Deshi produced maximum seed diameter (1.45cm). There was no difference in colour of the seed of all the litchi varieties.

Among the varieties, early flower initiation was observed in Deshi from mid January, while in Bombaya, Bilaiti and Elaichi flower initiation started from last week of January. Maximum duration from first flowering to last flowering was observed in China (35-45 days) and shortest duration of flowering in Deshi (25-30 days). Among the varieties, early fruit maturity was observed in Deshi (60-65 days). On the other hand, China recorded maximum days to maturity (75-85 days).

The highest value of chlorophyll content index was observed in Bombaya (45.20) and the lowest value was recorded in Elaichi (23.57). The TSS content recorded in Bombaya (20.33 %) was significantly higher and Bilaiti had the lowest TSS content (13.23 %). The highest value of titratable acidity (0.26 %) was recorded in China while Deshi recorded the significantly lowest titratable acidity (0.07 %). No significant difference was observed in reducing sugar content among Bilaiti, Bombaya and Elaichi. Maximum total sugar content was found in Bombaya (16.38 %), and China recorded lowest total sugar content (9.01 %). Highest ascorbic acid content was found in Elaichi (48.68 mg/100 g), significantly lowest ascorbic acid content was recorded in Piazi (36.83 mg/100 g).

During storage period minimum physiological loss in weight (PLW) was observed in CaCl_2 treated fruit.. Among the treatments, fruit treated with CaCl_2 and KMS exhibited lower browning index. However, browning was not observed up to second day of storage in treated fruits. Decay incidence was not observed up to 4th day of storage in treated fruits. However, fruit began to rot after 4th day of storage under ambient condition in all the treatment. Highest loss due to rotting was recorded in control and lowest was observed in fruits treated with CaCl_2 (300 ppm).

The results of the present investigation revealed that fruits of all the varieties under the study were superior in terms of fruit size, aril thickness, and seed size as compared to the local litchi varieties of this region. Considering the fruit size, fruit weight, aril thickness, quality of fresh fruits in terms of TSS, sugar contents and sensory evaluation, the varieties Bombaya and Deshi proved to be better than rest of the four varieties. Bomabaya fruits could be stored at room temperature with minimum physiological loss in weight and pericarp browning up to 4 days with CaCl_2 treatment.

Shelf life enhancement of *Kujithekera* (*Garcinia cowa* Roxb.) through various post harvest treatments

Shourov Dutta

An experiment was carried out in the Quality Control and PHT Laboratory of the Department of Horticulture, AAU, Jorhat during 2015-2016 with a view to study shelf life enhancement of *Kujithekera* (*Garcinia cowa* Roxb.) fruits through various post harvest treatments. The experiment was conducted at ambient condition (Mean temp 29.8°C, Mean RH 79.6%) and was laid out in a factorial completely randomized block design with 4 replications. The ripe *Kujithekera* fruits were collected from the Orchard, Department of Horticulture, AAU, Jorhat and subjected to the following post harvest treatments. T₁: Dipping the fruits in 100ppm sodium hypochlorite (NaOCl) solution for 5 min, air dried and packed, T₂: Dipping the fruits in 2% Calcium chloride (CaCl₂) solution for 5min, air dried and packed, T₃: Dipping the fruits in 1% wax emulsion for 5min, air dried and packed, T₄: Fruits without any chemical treatment. T₅: Fruits kept in an open tray without packaging and chemical treatment. In all the treatments except T₅, fruits were packed in transparent perforated (0.2% ventilation) low density polyethylene bags (25µ).

The results revealed that the *Kujithekera* fruits contained a good amount of Hydroxycitric acid (6.97 and 8.17g/100g in pulp and peel, respectively) and other nutritional qualities like TSS, total sugar and crude protein. The physicochemical qualities of the treated fruits were found to decrease significantly with the advancement of storage period. The fruits treated with 1% wax emulsion (T₃) retained the highest TSS, total sugars, ascorbic acid, hydroxycitric acid, energy value both in pulp and peel on 6 days after storage. The wax coated fruits (T₃) remained firmer (1.66Kg/cm²) with minimum rotting (5.37%) and retained acceptable colour (score value 8.25) up to 6 days after storage. The CIE lab parameters like L*, a*, b* and C* were the highest (45.73, 24.61, 13.02 and 27.84, respectively) in wax coated fruits (T₃). The fruit pulp qualities like crude protein, fat, ash, total phenol were almost same in wax coated (T₃) fruits and CaCl₂ (T₂) treated fruits on 6 days after storage. The wax coated fruits (T₃) had the highest shelf life (6 days) followed by CaCl₂ treated (T₂) fruits (5 days). It may be inferred that fruits dipped in 1% wax emulsion for 5 min, air dried and packed in transparent perforated (0.2% ventilation) LDPE bags (25µ), appeared to be the best treatment for shelf life enhancement of *Kujithekera* fruits with maximum retention of physicochemical and sensory qualities which extended the shelf life up to 6 days at ambient conditions.

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Major Advisor : Dr. M. Neog

Growth and flowering of lily (*Lilium longiflorum*) in response to planting density and nutrition levels

Tara Bhuyan

An experiment entitled “Growth and flowering of lily (*Lilium longiflorum*) in response to planting density and nutrition levels” was carried out in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014-2015. The experiment was laid out in a split plot design with three different planting densities ($D_1 = 30 \text{ cm} \times 30 \text{ cm}$, $D_2 = 30 \text{ cm} \times 25 \text{ cm}$ and $D_3 = 30 \text{ cm} \times 20 \text{ cm}$) and six nutrition levels ($N_1 = \text{FYM} - 5 \text{ kg m}^{-2}$, $N_2 = N_1 + \text{NPK @ } 5:10:7.5 \text{ g m}^{-2}$, $N_3 = N_1 + \text{NPK @ } 10:20:15 \text{ g m}^{-2}$, $N_4 = N_1 + \text{N:P:K @ } 15:30:22.5 \text{ g m}^{-2}$, $N_5 = N_1 + \text{N:P:K @ } 20:40:30 \text{ g m}^{-2}$ and $N_6 = N_1 + \text{N:P:K @ } 25:50:37.5 \text{ g m}^{-2}$). Each treatment was replicated three times in a Split Plot Design, taking planting densities as main plot and nutrition levels as sub-plot.

Results indicated that growth and flower characters were significantly influenced by planting densities, nutrition levels and their interactions. The highest value for most of the growth as well as flower attributing characters viz., plant height (56.16 cm), number of leaves plant⁻¹ (34.75), leaf area (15.69 cm² plant⁻¹), number of bulblets plant⁻¹ (2.82), number of flower plant⁻¹ (3.86), diameter of flower (18.81 cm), stalk length (44.49 cm), girth of flowering stalk (0.59cm), fresh weight of flower spike (51.01 g spike⁻¹), self life (10.26 days) and vase life (8.55 days) were recorded by treatment N_5 ($N_1 + \text{N:P:K @ } 20:40:30 \text{ g m}^{-2}$). Similarly, N_5 ($N_1 + \text{N:P:K @ } 20:40:30 \text{ g m}^{-2}$) also recorded the highest value for chlorophyll content (1.76mg g⁻¹), leaf phosphorus content (0.55%) while N_6 ($N_1 + \text{N:P:K @ } 25:50:37.5 \text{ g m}^{-2}$) recorded highest value for leaf nitrogen content (2.53%), leaf potassium content (2.03%), available soil nitrogen (276.83 kg ha⁻¹), available soil phosphorus (56.30 kg ha⁻¹) and available soil potassium (113.94 kg ha⁻¹). The minimum days to bud initiation (58.69 days) was recorded by treatment N_2 ($N_1 + \text{NPK @ } 5:10:7.5 \text{ g m}^{-2}$) and days to full bloom (91.41 days) was recorded by treatment N_1 (5kg FYM m⁻²).

Among different planting densities, D_3 (30 cm x 20 cm) recorded the highest value for plant height (52.19 cm), number of leaves plant⁻¹ (32.69), leaf area (16.05 cm² plant⁻¹), number of flower plant⁻¹ (3.73), diameter of flower (17.93 cm), stalk length (40.30 cm),

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Major Advisor : Dr. Pradip Mahanta

girth of flowering stalk (0.57 cm), fresh weight of flower spike (50.14g spike⁻¹). Similarly, D₃ (30 cm x 20 cm) also recorded highest chlorophyll content (1.61 mg g⁻¹), leaf nitrogen content (2.38%), leaf phosphorus content (0.55%), leaf potassium content (1.81%). However, D₁ (30 cm x 30 cm) recorded highest available soil nitrogen (258.79kg ha⁻¹), available soil phosphorus (47.37kg ha⁻¹) and available soil potassium (100.40kg ha⁻¹) content.

Among the interactions, N₅ (N₁ + N:P:K @ 20: 40:30g m⁻²) positively interacted with D₃ (30 cm x 20 cm) for highest number of leaves plant⁻¹ (37.50), diameter of flower (20.22 cm), stalk length (47.96 cm), fresh weight of flower spike (54.77g), chlorophyll content (1.86 mg g⁻¹) and leaf phosphorus content (0.59 %). N₅ (N₁ + N:P:K @ 20: 40:30g m⁻²) positively interacted with D₃ (30 cm x 20 cm) for highest leaf area (17.39 cm² plant⁻¹) which is at par with N₆ (N₁ + N:P:K @ 25: 50: 37.5g m⁻²) positively interacting with D₃ (30 cm x 20 cm). N₂ (N₁ + N: P: K @ 5: 10: 7.5g m⁻²) positively interacted with D₂ (30 cm x 25 cm) for minimum days to bud initiation (58.43 days). N₁ (5kg FYM m⁻²) positively interacted with D₃ (30 cm x 20 cm) for minimum days to full bloom. N₆ (N₁ + N: P: K @ 25: 50: 37.5g m⁻²) positively interacted with D₃ (30 cm x 20 cm) for highest leaf nitrogen content (2.56%) and leaf potassium content (2.23%). N₅ (N₁ + N: P: K @ 20: 40:30 g m⁻²) positively interacted with D₃ (30 cm x 20 cm) for highest leaf phosphorus (0.59%). The highest available soil nitrogen content (288.58kg ha⁻¹), soil phosphorus content (57.47kg ha⁻¹) and soil potassium content (118.64kg ha⁻¹) were recorded by treatment N₆ (N₁ + N:P:K @ 25: 50: 37.5g m⁻²) positively interacted with D₁ (30 cm x 30 cm).

Economics of cultivation revealed that the highest benefit cost ratio of 3.87 is obtained by T₈ (D₂N₅) closely followed by T₁₅ (D₃N₅) of 3.61.

Study on growth, yield and quality of strawberry in subtropical climatic conditions of Assam

Tilak Malakar

An experiment was carried out in the Instructional cum Research Farm, Department of Horticulture, Biswanath College of Agriculture, AAU, Biswanath Chariali during 2015-16 to study the growth, yield and quality of strawberry in subtropical climatic condition of Assam. Fifteen treatment combinations were laid out in the field in Factorial Randomized Block Design with three replications. The treatments comprised of five varieties namely, Cristal (V_1), Subarina (V_2), Sweet Charlie (V_3), Winter Dawn (V_4) and Eliyana (V_5). All the varieties were planted in open condition (S_1), poly house (S_2) and in net house (S_3). All the varieties were planted in three replications in each situation. All together 15 treatment combinations were laid out in Factorial Randomized Block Design with three replications. The variety Subarina recorded maximum plant height (18.62 cm) and plant spread (27.36 cm), produced maximum number of leaves (18.42), longest leaf (8.39 cm), longest petiole (9.12 cm) and maximum number of crowns (5.53). Whereas, the maximum leaf breadth (13.57 cm) and maximum achene density ($19.12/\text{cm}^2$) was recorded in Cristal. Maximum days to produce first flower was recorded in Cristal (48.19 days) whereas, minimum days taken to produce first flower was found in Winter Dawn (34.68 days) among all the varieties. Winter Dawn required the longest period (35.11 days) to mature the fruits after flowering whereas minimum days taken to mature the fruits after flowering was recorded in Cristal (33.01 days). Crop duration was significantly longest in Subarina (180.85 days) and shortest in Eliyana (163.01 days) irrespective of situations of cultivation. The values of the fruit characters namely, fruit length, fruit diameter, number of fruits per plant, weight of fruits, fruit production(g/plant) and yield (t/ha) were maximum in Subarina as compared to the rest of the varieties. However, fruit weight and fruit length were significantly affected by the situation of cultivation and both these characters were highest in the plants grown in S_1 (open condition).

Qualitative characters of fruits in terms of total soluble solids (8.13^o Brix), total sugars (6.60 %), reducing sugars (3.29 %) and non-reducing sugars (3.31 %) were significantly higher in Subarina as compared to other varieties. Titratable acidity of the fruits of all

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Major Advisor : Dr. D. N. Hazarika

varieties was considerably lower grown in different situations. Ascorbic acid content of fruits was significantly higher in Cristal (32.19 mg/100g) and lowest in Sweet Charlie (26.56 mg/100g). Ascorbic acid content of fruits were maximum (34.93 mg/100g) in S₂ (poly house) and minimum (23.57 mg/100g) in S₃ (net house). Maximum anthocyanin content was recorded in Subarina (20.01 mg/100g) whereas minimum in Eliyana (17.88 mg/100g) among all the treatments.

In the present investigation, the strawberry plants were observed to be infected by three diseases namely, Gnomoniopsis fruit rot and leaf blotch, Grey mould and Mild yellow edge virus disease sporadically in all the cultivation situations.

Growth and yield of *Aloe* (*Aloe barbadensis* M.) under open and polyhouse conditions as influenced by harvest dates

Urbashi Hazarika

An experiment was conducted on *Aloe* (*Aloe barbadensis* M.) at the Medicinal and Aromatic Plants (MAP) Block, Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2015-2016 to study the 'Growth and yield of *Aloe* (*Aloe barbadensis* M.) under open and polyhouse conditions as influenced by harvest dates'. A total of four treatments with five replications were laid out in a Randomized Block Design. The treatments comprised of: T₀- Harvesting at an interval of two months (recommended practice), T₁- Harvesting at one and a half months interval (after first harvest), T₂- Harvesting at two and a half months interval (after first harvest) and T₃- Harvesting at three and a half months interval (after first harvest) for both open and polyhouse conditions.

The studied characters showed significant differences among the treatments and two different growing conditions. The maximum plant height (37.27 cm), leaves per plant (9.54), matured leaves per plant (6.50), leaf length (30.21 cm), leaf diameter (3.07 cm), leaf thickness (0.74 cm), leaf volume (35.42 cm³) and number of suckers per plant (1.21) were recorded in T₃ in open condition while the minimum values were recorded in T₁. In polyhouse, the maximum plant height (59.76 cm), leaves per plant (13.84), matured leaves per plant (11.64), leaf length (47.61 cm), leaf diameter (5.17 cm), leaf thickness (1.53 cm), leaf volume (127.42 cm³) and number of suckers per plant (4.13) were recorded in T₃ in polyhouse condition, whereas the minimum values were recorded in T₁.

Regarding the different plant weight parameters, the maximum leaf fresh weight (144.92 g), leaf dry weight (6.94 g), peel fresh weight (46.53 g), peel dry weight (5.21 g), gel fresh weight (75.83 g) and gel dry weight (1.37 g) were recorded in T₃ while the lowest values were recorded in T₁ in polyhouse condition. Likewise, for open condition, the maximum leaf fresh weight (43.96 g), leaf dry weight (2.51 g), peel fresh weight (15.78 g), peel dry weight (1.42 g), gel fresh weight (17.10 g) and gel dry weight (0.63 g) were recorded in T₃ and the lowest values were recorded in T₁.

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Major Advisor : Dr. Bijit Kr. Saud

From the results of the yield parameters, in polyhouse condition, the maximum gel powder yield (0.85 g/100g), gel per leaf (71.07 g) and total leaf yield (5.11 kg) were recorded in T₃ against the minimum values under T₁. In open condition, T₁ recorded the minimum values against the maximum gel powder yield (0.52 g/100g), gel per leaf (13.10 g) and total leaf yield (1.24 kg) which were recorded in T₃ treatment.

In polyhouse condition, the maximum B:C ratio of 5.77 was obtained from T₃ followed by 2.69 from T₂ and the minimum B:C ratio (1.37) was recorded in T₁. Also, in open condition, the maximum B:C ratio of 4.08 was obtained from T₃ whereas, the minimum B:C ratio (1.16) was recorded in T₁. Hence, it can be concluded that *Aloe* leaves harvested at three and a half months interval in polyhouse resulted in higher productivity and maximum benefit in subtropical climate like Jorhat, Assam.

Precision farming in Banana cv. Grand-Naine (AAA) exploiting drip irrigation, nutrient management and mulching

Utpal Das

A study was carried out in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014-15, to study precision farming in banana cv. Grand-Naine (AAA) exploiting drip irrigation, nutrient management and mulching. The treatments consisted of: T₁-drip irrigation+ fertigation+ micronutrient foliar spray+ bunch spray of SOP+ black polyethylene mulching, T₂-drip irrigation+ fertigation+ micronutrient foliar spray+ bunch spray of SOP, T₃- drip irrigation+ fertigation+ micronutrient foliar spray, T₄-drip irrigation+ fertigation + bunch spray of SOP, T₅-Soil application of RDF+ flood irrigation (control). In the treatments drip irrigation at 80% ER, fertigation at 75% recommended dose NPK and at 80% ER, foliar spray of micronutrient formulation 2% spray at 2, 3, 5 months after planting, bunch spray of 2% SOP first after full bunch emergence and second at 30 days after first spray and black LDPE mulching of 50 micron thickness. N, P and K were applied through drip irrigation. The experimental design was laid out in RBD with four replications. Tissue culture plants were used for the study.

The results indicated that growth and yield characters were significantly influenced by all the treatments over control. The highest pseudostem height in large stage (150.38 cm) and shooting stage (247.95 cm), highest pseudostem girth in large stage (51.97 cm) and shooting stage (79.11 cm), number of functional leaves in large stage (7.12) and in shooting stage (12.73), the highest leaf area in large stage (0.46 m²) and shooting stage (0.74 m²) and LAI in large stage (0.14) and shooting stage (0.23) were observed in treatment T₁. T₁ recorded the shortest days to shooting (335 days), shooting harvest interval (91.33 days) and total crop duration (428.05 days). Among the physical parameters of the finger, T₁ recorded the highest finger length (22.58 cm), finger girth (13.83 cm), finger volume (133.41 cc) and finger weight (145.91 g). T₁ recorded the highest, bunch weight (21.68 kg), yield (66.91 t/ha) and harvest index (0.32). Treatment T₁ produced fruits with higher TSS (23.53p Brix), sugar-acid ratio (77.28), highest reducing sugar (9.05%), non-reducing sugar (15.68%), total sugar (24.73%) and pulp-peel ratio (2.42). From the economic point of view, T₁ recorded the highest B: C ratio of 4.78 against the lowest of 3.06 under control. Hence, considering the positive effect on growth, yield and quality, as well as in economic return T₁ is considered as the best treatment.

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Major Advisor : Dr. R. K. Bhattacharyya

Assessment of Genetic Components of Variation and Character Association in Indigenous Ridge gourd (*Luffa acutangula* L.) Germplasm

Utpal Mili

An investigation was carried out to assess the genetic variation and character association in a set of 25 genotypes of ridge gourd (*Luffa acutangula* L.) collected from the North Bank Plain Zone of Assam along with three check varieties. The experiment was carried out in the Instructional cum Research Farm, Department of Horticulture, B. N. College of Agriculture, Assam Agricultural University, Biswanath Chariali during 2013-2014, following Randomized Block Design with three replications and observations were recorded for 15 metric traits.

The analysis of variance indicated presence of significant variation for all the characters studied. The range of variation was highest for fruit yield plant⁻¹ (455.56g - 2038.89g plant⁻¹) followed by vine length (350.00 - 836.67cm) and for number of seeds fruit⁻¹ (46.78-189.67). The Genotypic Coefficient of Variance (GCV) values also markedly differed amongst the traits under study indicating the differential scope of selection of the traits under consideration. The highest GCV was observed for fruit yield plant⁻¹ (35.62) followed by number of fruits plant⁻¹ (31.76) and number of seeds fruit⁻¹ (31.14).

Heritability in broad sense was highest for individual fruit weight (96.73 %) followed by plant spread (86.61%) and fruit length (86.85%). High GCV should be accompanied with high heritability and genetic advance to arrive at high genetic gain. In the present investigation, highest genetic advance was exhibited by fruit yield plant⁻¹ (67.46) followed by number of seeds fruit⁻¹ (58.46) and number of fruit plant⁻¹ (58.12). From the above, it appeared that the characters viz., fruit yield plant⁻¹, number of fruits plant⁻¹ and number of seeds fruit⁻¹ were showing high GCV, Heritability and high genetic advance could be considered for selection to obtain high genetic gain from selection. The observation of high genetic variation in the genotype based on the variability parameters was well supported by the cluster result of following Euclidian cluster analysis following UPGMA rule. The dendrogram obtained exhibited wide diversity amongst the genotypes, which were grouped into ten diverse Clusters.

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Major Advisor : Dr. B. P. Gautam

Based on the *per se* performances of the genotypes and the relative distance between the genotypes on different clusters it may be suggested that the genotype RGC-26 for fruit length, RGC-1 for individual fruit weight, RGC-7 for fruit girth and RGC-19 for number of fruits plant⁻¹ could be considered as parents for hybridization programme.

Character association studies at both genotypic and phenotypic level through simple correlation coefficients indicated that fruit yield plant⁻¹ was significantly and positively correlated with fruit length, number of fruit plant⁻¹ and individual fruit weight. Thus, direct selection for fruit length, number of fruit plant⁻¹ and individual fruit weight may be suggested to bring about improvement in fruit yield plant⁻¹.

Crop loss assessment and Interaction of Root-knot Nematode (*Meloidogyne incognita*) and *Colletotrichum lagenarium* on Ivy gourd (*Coccinia indica* L.)

Binita Basumatary

An experiment was conducted in the field of Department of Nematology located at Instructional-cum-Research (ICR) Farm, AAU, Jorhat during the *rabi* season of 2015 to assess avoidable yield losses due to root-knot nematode, *Meloidogyne incognita* in Ivy gourd (local variety) in nematode infested field (374 J₂/200 cc soil). The experiment was laid out in Paired plot technique with ten replications. Required quantity of carbofuran granules @ 3 kg a.i./ha was applied at the spot two days before planting. Ten plots each of 3.0m x 3.5m size were treated and another ten plots were kept untreated control (without carbofuran application). Data indicated that mean number of fruit and yields of ivy gourd were reduced in untreated plots of ivy gourd by 27.58 and 35.09 % and increased root-knot index up to 3.93 and final nematode population by 50.26% respectively over control.

Studies on the interaction of *Meloidogyne incognita* and *Colletotrichum lagenarium* on Ivy gourd, the result indicated that the dual inoculation treatments significantly decreased plant growth parameters were the treatment with *M. incognita* @ 1000 J₂/kg of soil and *C. lagenarium* @ 2% (w/w). The treatment with *M. incognita* @ 1000 J₂/kg of soil + *C. lagenarium* @ 2% (w/w) simultaneous inoculation was statistically superior in decreasing the plant growth parameters of Ivy gourd. The number of galls, eggmasses and final nematode population were maximum in the treatment with *M. incognita* @ 1000 J₂/kg of soil. The maximum disease incidence was observed in the treatments with *M. incognita* @ 1000 J₂/kg of soil + *C. lagenarium* @ 2% (w/w) after 15 days of inoculation and simultaneous inoculation of *M. incognita* @ 1000 J₂/kg of soil + *C. lagenarium* @ 2% (w/w).

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Department : Nematology
Major Advisor : Dr. B. Mahanta

Bio-management of root-knot nematode in organic tomato

Palash Thengal

Tomato (*Lycopersicon esculentum L.*) has a special position in human diet due to its high nutritive value. Tomato production is threatened by plant parasitic nematodes; especially the root knot nematode *Meloidogyne incognita* causes a major loss to this crop. Seventeen germplasm/cultivars of tomato were screened for their reaction to *Meloidogyne incognita*, in the net house, Department of Nematology, AAU, Jorhat. It was observed that all varieties showed varying degrees of reaction to *M. incognita*. Out of seventeen tomato germplasm, two viz., 'Chiranjeevi' (hybrid) and 'Anoop' (hybrid) showed resistant reaction, eight viz., 'Punjab Chuhara', 'Arka Abha', 'Arka Alok', 'Rishika', 'Local 1', 'Local 2', 'Local 3', 'H 24' showed moderately resistant reaction, six germplasm viz., 'TJ Rakshya', 'TJ 59', 'TJ Shaktiman', 'Mirika', 'Rocky' and 'Nayak' showed susceptible reaction, and 'Pusa Ruby' which was included as susceptible check variety in the experiment showed highly susceptible reaction to *M. incognita*.

A field experiment was conducted in *rabi* season, 2014-2015 in the organic block of Instructional-cum-Research Farm, Assam agricultural university, Jorhat, to study the efficacy of bioagents, organic amendment and clear plastic mulching in management of *M. incognita* in organic tomato. All treatments viz., clear plastic mulch of 0.75 mm density, vermicompost, *Trichoderma viride*, mustard oil cake alone or in combination significantly increased plant growth parameters and yield of tomato over control. However maximum reduction of galls, egg masses per root system and final nematode population in soil was observed in the treatment with clear plastic mulch of 0.75 mm density + mustard oil cake @ 750 kg/ha over control.

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Department : Nematology
Major Advisor : Dr. K. Hazarika

Occurrence and distribution of root-knot nematode *Meloidogyne incognita* in Patchouli *Pogostemon cablin*

Pallab Buragohain

Patchouli [*Pogostemon cablin* (Blanco)] is an important aromatic plant belonging to family Lamiaceae, is a native of Philippines (Arpana *et al.*, 2008). It is grown wild in Malaysia, Indonesia, Singapore and few other countries. Owing to high demand of its essential oil many countries have domesticated this crop. It has multiple uses, it is used in cosmetics, breath fresheners, flavouring baked foods, meat, sausages, etc. Patchouli is very susceptible to root -knot nematode and wilt causing pathogens. In moist and wet weather condition root knot infestation is high in plants which may lead to wilting of plant and kill the plant within 2-3 days due to secondary infection by fungal and bacterial pathogens.

The study on “Occurrence and distribution of root-knot nematode *Meloidogyne incognita* in patchouli *Pogostemon cablin*” was carried out in the year 2014 -2016, in Golaghat, Nagaon, Jorhat and Sonitpur districts by conducting a survey programme. A total of 123 samples were collected randomly from the four districts. Root-knot infestation was recorded in most of the fields covering the four districts. Root and soil samples were found to be heavily infested by root-knot nematode. The maximum frequency was recorded in Nagaon districts i.e. 38.88 per cent whereas minimum frequency of 21.87 per cent was recorded in Golaghat district. Many fungal pathogens were found to be associated with most of the root-knot infested plants. In the present investigation, three fungal pathogens were found to be associated with root-knot infested plants. They are *Fusarium* sp., *Rhizoctonia solani* and *Cercospora* sp. It has been observed that the patchouli plants are also infested by different insect pests like leaf roller and grass hopper. These insect pests are voracious eater and almost eat up the green foliage leading to defoliation and heavy yield loss.

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Department : Nematology

Major Advisor : Dr. (Mrs) B B. Gogoi

Assessment of maize (*Zea mays* L.) genotypes for nitrogen use efficiency and biochemical traits

Aditi Eliza Tirkey

Plant breeders attempt to concentrate in the same variety a number of genes for higher productivity, adaptability, resistance and quality. Genes for various traits are usually dispersed in various germplasm, more particularly in the land races of maize. The different local maize germplasm of North East India may have different important traits such as nitrogen use efficiency, nutritional traits and other important yield traits. Identification of nitrogen use efficient and nutritionally rich germplasm is an important consideration in modern maize breeding particularly under changing climatic scenario. In the present investigation, attempts were made to assess ten maize genotypes for nitrogen use efficiency and related traits, nutritional traits and other important morphological traits in an experiment laid out in RCBD during *rabi* 2015-16 under two levels of nitrogen N_0 and N_{80} . The ANOVA indicated existence of sufficient variability among the genotypes for all the traits at both the levels of nitrogen as revealed by significant mean squares due to genotype. Among the genotypes tested, highest NUE was recorded in PAC 740 at both N_0 and N_{80} . For nutritional traits, Khayarghutu gave the highest mean performance for starch, protein and ash at N_0 level while PAC 740 gave best results for all the nutritional traits at N_{80} level. High mean performance for grain yield per plant was observed in PAC 740 in both N_0 and N_{80} . Genotypic and phenotypic coefficients of variation were the highest for nitrate reductase activity at N_0 while the highest GCV for root biomass and the highest PCV was recorded for nitrate reductase activity were observed at N_{80} level. For nutritional traits, highest GCV and PCV were recorded for fat content. Amongst the morphological traits, ears per plant recorded the highest GCV and PCV at N_0 level and 100-kernel weight showed the highest GCV and PCV at N_{80} level. Heritability ranged from medium to high in most of the traits. Highest heritability among all the physiological traits was observed for root volume at N_0 and for whole plant biomass at N_{80} . For nutritional traits, highest heritability was seen in protein and ash content at N_0 and in ash at N_{80} . Highest heritability among all the morphological traits was observed for days to 75% dry husk at N_0 and for days to 50% tassel at N_{80} . Nitrate

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Department : Plant Breeding and Genetics

Major Advisor : Dr. N. Sarma Barua

reductase activity recorded the highest genetic advance (G_s) at N_0 while root biomass showed the highest G_s in N_{80} . Amongst nutritional traits, fat recorded the highest G_s at both N_0 and N_{80} . Highest G_s was recorded by number of kernel row per ear at N_0 and 100-kernel weight at N_{80} . High heritability coupled with high genetic advance were observed for whole plant biomass, leaf area, root volume, root biomass, chlorophyll at vegetative stage, ear height, 100-kernel weight, and ears per plant at N_0 and for whole plant biomass, leaf area, root volume, root biomass, NRA, days to 50% pollen shed, days to 50% silking, 100-kernel weight and grain yield per plant at N_{80} level indicating preponderance of additive gene effects for these traits. Simple selection method without progeny testing may be effective for improvement of population with respect to such traits.

Morpho-physiological and molecular characterization of inter specific hybrids of *Solanum lycopersicum* L. and *S. pimpinellifolium* for fruit quality and yield attributes

Amrit Tamuly

The tomato *Solanum* species which includes the cultivated tomato *Solanum lycopersicum* L., and more than 10 related wild species, belongs to the family *Solanaceae*. Varieties under *Solanum lycopersicum* L. are poor in adaptability and other characteristics due to their narrow genetic base. *Solanum pimpinellifolium*, a closely related species of *Solanum lycopersicum* L., harbours a number of quality traits and yield attributes not present in our cultivated tomatoes. Parents for the inter-specific hybridization with *S. pimpinellifolium* carried out during *Rabi* 2014-15 comprised of six tomato varieties of *S. lycopersicum*. The parents as well as the inter-specific hybrids were evaluated for fruit quality and yield attributes in the field condition during *Rabi* 2015-16. All the varieties were cross compatible with *Solanum pimpinellifolium*. Analysis of variance revealed significant variation among the parents, crosses as well as parents versus crosses for most of the characters studied. The maximum mean performance for yield and yield attributing characters was exhibited by the parent H-24 (5.80 kg/plant) and the cross *Solanum pimpinellifolium* x Arka Alok (2.44 kg/plant). Heritability coupled with genetic advanced was found in numbers of fruits per plant (98.7%, 186.43%) followed by fruit weight (98.2%, 105.63%) and fruit diameter (98.6%, 80.7%) respectively. Yield per plant was positively correlated with fruit length and fruit breadth. Path analysis at genotypic level revealed that harvest duration followed by primary branches, fruit weight, and number of fruits per cluster exhibited maximum direct effect on fruit yield per plant. Variation among the species of cultivated tomato and *Solanum pimpinellifolium* could be detected with 30 SSR markers out of 46 SSR markers surveyed. The percentage of polymorphism was found to be 65.21%. The markers TS 1256, TS 5636 and TS 431 detected specific alleles present in *Solanum pimpinellifolium* in the inter-specific hybrids made from crosses with Arka Abha and Punjab Chuhara when *Solanum pimpinellifolium* was used as pollen parents in the respective crosses. The detection of common allele in the pollen parent and inter-specific hybrids confirmed hybridity of the crosses.

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Department : Plant Breeding and Genetics

Major Advisor : Dr. Prabalee Sarmah

Evaluation of autumn rice (*Oryza sativa* L.) genotypes of Assam for drought related traits

Chongtham Chinglen Meetei

Rice (*Oryza sativa* L.) is an annual grass which belongs to the family *Poaceae* under the genus *Oryza*. The deficit of water (drought) is the major constraint limiting the rice production significantly under rainfed rice ecosystem. In rainfed ecosystem, soil moisture stress during germination, early vegetative stage and also at reproductive stage results towards in low productivity of autumn rice. The present investigation is to evaluate autumn rice genotypes for their tolerance to moisture stress.

A set of 30 autumn rice genotypes were evaluated under drought stress and non-stress conditions during *Ahu* 2014 and late *Sali* 2015 to identify drought tolerant genotypes on the basis of morphological, physiological and biochemical traits related to drought tolerance. The experiment was conducted in ICR Farm of Assam Agricultural University, Jorhat. The observation was recorded for morph-physiological, biochemical and yield attributing characters. The genotypes were assessed for their mean performance, genetic variability, and association of characters through correlation analysis. The analysis of variance showed the presence of significant variability among the genotypes for all the characters studied both under non-stress and stress condition. The phenotypic coefficient of variation for the characters was higher than the genotypic coefficient of variation. High heritability (>80%) coupled with high genetic advance (>50%) were recorded for leaf area per plant, leaf area duration, root dry mass root volume. The mean performance of the genotypes under stress condition revealed that *Bali Ghungoor* was the highest yielder possessing high leaf area per plant and leaf area duration. Leaf rolling score was low in genotype *Maizobiron*. Proline content was the highest in genotype *Surya Mukhi*, and root volume, root length, root dry mass were the highest in genotypes *Ikhojoi*. Under stress condition association studied revealed that leaf area per plant, leaf area duration and grain yield exhibited significant positive association with harvest index, whereas, pollen sterility percentage showed negative significant correlation with grain yield and harvest index. The mean performance of the genotypes for drought tolerance traits revealed that *Suryamukhi*, *Haru Bengunigootia*, *Teraboli*, *Ikhojoi*, *Bali Ghungoor*, *Lal Kach*, *Banglami* and *Shahbhagi Dhan* and *Maizobiron* are the few promising genotypes under moisture stress condition that could be utilized in the development of drought tolerant genotypes.

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Department : Plant Breeding and Genetics

Major Advisor : Dr. D. Sarma

Genetic variability studies in black gram genotypes under deficit moisture stress situation

Dibosh Bordoloi

Black gram (*Vigna mungo* L. Hepper) is an important food legume and it has high nutritive value with 24-26% protein. Black gram production is affected by various abiotic and biotic constraints which penalize seed yields. Among them, drought is known to cause substantial reduction in the seed yield of the crop. This study was conducted to evaluate black gram genotypes for genetic parameters and drought tolerance. A total of 10 black gram genotypes were studied under moisture stress and non-stress situations in pot experiments at Assam Agricultural University during 2015. A complete randomized design with three replications was used. Analysis of variance revealed significant genetic variation among the genotypes for almost all the measured traits. Mean comparisons showed that genotype AKU 10-6 and SBC 40 produced higher seed yield under moisture stress and non-stress situation. Genotypic and phenotypic coefficient of variation was high for proline content followed by 100 seeds weight in both the situation. Broad sense heritability estimates ranged from medium to high. High heritability was recorded for 100 seed weight, proline content, chlorophyll content, pods per plant and relative leaf water content. High heritability, coupled with high genetic advance values, was also observed for relative leaf water content and proline content in both situations. Moreover, there were significant positive correlation between seed yield with cluster per plant, leaf area, chlorophyll content, seeds per pod and pods per plant. It was also found that the correlations between seed yield with number of days to 50% flowering and proline content were negative and significant. Path coefficient analysis revealed that pods per plant seeds per pod and relative leaf water content had high positive direct effect on seed yield under both moisture stress and non-stress situation. Therefore, selection pressure should be directed towards these traits to improve the seed yield stability across different moisture levels. In stress situation the genotype AKU 10-6 could be considered as a suitable genotype due to its highest seed yield with early flowering, and the highest proline content and relative leaf water content. In non-stress situation the genotype SBC 40 showed highest seed yield with higher pods per plant, pod length, 100 seeds weight, leaf

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area, chlorophyll content. So, this genotype considered as best genotype under non-stress situation. In both situations the genotype AKU 10-6 showed lower % of reduction almost all the characters like branches per plant, pod length, seeds per pod, 100 seeds weight, seed yield per plant, chlorophyll content. So, this genotype considered as stable genotype. However, further testing of these genotypes in the field conditions under both situations is required to assess the real worth of the genotypes.

Trait expression changes for fitness of *Joha* rice of Assam in response of organic and inorganic culture

Khirud Panging

Twelve diverse genotypes of *Joha* rice comprising of ten local germplasm and two improved genotypes were evaluated for important morpho-physiological and quality characters under inorganic and organic culture. With two objectives, the genotypes were subjected to analyses of variance and covariance for estimation of genetic variability parameters, correlation coefficients and causal relationship among the 41 characters from germination to quality aspects traits. The experiment was carried out during the *Sali* season, 2015 at ICR Farm of Assam Agricultural University in a Randomized Block Design with three replications.

Variation was observed among the genotype with respect to different character like seedling stage, vegetative stage, reproductive stage, maturity stage and quality aspects parameters. With respect to quantitative characters, the analysis of variation revealed significant variation for all the genotypes under investigation. The highest coefficient of variation (CV%) was for root length (19.50%) in inorganic culture and for root volume (19.66%) in organic culture, indicating environmental effects for these characters.

Under inorganic culture, the highest genotypic coefficient of variability (GCV) was recorded for iron content (46.61%) followed by root dry weight (37.00%) and root volume (31.53%), while in organic culture, the highest estimate of genetic coefficient of variability (GCV) was recorded for root dry weight (47.4%) followed by iron content (43.9%) and weed dry weight (33.0%). The heritability in broad sense was recorded from the flag leaf length to the quality character Iron content under both inorganic and organic culture. The GA calculated as per cent of mean was recorded for iron content in both inorganic (95.91%) and organic culture (90.34%), followed by root dry weight and weed dry weight. All these characters are estimated high GA.

In inorganic culture 15 traits were positively correlated with grain yield per plant out of 39 yield correlations genotypic level. At phenotypic level, grain yield per plant showed positively correlated with 25 characters and negatively correlated with 14 characters. For organic culture, at genotypic level there was only 12 significant yield correlation. Among the

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characters, biological yield for inorganic culture exhibited the highest positive direct effect (1.547) on the grain yield per plant followed by days to first flowering (0.035) and days to maturity (0.008). In organic culture, highest positive direct effect was recorded for biological yield on grain yield per plant (1.766), followed by days to first flowering (0.017), panicle weight (0.005) and days to maturity (0.002).

The highest positive indirect effect was recorded for straw weight per plant on grain yield per plant *via* biological yield per plant (1.211), followed by harvest index *via* straw weight per plant (1.115), 1000-grain weight *via* straw weight (0.523). The highest negative indirect effect was recorded for grains per panicle on grain yield per plant *via* biological yield (-1.319) followed by biological yield on grain yield per plant *via* straw weight per plant (-1.151). Residual effect was found to be 0.0193 for inorganic, while in organic culture the residual effect was negligible.

Based on the performance of the 12 *Joha* genotypes in inorganic and organic culture, *Keteki Joha* was found superior for inorganic culture, which is an improved cultivar of aromatic rice. The land race, *Kukrajhar Local Joha* proved superior to the other genotype under organic culture. *Indrabhog* along with *Keteki Joha* with excellent grain type would be suitable for both inorganic and organic culture. These genotypes along with *Kola Joha*, *Kali Jeera* and *Manimuni Joha* could be further investigated for GE interaction over locations and years. Weed suppressing ability of *Kunkuni Joha*, *Local Joha* and *Indrabhog* needs to be correlated with plant type characters for future organic rice breeding. *Indrabhog* could also be considered for direct release under organic farming.

Comparative assessment of seed ageing and deterioration during storage in different types of cultivated rice (*Oryza sativa* L.)

Jintu Sonowal

The knowledge of seed aging and deterioration mechanism is essential to minimise the storage loss and to maintain quality standards of the seed. The present study is a preliminary step for identification of storage potential of four different types of rice varieties of Assam viz., Mahsuri (HYV), Bokul Bora (Local glutinous rice), Kola Joha (Local Aromatic rice) and Ronga Sali (Local Pigmented rice) under different storage conditions. Effect of packaging material on the storability of the rice seeds was evaluated using three different types of packaging materials viz., cloth bag, HDPE interwoven bag and HDPE bag (600 gauges). Observations were taken at bimonthly interval and the final observations were taken at the 10th months of storage. Based on the results of ambient storage study and accelerated aging test Kola Joha, an aromatic variety is found to be the most sensitive and prone to deterioration whereas the variety Bokul Bora from the glutinous group exhibited better storage performance. In the light of the present study, it can be concluded that maintenance of quality in rice seeds stored in HDPE interwoven bags in ambient storage condition is appropriate for one growing season. The variation in the moisture content was observed over the storage period irrespective of packaging materials and varieties in ambient storage condition. The variation may be due to the seasonal changes in atmospheric temperature and R.H. and influence of packaging materials. The observations on electrical conductance revealed loss of membrane integrity with increase in storage period. However, the lowest E.C. value was observed in HDPE interwoven bags in all the varieties and highest was observed in Kola Joha in cloth bag. The estimated biochemical parameters indicates the gradual decline in total soluble protein and increase in total free amino acid content in all the varieties in both ambient storage and A.A. treatment with increase in storage period and seed aging. Significant difference in α -amylase enzyme activity was found among the tested varieties. Bokul Bora exhibited highest α -amylase enzyme activity after storage of 10th

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Major Advisor : Dr. S. D. Deka

months and the lowest was observed in Kola Joha which was reflected in the laboratory germination percentage. Lipid peroxidation is considered as the central cause of seed deterioration and loss of membrane integrity. In the present study, one of the indicators of lipid peroxidation, malondialdehyde (MDA) was also estimated initially and at the end of storage/aging period i.e. on the 10th months of storage and on 5th days of aging. The study revealed that the deteriorative pattern can be predicted on the basis of lipid peroxidation value.

Seed quality improvement of *Capsicum annuum* L. var. *grossum* through application of biopesticide

Santonu Hazarika

Capsicum (*Capsicum annuum* L. var. *grossum*), commonly known as sweet pepper belonging to the solanaceae family, is a high value low volume crop which has excellent prospectus both for domestic and export market. Despite of its economic importance growers are not in a position to produce good quality capsicum with high productivity due to various biotic, abiotic and crop factors. Its production has some constraints which include flower dropping, poor fruit set, storing of seed and susceptibility to viral diseases. *Capsicum* is extensively attacked by a range of field and storage pests, which translates into extensive damage, if crop protection measures are not taken. A field experiment was conducted at Experimental Farm, Department of Horticulture, Assam Agricultural University during rabi season of 2014-15 for seed quality improvement of *Capsicum annuum* L. var. *grossum* through application of biopesticide. The experiment was laid out in randomized block design with eight treatments replicated three times.

The result revealed that growth and yield attributing characters are significantly influenced by the application of biopesticides. Highest plant height (23.27 cm) was recorded by treatment T₈ (mustard oil cakes in furrows). Treatment T₄ (both seeds and furrows treated with jatropha oil) and treatment T₂ (seeds treated with jatropha oil) were recorded with minimum days to 50% flowering and 50% fruit setting respectively. The highest number of fruit per plant (10.00 numbers), fruit length (9.23 cm), fruit Girth (10.23 cm), number of seed per fruit (125.67) and yield per plot (12.23 kg) was observed in treatment T₈ (mustard oil cakes in furrows), which was statistically at par with treatment T₄ (both seeds and furrows treated with jatropha oil) followed by T₂ (Seeds are treated with jatropha oil) and T₃ (furrows treated with jatropha oil). Lowest number of insects per plant was recorded in treatment T₇ (use of both insecticide and miticide).

Among the seed quality parameters germination percentage was not significantly different in zero day and 60 days of storage. But after 120 and 180 days of storage treatment T₂ (seeds treated with jatropha oil) was recorded with highest germination percentage 83.33%

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Major Advisor : Dr. A. Sarma

and 75.33% respectively. There was no significant difference in seed vigour index at zero day and 60 days of storage, but significant difference was observed after 120 and 180 days of storage. Treatment T₄ (both seeds and furrows treated with jatropha oil) was recorded with highest seed vigour index 707.73 and 559.27 after 120 and 180 days of storage respectively. In respect of radical length and shoot length there was no significant difference at zero day and 60 days of storage, but after 120 and 180 days of storage there was significant difference was observed. Highest radical length and shoot length was observed in treatment T₄ (both seeds and furrows treated with jatropha oil). Biopesticides also affect the health of the seed. Lowest percentage of infected seed was observed in treatment T₂ (seeds treated with jatropha oil).

Exploring microbial bioagents for management of pathogens associated with micropropagated banana

Joli Dutta

Four antagonistic microorganisms *Trichoderma viride*, *Metarhizium anisopliae*, *Pseudomonas fluorescens* and *Bacillus thuringiensis* and their consortia were used to suppress *Colletotrichum musae*, the causal agent of anthracnose disease and *Ralstonia solanacearum*, the causal agent of bacterial wilt disease of micropropagated banana during 2014-16. The compatibility tests conducted *in vitro* among these bioagents showed that all the bioagents were compatible amongst themselves. The combinations of different antagonists were tested to assay their ability to inhibit the growth of *C. musae* and *R. solanacearum* *in vitro*. The inhibition produced by the combinations of four bioagents *T. viride*, *P. fluorescens*, *M. anisopliae* and *B. thuringiensis* was significantly highest against both *C. musae* (80.56%) and *R. solanacearum* (97.06%). The efficacy of the microbe based consortial formulations was also tested for their ability to suppress diseases caused by *C. musae* and *R. solanacearum* *in vivo* in pot grown micropropagated banana plantlets. Three best consortial formulations viz., Efficient microbe 1 (*T. viride*, *M. anisopliae*, *P. fluorescens* and *B. thuringiensis*), EM 2 (*T. viride*, *B. thuringiensis* and *M. anisopliae*) and EM 3 (*T. viride*, *M. anisopliae* and *P. fluorescens*) for anthracnose and EM 1 (*T. viride*, *M. anisopliae*, *P. fluorescens* and *B. thuringiensis*), EM 2 (*T. viride*, *M. anisopliae* and *P. fluorescens*) and EM 3 (*T. viride*, *B. thuringiensis* and *M. anisopliae*) for bacterial wilt which were applied as root and soil treatment of micropropagated banana. There was a significant decrease of disease incidence for both anthracnose (13.5%) and bacterial wilt (10.7%) with highest disease reduction over control for anthracnose (40.58%) and bacterial wilt (59.94%). The numbers of leaves per plant, shoot length, shoot girth, root length and numbers of roots per plant of micropropagated banana plantlets increased in Soil treatment with EM 1 + EM 2 + EM 3 (No. of leaves per plant 19.05, shoot length 21.41 cm, shoot girth 16.77 cm, root length 29.34 cm and no. of roots per plant 20.34) and Soil treatment with EM 1 + EM 2 + EM 3 (No. of leaves per plant 19.05, shoot length 21.41 cm, shoot girth 14.41cm, root length 19 cm and no. of roots per plant 20.34) for management of anthracnose and bacterial wilt of micropropagated banana plantlets respectively.

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Department : Plant Pathology

Major Advisor : Dr. L. C. Bora

Scheduling of copper fungicide for the management of late blight in organic potato production

Manash Jyoti Gogoi

In the present investigation, efforts have been made to evaluate the comparative efficacy of different forms of copper fungicide *viz.*, copper sulphate, copper oxy-chloride and copper hydroxide against late blight of potato incited by *Phytophthora infestans* (Mont.) de Bary under the same spray schedule (one prophylactic spray at canopy closure followed by two more sprays after appearance of late blight) with a view to select the most effective copper fungicide for organic management of the disease. Field experiment performed during 2014-15 revealed that all the copper fungicides could control late blight to a varying extent. However, among the copper fungicides, copper hydroxide proved to be the best in reducing the attack of late blight. This treatment not only gave highest tuber yield (4.48 t/ha) with a corresponding minimum (12.74%) tuber infection but also provided highest protection (22.33%) against late blight.

Based on results from the first year investigation, copper hydroxide was selected for developing an effective spray schedule against late blight. In the field experiment carried out during 2015-16, all the spray schedules of 0.2% copper hydroxide were found to be significantly effective against the disease in comparison to the unsprayed control. Amongst the different spray schedules, the treatment comprising of one prophylactic spray of 0.2% copper hydroxide at canopy closure followed by 7 subsequent sprays at 6 days interval proved to be the best spray schedule. In this treatment, the late blight appearance was delayed by 6 days from first appearance of the disease in unsprayed control. This treatment recorded the lowest intensity (48.88%) of late blight with maximum control (51.12%) of the disease even after 15 days from first appearance of the disease in the untreated control. The treatment combination not only recorded the highest yield of healthy tubers (5.79 t/ha) with minimum tuber infection (10.77%) but also provided maximum net return of Rs. 32,430.00 along with a corresponding incremental benefit-cost ratio of 2.06:1. Although, the spray schedule of one prophylactic spray at canopy closure followed by 6 subsequent sprays at 8 days interval recorded a relatively lower (5.17 t/ha) yield, however this treatment gave the highest incremental benefit-cost ratio (2.08:1) with a net return of Rs. 26,274.00.

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Department : Plant Pathology

Major Advisor : Dr. M. K. Saikia

Seasonal fluctuation of microbial contamination in oyster mushroom and their management

Kala Chhetri

In oyster mushroom cultivation there is problem with contamination of beds from foreign micro-organism that causes effects on the growth of mycelia, which grow at sub-optimum levels and give low yields. The present investigation aimed to study on the seasonal fluctuation of contaminant microflora in the beds of *Pleurotus florida* and to find out certain botanicals and GRAS chemicals for their management.

The study revealed the occurrence of two major contaminants in mushroom bed viz., *Tricoderma harzianum* and *Aspergillus flavus*. The highest incidence of these were recorded in the beds when the crop is cultivated in the month of September causing maximum loss of mushroom yield. The crop cultivated in the month of January was completely free from infection of contaminating microflora resulting in highest yield of mushroom. Higher temperature (29.8-32.6°C) and relative humidity (80.8-85%) favoured the higher incidence of contaminants in bed.

The effect of aqueous extracts of four botanicals viz., *Azadirachta indica*, *Ocimum sanctum*, *Trigonella foenum graecum L.* and *Acorus calamus L.* at three different concentrations viz., 5, 10 and 20 per cent were tested *in vitro* for their efficacy against the contaminants. Out of these, *Acorus calamus* at 20 per cent exhibited significantly highest inhibition of mycelia growth of *T. harzianum* and *A. flavus*, respectively in comparison to control. This was followed by *A. calamus* at 10 per cent concentration on *T. harzianum* and *T. foenum graecum* at 20 per cent on *A. flavus*, respectively.

Four GRAS chemicals viz., sodium chloride, calcium carbonate Sodium bi-carbonate and boric acid at three different concentrations viz., 1 per cent, 3 per cent and 5 per cent were also tested *in vitro* against *T. harzianum* and *A. flavus*. Amongst the GRAS chemicals boric acid at 5 per cent concentration showed significantly highest inhibitory effect against both the contaminants in comparison to control.

In compatibility test, *A. calamus* and *T. foenum graecum* at 20 per cent and boric acid at 5 per cent concentration were found compatible with the mycelia growth of *P. florida* *in vitro*.

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Department : Plant Pathology

Major Advisor : Dr. Daisy Senapoty

On the basis of *in vitro* studies *A. calamus* and *T. foenum graecum* at 20 per cent and boric acid at 5 per cent concentration were used for surface sterilization of substrate at the time of spawning and opening of beds of *P. florida*. The highest yield was recorded from the beds treated with *A. calamus* at 20 per cent concentration which resulted *at par* yield of *Allium sativum* at 4 per cent concentration which was used as treated control. Moreover, the additional benefit cost ratio between the applications of rhizome extract of *A. calamus* and mushroom yield was found to be highest compared to other treatments.

This study may provide an idea of appropriate cultivation time of *Pleurotus florida* as well as an effective alternatives for minimizing the infection of mushroom beds from contaminant microflora.

Evaluation of phyto extract and bio-control agent against fruit rot of Tomato caused by *Fusarium* spp.

Pallabi Bora

Tomato (*Solanum lycopersicum* L.) in Assamese is known as Bilahi. It is used as vegetable and fruit in our daily diet. Tomato fruit is attacked by fruit rot disease caused by *Fuusarium oxysporum* f.sp. *lycopersici*. The yield loss due to this disease may extend up to 80 per-cent (Sharma 1995). Therefore, an attempt was made to evaluate the efficacy of phyto extract and antagonist on reduction on radial growth of *F. oxysporum* f.sp. *lycopersici*. In *in vitro* evaluation, aqueous extract of neem, garlic and tulsi significantly reduced the radial growth of *F. oxysporum* f.sp. *lycopersici* in all the concentrations viz., 5, 10 and 20 per cent as compared to control. However, neem extract was most effective (85.00% of growth inhibition) against *F. oxysporum* f.sp. *lycopersici* followed by garlic extract and tulsi extract, while extract of tulsi was least effective. Amongst the three antagonists' viz., *Trichoderma harzianum*, *Gliocladium virens* and *Trichoderma koningii*, maximum radial growth inhibition (82.51%) of *F. oxysporum* f.sp. *lycopersici* was recorded by *T. harzianum* as compared to others. In the compatibility test, neem extracts showed slightly antagonistic activity on *T. harzianum* at 5 and 10 per-cent but showed moderate antagonistic activity on *T. harzianum* at 20 per-cent while moderate antagonistic effect was shown against *T. koningii* by neem extracts at 5, 10 and 20 per-cent but highly antagonistic effect was shown on both the antagonists of garlic extracts at 5, 10 and 20 per-cent. In *in vitro* evaluation, minimum (11.42%) Per cent Disease Incidence (PDI) and minimum (4.23%) Per cent Disease Severity (PDS) with maximum (81.66%) Per cent Disease Control (PDC) and increased (85.81%) Per cent Disease Severity control (PDSC) respectively of fruit rot of Tomato were achieved when tomato fruits were pre dipped in 30% of neem extract followed by *Fusarium oxysporum* f.sp. *lycopersici*. Similarly, Minimum (8.42%) Per cent Disease Incidence (PDI) and minimum (1.64%) Per cent Disease Severity (PDS) with maximum (68.27%) Per cent Disease Control (PDC) and increased (81.02%) Per cent Disease Severity control (PDSC) respectively of fruit rot of Tomato were achieved when tomato fruits were pre dipped in $10^2 \times 10^{-4}$ c.f.u/ml of spore suspension followed by *Fusarium oxysporum* f.sp. *lycopersici*. Under Pot condition, minimum (7.40%) Per cent Disease Incidence (PDI) with increased (83.18%) Per cent Disease Control (PDC) was observed in soil application of *T. harzianum* grown in wheat bran media @ 2%/ pot along with spraying of neem extract @ 10% at flowering and fruiting stage.

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Department : Plant Pathology

Major Advisor : Dr. B. C. Das

Microbial antagonist in management of pathogenic flora causing root decay of lettuce under hydroponic culture

Parveen Khan

Effectiveness of bio-intensive management of fungal rot and bacterial wilt of lettuce (*Lactuca sativa* L.) incited by *Fusarium oxysporum* f.sp. *lactucae* (Fol) and *R. solanacearum*, was evaluated under hydroponic culture tank system during 2015-2016. Compatibility of four potential microbial bioagents viz. *Trichoderma viride*, *Bacillus thuringiensis*, *Pseudomonas fluorescens* and *Metarhizium anisopliae* were tested *in vitro* and the positively compatible bioagents were further assessed their antagonistic properties against Fol and *R. solanacearum*. *T. viride* exhibited significantly highest antagonistic activity (68.56%) against Fol and the combination of *T. viride*, *B. thuringiensis* and *P. fluorescens* was found significantly effective (70.27%) in suppressing growth of *R. solanacearum in vitro*. When these effective bioagents were applied alone or as consortia, significant reduction of fungal rot and bacterial wilt incidence was observed in hydroponically grown lettuce crop with considerable increase in healthy harvest as compared to control (untreated). *T. viride* (10^8 cfu/ml) was found to suppress Fol infection in lettuce exhibiting lowest root infection (15.39%), lowest leaf infection (18.09%) as well as least fungal rot infection (17.29 %) with highest crop growth attributes and yield (251.25 g /plant). In respect to suppression of bacterial wilt of lettuce application consortial formulation of *T. viride*, *B. thuringiensis* and *P. fluorescens* (10^8 cfu/ml) exhibited lowest root infection (20.40%), lowest leaf infection (16.55%) as well as least wilt infection (18.57 %) with highest crop growth attributes and yield (242.50 g/plant).

Correlation studies revealed that disease incidence was negatively correlated with the yield of hydroponically grown lettuce plant.

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Department : Plant Pathology
Major Advisor : Dr. P. K. Borah

Biosynthesis of silver nanoparticles and its effect against soil borne pathogens

Pranjal Kumar Kaman

Development of reliable and eco-friendly process for synthesis of metallic nanoparticle is an important steps in the field of nanotechnology. An effort was made for biosynthesis of silver nanoparticles from *Trichoderma asperillum*, a potential indigenous biocontrol agents. Silver nitrate was added as precursor for the synthesis of silver nanoparticles. The biosynthesized silver nanoparticles was characterized by UV-Vis spectrophotometer, Dynamic Light Scattering (DLS), X-ray diffraction (XRD), Zeta Sizer and Transmission Electron Microscope (TEM). UV Vis spectrum of aqueous medium containing silver ion showed peak at a wavelength of 420 nm corresponding Plasmon Absorption of silver nanoparticle. DLS study showed that the biosynthesized silver nanoparticles have a size of 27.64 nm with polydispersity index (PDI) of 0.409. This indicates that the biosybtthesized nanoparticle were polydispersed in nature. The charge of silver nanoparticles was determined by zeta sizer and found to have negative potential value of -1.34 and indicated as stable on dispersion. TEM study revealed the formation well dispersed silver nanoparticles in the range of 9-41 nm with roughly spherical in shape. Fungicidal activity of silver nanoparticle at different concentration (100 ppm, 50 ppm, 30 ppm, and 10 ppm) was tested against four soil borne plant pathogens viz., *Rhizoctonia solani*, *Fusarium* sp., *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii* and comparison was made with Carbendazim @3000 ppm. The result showed that the silver nanoparticles at 100 ppm significantly inhibit the mycelia growth of the pathogens as compared to the Carbendazim at 3000 ppm.

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Department : Plant Pathology
Major Advisor : Dr. Pranab Dutta

Study on incidence of Sesamum phyllody disease in Assam and its biological characterization

Shankar Hemanta Gogoi

In the present investigation Roving survey was conducted in five districts of Assam namely Biswanath, Jorhat, Nagaon, Karbi Anglong, Sonitpur during kharif season, 2015 to study Sesamum phyllody disease incidence, symptomatology, type and population of leafhoppers and to ascertain the loss in yield. The experiment on transmission of the disease with different combinations of no. of leaf hopper *Orosius albicinctus* (Dist.)/plant, acquisition and inoculation feeding period was carried out under net house at B.N.College of Agriculture, Biswanath Chariali. During survey symptoms of the disease were observed as development of phyllody, floral proliferation, floral virescence, witches broom, stem fasciation and cracking of capsule. Highest disease incidence was observed in Karbi Anglong (23.22%) followed by Biswanath (20.23%), Sonitpur (19.91%), Jorhat (18.38%) and Nagaon (17.46%) district respectively. Five different types of leafhoppers viz., *Cofana unimaculata* (Dist.), *Exitianus indicus* (Dist.), *Hishimonus phycitis* (Dist.), *Nephotettix nigropictus* (Stal) and *Orosius albicinctus* (Dist.) were collected during the survey with average population of 3.4, 3.2, 6.2, 3 and 5.6 no./ five net sweep respectively. In the farmer's field, the loss of no of pod/ plant and seed yield due to the disease was ranged from 58.54-100 and 57.20-100 percent respectively.

The leafhopper *Orosius albicinctus* (Dist.) could transmit the disease successfully in artificial inoculation. The rate of transmission of the disease increased significantly as the no. of leafhopper was increased from 1 per plant (29.47%) to 3 per plant (84.26%). The disease transmission also increased significantly as the acquisition feeding (AFP) period increased from 3 days (49.38%) to 5 days (64.75%). Likewise, lowest disease transmission (16.67%) was observed in plants with 5 days inoculation feeding period (IFP) and increased significantly in 10 IFP (100%). The interaction effect of no. of leaf hopper/plant, acquisition feeding period and inoculation feeding period also exhibited positive and significant increase in transmission. Highest disease incidence was observed in plants inoculating with 3 no of leafhopper per plant +5 days AFP + 7and 10 days IFP and lowest in treatment with 1 leafhopper per plant + 3 days AFP + 5days IFP. Similar effect was also observed in time

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Major Advisor : Dr. M. K. Kalita

period taken for first appearance of symptom. Lowest time period (25 days) for first appearance of symptom was taken when plants were inoculated with 3 no of leafhopper/plant + 5days AFP + 7 and 10 days IFP and highest (39days) in plants inoculated with 1 leafhopper/plant + 3 days AFP + 5days IFP.

The effect of Sesamum Phyllody disease on yield characters of sesamum also varied based on the age of the plant at infection. Highest reduction in no of pod per plant (67.85%), 1000 seed weight (21.97%), and seed yield per plant (69.87) over healthy was observed when plants were infected at 50-55 days of age. As the age of the plant at symptom development increased the effect on yield characters also reduced significantly and lowest reduction in no. of pod per plant (21.43%), 1000 seed weight (8.71%) and seed yield per plant (28.20%) over control was observed in plants showing symptoms at 70-75 days of age.

The sesamum phyllody disease was successfully transmitted by graft transmission (80%) and dodder (90%) but it was not transmitted by seed and sap inoculation. There was no effect in germination of seeds collected from infected sesamum plants.

A study on extent of adoption of scientific eri culture practices by the rearers in Jorhat district of Assam

Kalyan Sonowal

Silk and its culture in Assam is not only a culture but a tradition, not a history but a way of life fitted to the socio-economic structure of the society, a rich heritage which leads the state to a legend in the world silk history. Though all the four major varieties of silk, *viz.*, eri, muga, mulberry and tasar are reared in Assam, eri silk occupies the prime position in the sericulture scenario of the state. According to Economic Survey Assam 2014-15, the eri silk productivity of Assam is 161.18 kg per hectare. Although improved technologies, package and practices have been developed by the various research organizations for development of ericulture, yet full potential isn't harnessed. Therefore the present study was aimed to get an overview of the extent of adoption of scientific eri culture practices and also to identify the problems in carrying out eri farming by the rearers. A purposive-cum random sampling design was followed to obtain a sample size of 80. Ten independent and one dependent variable were selected for the study. Frequency, percentage, standard deviation, correlation, t-test were the statistical techniques used for the analysis of data.

The findings revealed that 45.00 per cent of the eri rearers belonged to age group of 36-50 years and had their education up to middle school. Moreover, 66.25 per cent of the rearers belonged to Schedule Tribe, 57.50 per cent of the respondent had medium family size. In case of operational land holding, 51.25 per cent of the eri rearers belonged to small farmer. It was also found that 55.00 per cent of the erirearers had their annual income ranging between Rs. 35,001 to 75,000. The respondents had medium level of extension contact, risk bearing and decision making ability.

The results further revealed that 63.34 per cent of the respondent had medium level of extent of adoption in the district. A positive and significant relationship was found between extent of adoption and age, education level, size of operational land holding, annual family income, extension contact, risk bearing ability and decision making ability of the respondents. Major problems reported by the respondents included lack of awareness on technology adoption, lack of need based training, lack of capital, lack of land for host plant cultivation, non-availability of irrigation facilities, fluctuation of cocoon prices, lack of marketing facilities, storage facilities etc.

Concerned agencies need to step up the measures for better extension support to promote it as an employment opportunity and entrepreneurship by imparting skills on improved technologies.

Abstract of M. Sc. Thesis

Department : Sericulture

Major Advisor : Dr. L.C. Dutta

Effect of cooking pre-soaked muga cocoons on reeling and yarn quality

Lalrammawia

An investigation was undertaken with a view to study the effect of cooking pre-soaked muga cocoons on reeling and yarn quality in the Department of Sericulture, Assam Agricultural University, Jorhat during 2014-16.

The results revealed that cocoons pre-soaked in alkaline media and cooked in sunken system showed better performance in cooking parameters. Less cooking, deflossing period and higher cooking efficiency were found in cocoons pre-soaked in alkaline media and cooked in sunken system. Among three different concentrations of soda less cooking and deflossing period were recorded in 0.30 per cent soda concentrations. Increasing of soda concentrations there is a tendency of decreasing of the cooking and deflossing period in sunken and floating system. Cooking efficiency was also registered higher in 0.30 per cent soda concentrations. The reelability percentage was recorded higher in cocoons pre-soaked in alkaline media and cooked in sunken system. Among three different concentrations of soda higher reelability percentage and filament length were registered in 0.30 per cent soda concentrations than the rest of two concentrations. The denier was recorded lower in cocoons pre-soaked in alkaline media and cooked in 0.30 per cent soda concentration for sunken system. Less tenacity was found in sunken system after pre-soaked in alkaline media while it was found higher in floating system and pre-soaked in plain water. The elongation percentage was found to be more in sunken system and pre-soaked in alkaline media. Among the three different concentrations of soda the lowest tenacity and highest elongation were recorded in 0.30 per cent soda concentrations. Though there is decreasing trends of tenacity and increasing trends of elongation percentage of muga reeled yarn with increasing of soda concentrations.

From the investigation it was evident that cocoons pre-soaked in alkaline media and cooked (0.30% soda) in sunken system was found to be better in all parameters. The concentrations of soda had significant effect on cooking, reeling and yarn quality of muga silk. Cocoons cooked in 0.30 per cent soda concentration showed better performance in all parameters. From the study it may be concluded that the sunken system can be adopted for cooking of muga cocoons (in 0.30% soda) after pre-soaking in alkaline media for better performance of cooking, reeling and yarn quality.

Abstract of M. Sc. Thesis

Department : Sericulture

Major Advisor : Dr. D. P. Khanikor

Integrated strategies for the management of Flacherie disease of Muga silkworm (*Antheraea assama* Ww.)

Merrylina Sonar Marak

Flacherie, a bacterial disease of Muga silkworm, *Antheraea assama* Westwood (Lepidoptera: Saturniidae) is a deadly disease causing extensive losses in cocoon crop harvest. The causal organisms were identified through morphological, biochemical and molecular characterization methods and found to be caused by two different bacteria *Bacillus amyloliquefaciens* subsp. *plantarum* and *Pseudomonas* sp. In order to control the disease, the present study was conducted wherein botanicals, microbial biocontrol agents and antibiotics were used as an integrated control measure. *In vitro* studies revealed that botanicals, *Mikania micrantha* HBK causes maximum inhibition of growth (27.37%) and found most effective in suppressing the growth of *Bacillus amyloliquefaciens* subsp. *plantarum* whereas *Aloe barbadensis* Mill. was found best against *Pseudomonas* sp. causing a growth inhibition of 25.53 per cent. Among the five different microbial biocontrol agents *Trichoderma asperillum* was found best for both the pathogens. Similarly, two antibiotics viz, Streptomycin and Tetracycline (at 50 ppm and 100 ppm) were tested *in vitro* and Streptomycin 100 ppm was found best in inhibiting growth of the pathogens. When the best treatments in different combinations with each other were tested in controlled conditions against *Bacillus amyloliquefaciens* subsp. *plantarum*, the combined application of the four treatments (*M. micrantha*, *A. barbadensis*, *T. asperillum* and Streptomycin 100 ppm) was found to reduce 87.50 per cent larval mortality of silkworm with significantly better larval weight and cocoon characters. Similarly for, *Pseudomonas* sp. the combined application of the four treatments (*M. micrantha*, *A. barbadensis*, *T. asperillum* and Streptomycin 100 ppm) exhibited better results in reducing larval mortality and significantly better larval weight and shell weight.

Abstract of M. Sc. Thesis
Department : Sericulture
Major Advisor : Dr. Pranab Dutta

Study on incidence and bio-ecology of castor semilooper and castor butterfly infesting castor plant (*Ricinus communis* L.) – A primary food plant of eri silkworm

Pranjal Jyoti Phukan

The present study on incidence and bio-ecology of castor semilooper, *Achaea janata* L. and castor butterfly, *Ariadne merione* C. on castor plant in relation to weather parameters were carried out in the Department of Sericulture, Assam Agricultural University, Jorhat during 2015-16. Results indicated that the castor butterfly, *Ariadne merione* C. is a holometabolous insect which passed through egg stage, five larval stages, pupal stage and adult stage. The total developmental period was found minimum in the month of September and maximum in the month of January. After mating, female laid round, sculptured, hairy and shiny white eggs singly on the lower surface of the leaves. The larva after emergence started feeding on the leaves and causes severe defoliation. Infestation of the pest was seen throughout the year starting from April and continued till February. Intensity of attack, extent of damage and population build up of the pest varied during different months and reached a peak during the end of October. Correlation and regression studies were carried out between the incidence, intensity, extent of damage and population build up of castor butterfly with the weather parameters viz., temperature (maximum and minimum), relative humidity (morning and evening), total rainfall, number of rainy days and bright sunshine hours. Significant correlation was found with bright sunshine hours.

Though castor semilooper, *Achaea janata* L. is considered as a important pest of castor, there was no incidence of the pest in the selected sites of the study during the period of investigation.

Thus, it may be concluded that the castor butterfly, *Ariadne merione* C. is a serious pest of castor infesting the plant from April to February causing extensive damage to the plant. The incidence, intensity and population build up of the pest were largely regulated by environmental factors. Therefore, proper eco-friendly management practices are necessary towards utilization of both indigenous and improved technologies, ecological literacy and knowledge on low cost as well as improved IPM interventions to make better management decisions for sustainable production of castor crop.

Abstract of M. Sc. Thesis

Department : Sericulture

Major Advisor : Dr. L. C. Dutta

Isolation and Characterization of Arbuscular Mycorrhizae from Rice Rhizosphere in Acid Soils

Ipsita Ojah

Rice (*Oryza sativa* L.) is the major food crop grown in Assam which occupies about 27 lakh hectare and 70% of it as winter rice with an average productivity of 1.97 t/ha. Moderately to strongly acidic, low cation exchange capacity with low to medium phosphorus fertility index supposed to harbour arbuscular mycorrhizal fungi (AMF) in paddy soils. In the study, attempts have been made to isolate and characterize the association of AMF in the rhizospheres of seven rice varieties widely grown in Assam. The results exhibited the occurrence of AMF spores in the rhizosphere of wet land rice varieties in between 209.00 and 397.00/100g soil of which highest value observed in Joha rhizosphere (397.00/100g). Root samples of the seven rice varieties examined, four varieties (Bora, Joha, Bahadur and Badsabhog) depicted more than 40% of root colonization with the highest value in Bora (48.87%). The AMF spores occurred in the rhizosphere were negatively influenced by available P_2O_5 ($r = -0.437^{**}$), but established strong positive correlation with organic carbon ($r = 0.363^{**}$) of the rhizosphere. However the available P_2O_5 in the rhizosphere clearly correlated with the enzyme phosphomonoesterase (0.643^{**}) which in turn showed correlation with bacteria ($r = 0.309^*$) and fungi ($r = 0.378^{**}$). The AMF spores, as well, illustrated the significant correlations with easily extractable glomalin (EEG) ($r = 0.485^{**}$) and total glomalin (TG) ($r = 0.632^{**}$) respectively, determined in the rice rhizosphere. Morphological characterization of the isolated AMF spores, explained the prevalence of two genera *Glomus* and *Gigaspora* which were successfully mass multiplied in maize root as host crop.

The consortia of mass multiplied AMF spores and root propagules were tested for their effectiveness in a pot experiment in rice with three levels of P_2O_5 (0, 20 and 40 kg/ha) under submerged condition. By reducing levels of P_2O_5 (20kg/ha) comparable plant biomasses were recorded ($P < 0.05$) under AMF inoculation with that of highest level of P_2O_5 (40kg/ha) with or without AMF inoculation. By reducing the P supply (20kg/ha), the measurable effect of AMF ($P < 0.05$) was obtained for P and N concentration (1.27 and 7.88mg/g respectively) and their uptake (20.63 and 127.50 mg/plant respectively) in rice plants which were comparable with uninoculated plants at 40kg P_2O_5 /ha. AMF spores and root colonization were found at all levels of P supply, although overall the numbers of AMF spores and percent root colonization decreased with increasing P under AMF inoculation which implies that saturation or inundation does not necessarily prevent the development of AMF association.

Abstract of M. Sc. Thesis

Department : Soil Science

Major Advisor : Dr. Dhruba Jyoti Nath

Variability of soil properties in Majuli and Ujani- Majuli blocks of Jorhat district of Assam

Joni Yoka

Study on the soil properties of the largest river island of the world- Majuli of Jorhat district of Assam was carried out during 2015-16 with a view to develop soil fertility database and for preparation of soil fertility maps of Majuli and Ujani-Majuli blocks. Soil samples (412 nos.) were collected from 18 Gaon Panchayats of Majuli Island from a depth of 0-15 cm with GPS and GIS technique. The collected soil samples were analysed for physico-chemical properties, available major and micronutrients and thematic maps were prepared using TNT-mips (2014) software. With sandy loam texture, the physical and chemical parameters of soil of Majuli Island were shown to exhibit great variability. The data on bulk density, particle density, porosity and water holding capacity were varied from 1.18 - 1.46 Mg m⁻³, 2.11 - 2.76 Mg m⁻³, 39.47 - 53.42 per cent and 23.79 - 48.72 per cent in the soils of Majuli block and 1.25 - 1.49 Mg m⁻³, 2.28 - 2.79 Mg m⁻³, 37.29 - 50.39 per cent and 21.66 - 40.21 per cent in case of Ujani Majuli block, respectively. The Majuli soils were low in EC and CEC, and strongly acidic to neutral in soil reaction. With the variation of 26.6 per cent, SOC content ranged between 0.67 and 2.92 per cent in case of Majuli block and 0.57 and 2.84 per cent in Ujani Majuli block. A very high content of SOC was observed in the surface 0-15 cm soil depth (in 89.22% soils of the island). Available N, P₂O₅ and K₂O content in the soil of the river island varied from 163.07 to 815.71, 10.03 to 76.41 and 104.53 to 528.02 kg ha⁻¹, respectively. Majority of the Majuli soils *i.e.* 96.35, 91.14 and 90.07 per cent of the total investigated samples were medium in available N, P₂O₅ and K₂O status, respectively. Results revealed that the available S in soil varied from low to high range and data ranged between 2.43 and 26.11 mg kg⁻¹. However, Ca and Mg were in sufficient range in both the blocks of the Island. Based on critical limits, DTPA extractable micronutrients like Fe, Mn and Cu were recorded to be in sufficient range. However, out of total investigated soil samples, 50.16 per cent was deficient and 49.84 per cent was sufficient in DTPA-Zn. Data also showed HWS-B content in deficient range (in 99.86% soils). Soil properties showing large variations were EC (34.26%) and OC (26.65%), along with major nutrients

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Department : Soil Science

Major Advisor : Mr. Bhabesh Gogoi

viz., available N (31.80%), P₂O₅ (29.31%), K₂O (29.76%) and S (35.51%). Among the micronutrients, the highest variation was observed in case of Zn followed by Cu and B. Correlation studies indicated that major nutrients showed positive and significant correlation with CEC and organic carbon; and secondary nutrients were positively correlated with soil properties such as EC, CEC, SOC and with all the primary nutrients in Majuli and Ujani Majuli blocks. All the micro nutrients in soils showed positive correlation with SOC and soil pH, except DTPA-extractable Fe, Mn and Cu which were found to be negatively correlated with pH of soil. At last, soil fertility maps prepared using GPS data also showed reliable informations regarding their nature, extent and distribution in soils of Majuli Island.

Evaluation of Biochar for Correcting Soil Acidity and Moisture Content

Kanku Deka

The study on “Evaluation of Biochar for Correcting Soil Acidity and Moisture Content” was carried out to characterize the physico-chemical properties of biochars, its potentiality to correct soil acidity and assessing their suitability to conserve soil moisture. Locally available bio-wastes viz., rice husk, rice straw, *toria* stover and bamboo leaves were used as raw materials to produce chars in slow pyrolysis (300-400°C) process. Two samples of feedstock each from 5 development blocks of Jorhat district were collected, dried and pyrolysed for production of char for their physico-chemical properties. Percent moisture and ash content, bulk density, particle density and porosity of biochars ranged from 3.26 to 4.91%, 3.70 to 24.97%, 0.178 to 0.729 g/cm³, 0.85 to 2.02 g/cm³ and 61.54 to 78.90%, respectively. Pore volume, particle size and specific surface are arranged from 0.83 to 1.15 ml, 310×147 to 350×209 μm² and 89.40 to 184.75 m²/g, whereas pH, EC, CEC, total Carbon varied from 7.74 to 9.46, 0.272 to 1.005 dsm⁻¹, 12.74 to 16.68 cmol (p⁺)/kg and 36.63 to 49.424%, respectively. Porosity maintained significant and positive correlation with pore volume (0.715**) and specific surface area (0.614**). CEC had significant positive correlations with total C (0.583**), total N (0.587**), total K (0.443**) and IAN (0.766**). Percent total N, P, K, and S had their value ranged from 47.27 to 60.07, 0.017 to 0.032, 0.237 to 0.453 and 0.083 to 0.099; while, Ca and Mg, Fe, Zn, Cu and Iodine adsorption number ranged from 1.11 to 5.23 and 0.148 to 1.326 cmol (p⁺)/kg, 16.65 to 2.91, 30 to 162, 8.6 to 43 mg/kg and 186.64 to 489.77 mg/g of biochar. Rice straw biochar being alkaline was considered for incubation study at 3, 6 and 9 weeks of incubation periods where three doses of biochar (0, 0.5 and 1%) and five levels of liming material was applied. Increase in levels of liming material and biochars doses increased soil pH as well as ECEC significantly irrespective of incubation periods. Percentage of aluminium neutralized to its initial Al content was found increasing due to increase in levels of liming and biochars materials. Such increase was to the tune of 82 and 95 per cent due to biochar and because of application liming material, respectively. In regards to retaining soil moisture content due to biochar application, it was found decreasing significantly with the progress in days of experimentation irrespective of types of biochar used. Increase in biochar doses increased the soil moisture content significantly over the one where no biochar was applied.

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Department : Soil Science

Major Advisor : Dr. B. K. Medhi

Development of Pedotransfer Model for Available Phosphorus based on Soil Organic Carbon in Acid Soils of Upper Brahmaputra Valley Zone of Assam

Krishna Saikia

The study on “Development of Pedotransfer Model for Available Phosphorus based on Organic Carbon in Acid Soils of Upper Brahmaputra Valley Zone of Assam.” was carried out with the objectives 1) to develop a soil Av-P-OC pedotransfer model for acidic soils, 2) to verify the developed model with laboratory database and 3) to evaluate the relationship of available P with their various forms. Altogether 200 surface soil samples (15 cm) were collected from the five districts viz. Tinsukia, Dibrugarh, Sivsagar, Jorhat and Golaghat of UBVZ of Assam. Soil available P_2O_5 , organic carbon (OC), pH and texture were determined for all the samples. The pH, OC %, and available P_2O_5 ($kg\ ha^{-1}$), of the soils ranged from 4.26 to 5.9, 0.18 to 1.12, 14.23 to 54.97, respectively and the texture varied from sandy loam to clayey. From these, 40 samples were selected randomly based on variation in texture for developing a pedotransfer model. The sand %, silt % and clay % of these soils ranged from 15.0 to 56.0, 11.0 to 44, 19 to 52 with OC %, pH, CEC [$c\ mol\ (p+) \ kg^{-1}$], Al_d (%), Fe_d (%), available P_2O_5 ($kg\ ha^{-1}$) from 0.28 to 1.12, 4.5 to 5.90, 4.9 to 8.60, 0.55 to 1.78, 0.64 to 1.81, 16.84 to 52.23, respectively.

A pedotransfer model for predicting soil available P_2O_5 from soil organic carbon (OC) was developed and soil available P_2O_5 (Av. P) was estimated as a function of soil OC. The model is $Av. P = 5.734 + 43.965 * OC$. The soil available P_2O_5 predicted from the soil available P pedotransfer model was compared with the soil available P determined by laboratory test using the paired samples t-test and the Bland-Altman approach. The soil available P predicted by the soil available P pedotransfer model was found not to be significantly different from the soil available P determined by laboratory test ($P > 0.05$). The mean difference between the soil available P pedotransfer model and laboratory test was $0.00\ kg\ ha^{-1}$ (95% confidence interval: -0.735 and $0.735\ kg\ ha^{-1}$; $P = 1.00$). The standard deviation of the soil available P differences was $2.30\ kg\ P_2O_5\ ha^{-1}$. More than 95 % values of soil available phosphorus differences lied within the limits of agreement which in this case are -4.503 and

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Major Advisor : Dr. K.N. Das

+4.503 kg ha⁻¹. Thus, the pedotransfer model can be accepted as it also did not show any bias between the two methods calculated by Bland-Altman approach.

The P fractions in the soils were evaluated using standard method. The results revealed that the sequential occurrence of various inorganic P fractions followed the order: Fe-P > Al-P > Organic-P > Residual-P > Ca-P > Saloid-P. The order of partial contribution of inorganic P fractions towards total inorganic P was Fe-P > Al-P > Res-P > Ca-P > Saloid-P. Bray's-I P showed highly significant positive correlation with OC (r=0.956**), pH (r= 0.532**), CEC (r= 0.800**), clay (r=0.790**) and significant negative correlation Al_d (r= -0.599**), Fe_d (r= -0.682**).

Step wise multiple regression analysis indicated that the highest contribution was imparted by Al-P (22.9%) towards available P while addition of Fe-P, saloid P, organic P, and Ca-P contributed 34.5 per cent towards available P. Inclusion of residual P changed the contribution to 35.0 per cent.

From the foregoing discussion, it is concluded that the pedotransfer model can be accepted as because there was no bias between the two methods which is a pre-requisite according to Bland- Altman approach for both the methods to be in close agreement.

Hydro-physical characteristics of soils of Jorhat district under paddy cultivation

Mridupawan Saikia

The study on “Hydro-Physical Characteristics of soils of Jorhat District under Paddy cultivation” was carried out with the objective (1) To evaluate physical characteristics of soils of Jorhat district under paddy cultivation and (2) To generate information on soil water relationships in soils of Jorhat district under paddy cultivation. Soil samples were collected from Titabor, representing Humid Alluvial Flood Free Zone (HAFFZ), Baghchung, representing Humid Alluvial Flood Prone zone (HAFFZ) and Nimatighat, representing Char areas (CA) of Jorhat district. From each agro-ecological zones representative samples (both disturbed and core) were collected from two (2) locations and in each location from two land situations *viz.* lowland and medium land and at each land situation from three depths *viz.* 0-15, 15-30 and 30-45cm. Soil samples are analyzed for determination of pH, organic carbon (O.C.), particle size distribution, texture, bulk density (BD), particle density (PD), porosity, maximum water holding capacity (MWHC), volume expansion (VE), saturated hydraulic conductivity (SHC), infiltration, aggregates of different size, mean weight diameter (MWD) and soil moisture retention following standard procedures as outlined by Baruah and Barthakur (A Textbook of Soil Analysis). pH, O.C., BD and PD values ranged from 4.57 to 6.86, 0.65 to 2.06 %, 1.30 to 1.42 Mg m⁻³ and 2.31 to 2.60 Mg m⁻³ respectively. Porosity, MWHC and VE values ranged from 33.93 to 43.27 %, 29.13 to 44.37 % and 5.03 to 10.78 m³ m⁻³, respectively. Hydraulic properties such as SHC and Infiltration values varied from 2.55 to 5.88 mm h⁻¹ and 7.19 to 16.97 mm h⁻¹, respectively. MWD values ranged from 0.49 to 3.15 mm within 0-45 cm depth in all the ecological zones. The sand (0.642**) and silt (0.436**) showed positive and clay (-0.750**) showed negative significant correlation with SHC. MWD showed significant negative and positive correlation with silt (-0.345*) and clay (0.408*) respectively while O.C. showed a significant negative correlation with B.D. (-0.648**). The soil moisture retention was increased as the clay content increased. Sand content of the soils had significant negative correlation with moisture retentions at different suctions *viz.* 0.3 bar (-0.77**), 0.5 bar (-0.707**), 1 bar (-0.716**), 5 bar (-0.554**) and 15 bar (-0.586**) suctions. The silt content had significant negative

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Department : Soil Science

Major Advisor : Dr. D. Bhattacharyya

correlation (-0.529**) with moisture retention at 15 bar suction while the clay content had significant positive correlation with moisture retention at 0.3 bar (0.722**), 0.5 bar (0.707**), 1 bar (0.622**), 5 bar (0.582**) and 15 bar (0.771**) suctions, respectively. Available water content of Titabor, Baghchung and Nimatighat are 21.11 and 22.32 per cent, 21.51 and 23.42 per cent and 23.72 and 20.56 per cent for both lowland and medium-land situations, respectively. The Profile Water Storage capacity of HAFFZ for both lowland and medium land situation are 20.11 and 20.66 cm m^{-0.45} respectively. For both the land situations water storage capacity remained almost similar. For CA and HAFPZ the storage capacity ranged from 19.97 to 23.55 cm m^{-0.45}. In Pedotransfer Functions the exponent for p-è relationship decreased and exponent for K-è increased as the depth increased. The findings of this study leads to the conclusion that the water storage capacity of the paddy soils of Jorhat district was high irrespective of land situations a second crop can be cultivated in these soils without irrigation immediately after harvesting of paddy. The functional relationships of soil water suction (p) and hydraulic conductivity (k) with soil water content (è) developed for the paddy soils of Jorhat district can be utilized for large can planning of efficient use of available water resources of the area. In this regard, value for exponent of water (è) for p-è and K-è relationship determined in this study for the paddy growing soils of HAFFZ, HAFPZ and CA of Jorhat district may be utilized for undertaking future research for crop efficient use of available water resources

Effect of Long term Herbicide Application in Rice-Rice System on Population Dynamics of Soil Microbes, Enzyme Activity and Soil Carbon Stock

Poran Kishore Dutta

The study on the “Effect of Long term Herbicide Application in Rice-Rice system on Population dynamics of Soil Microbes, Enzyme Activity and Soil Carbon Stock” was conducted during 27th and 28th crop cycle in the year 2015-2016 which forms a part of the long term trial under AICRP on Weed Management that was established during 2001 at ICR farm of Assam Agricultural University. The experiment was laid out in randomized block design replicating three times with five treatments *viz.*, Farmers Practice (One Hand Weeding); Butachlor + 2,4-D (100% NPK through chemical fertilizer); Butachlor + 2,4-D (75% NPK through chemical fertilizer, 25% through Organic source); Butachlor + 2,4-D rotated with Pretilachlor (100% NPK through chemical fertilizer); Butachlor + 2,4-D rotated with Pretilachlor (75% NPK through chemical fertilizer, 25% through Organic source). Biological parameters were analysed from surface soils collected periodically at 0, 7, 14, 30, 60 days after application of the herbicide in both autumn and winter rice. In the present study, herbicide application resulted in inhibition of beneficial microbes *viz.*, *Azotobacter* and phosphate solubilising bacteria up to 14 days after which it increased. Application of organic manure along with herbicide could lessen the toxic effect of the herbicide on the microbial population. Soil enzyme activities showed diverse trends following herbicide application. The phosphatase enzyme was significantly reduced following herbicide application upto 14 days while it has positive effect on dehydrogenase activity and the effect was more prominent by organic manure application. Urease activity in soil recorded no characteristic trend due to herbicide application during both autumn and winter rice. Highest enzyme activities were recorded in treatments where organic matters have been applied. The soil respiration was inhibited following herbicide application upto 14 days during both the autumn and winter rice. Highest significant microbial biomass carbon was recorded in the treatment where organic matter was applied. The physico-chemical properties *viz.*, bulk density, porosity,

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Department : Soil Science

Major Advisor : Dr. Kaberi Mahanta

water holding capacity, mean weight diameter, pH, available nitrogen, phosphorus and potassium and organic carbon were determined from surface soil samples collected after the harvest of both autumn and winter rice. Long term application of farmyard manure has improved soil physical properties like bulk density, porosity and water holding capacity except the mean weight diameter. The organic carbon content of the soil increased significantly due to organic manure addition. Available nitrogen, phosphorus and potassium content of the soil was recorded in the medium range with highest available nitrogen, phosphorus and potassium content recorded in the treatment receiving rotation of pre-emergence herbicide with organic matter application in both autumn and winter rice. Carbon stock was recorded to be higher in the treatments receiving organic manure. The use of herbicide along-with organic manure significantly increased the nutrient uptake in both autumn and winter rice. Application of herbicide with organic manure significantly increased the grain yield in both the crops. Highest grain yield 39.14 qha⁻¹ and 41.92 qha⁻¹ in autumn and winter rice respectively has been recorded in treatment receiving rotation of pre-emergence herbicide and where 25% nitrogen is substituted through organic manure.

Soil Carbon, Nitrogen and Microbial status in Humid Alluvial Flood free zone of Jorhat District under Different Land Use

Sushil Kumar Nishad

The study on “Soil Carbon, Nitrogen and Microbial status in Humid Alluvial Flood free zone of Jorhat District under Different Land Use.” was carried out with the objectives 1) To evaluate soil carbon (C) and nitrogen (N) status and microbial biomass carbon (MBC) and nitrogen (MBN) under different land use and 2) To determine the amount and distribution of different **forms** of N under different land use. Soil sample was collected from three depths *viz.*, 0-15 cm, 15-30 cm and 30-45 cm and from three locations under each land use type *viz.* tea, bamboo and rice. The MBC and MBN were determined by Chloroforma Fumigation Direct Extraction (CFDE) method (Vance, 1987). Forms of nitrogen *viz.* total hydrolysable nitrogen (THN), hydrolysable ammonium nitrogen (HAN), ammonium amino-sugar nitrogen (AASN) and amino acid nitrogen (AAN) was determined by diffusion method (Bremner, 1965). Wide variation was observed in physico-chemical characteristics of the soils under tea, bamboo and rice cultivation. The texture, pH, organic carbon, CEC and Av. N, Av. P, Av. K, bulk density (BD), particle density (PD), and porosity of the soils ranged from sandy loam to clay, 4.74 to 5.69, 0.26 to 0.99 per cent, 6.2 to 9.26 cmol (p⁺) kg⁻¹, 175.61 to 234.15 kg ha⁻¹, 13.03 to 31.2 kg ha⁻¹, 32.37 to 187.74 kg ha⁻¹, 1.30 to 1.43g cm⁻³, 2.59 to 2.67 g cm⁻³, 48.18 to 50.43 per cent, respectively. Organic carbon (0.99 per cent) and MBC (461.26 µgg⁻¹) were highest in soils under bamboo plantation. Nitrogen status *viz.*, Av N (229.97 kg ha⁻¹) and TN (0.056 %) was the highest in bamboo soil. The MBN (74.43 µg g⁻¹) was the highest in soils under bamboo. The OC, MBC and MBN decreased with increasing soil depth in all land use types. However, the TN and Av. N were decreasing with increase in soil depth irrespective of land use. The TN, THN, HAN, AASN and AAN found to be the highest in soils under bamboo plantation (0.056 %, 245.77 ppm, 183.55 ppm, 169.22 ppm and 148.33 ppm, respectively) and lowest in soils under rice cultivation (0.042%, 112.83 ppm, 147.55 ppm, 148.22 ppm and 145.88 respectively). In Tea soil OC content of the soils had significant positive correlation with CEC (0.374**), Av. N (0.330*) and Av. K

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Department : Soil Science

Major Advisor : Dr. D. Bhattacharyya

(0.812**) and the Av. N was correlated positively with OC (0.330*). However, in bamboo plantation OC had significant positive correlation with CEC (0.374*), Av. N (0.330*), Av. K (0.812**), of soils. In rice soils the OC content had significant correlation with CEC (0.507*), Av. N (0.330*), Av. K (0.812**), MBC (0.531**). The TN content of soil under rice cultivation was correlated significantly and positively with CEC (0.880**), MBC (0.768*) and MBN (0.847**) of the soils. The TN of the soils was found to have significant positive correlation with AAN (0.702**), the THN significantly correlated with HAN (0.667**), AASN (0.708**) and AAN (0.412*) and the HAN was significantly correlated with AASN (0.508**) only. The findings of the present investigation lead to the conclusion that in Humid Alluvial Flood Free zone of Jorhat district, the three land use type *viz.* tea, bamboo and paddy had significant effect on C, N and MBC and MBN status of the soils. The change in C and N status as well as MBC and MBN lead to change in soil physical and chemical properties which is supported by the existence of significant correlation of OC, N, MBC and MBN with important soil physico-chemical characteristic. A significant relationship was also observed between forms of nitrogen and the OC content of the soils under these LUTs. The OC accumulation is the highest in bamboo plantation which leads to higher content of all forms of N in these soils and reverse is the trend in soils under rice cultivation.

Effect of certain ITKs used in tea plantation for management of tea pests with special reference to red spider mite

Kapil Kumar Bhuyan

An investigation entitled “Effect of certain ITKs used in tea plantation for management of tea pests with special reference to red spider mite” was carried out at Deha Tea Estate, Jorhat as well as in the Department of Tea Husbandry and Technology, Assam Agricultural University, Jorhat during 2015-2016. A survey was also conducted on Indigenous Technical Knowledge (ITK) of pest management prevalent among the small tea growers of different districts of Assam. Mosaic of ITKs appeared from the tea growers practices and many of them may serve as an input for valid scientific investigation for large scale use in tea pest management. Fish extract in combination with cow dung, cow urine and water when sprayed at 1:100 dilution significantly reduced red spider mite population, percentage of leaves and leaf area infested by red spider mite. Percentage of shoots infested by tea mosquito bug was also reduced by this combination. *Polygonum hydropiper* in combination with cow urine and water when sprayed at 15:200 dilution significantly reduced red spider mite population, percentage of leaves and leaf area infested by red spider mite. Percentage of shoots infested by tea mosquito bug was also reduced by this combination. Both Fish extract and *Polygonum hydropiper* extract combinations were found to increase plucking point density and yield of tea. Among all ITKs, Fish extract 1:100 caused higher reduction of infestation of red spider mite and tea mosquito bug followed by *Polygonum hydropiper* extract 15:200. Influence of both the treatments on management of red spider mite and tea mosquito bug was at par with that of Azadirachtin (5%).

In laboratory condition, highest reduction in hatchability of eggs of red spider mite was achieved by Fish extract 1:100 followed by *Polygonum hydropiper* extract 15:200 in both the periods of study. Both Fish extract 1:100 and *Polygonum hydropiper* extract 15:200 caused significant mortality on nymphs of red spider mite. The potency of both Fish extract 1:100 and *Polygonum hydropiper* extract 15:200 were observed on adult mortality of red spider mite upto the extent of 81-85%. The study revealed that few ITKs are quite effective to manage red spider mite and tea mosquito bug.

Abstract of M. Sc. Thesis

Department : Tea Husbandry and Technology

Major Advisor : Dr. G. K. Saikia

Study on Variability of Soil Nutrients and Moisture Status under Tea based Cropping with Arecanut

Madhuja Bikash Borah

Tea is the most popular, refreshing and healthy beverage throughout the world because of its caffeine content, characteristic aroma and flavanols produced from the shoots of the commercially cultivated tea plants [*Camellia sinensis* (L.) O. Kuntze].

For this purpose field experiment with factorial RBD was conducted with spacing, depth and spacing x depth interaction in tea based cropping (arecanut) and tea grown as monocrop (conventional shade) in Experimental Garden for Plantation crops, Department of Tea Husbandry and Technology, Assam Agricultural University, Jorhat, Assam during 2015. Soil nutrient and soil moisture status variability with spacing and depth was studied in tea based cropping with arecanut and tea grown as monocrop.

Soil samples were collected for tea-arecanut cropping system at different spacing viz. 30 cm (S1), 60 cm (S2), 90 cm (S3) and 120 cm (S4) and depth ranging from (0-30, 30-60, 90-120 cm) from arecanut to tea crop at four different depth on each spacing viz. 0-30 cm (D1), 30-60 cm (D2), 60-90 cm (D3), 90-120 cm (D4). Similar samples were collected from tea grown as monocrop with conventional shade viz. 30 cm (s1), 60 cm (s2), 90 cm (s3) and 120 cm (s4) and depth ranging from (0-30, 30-60, 90-120 cm) from *Albizia* spp. to tea crop at four different depth on each spacing viz. 0-30 cm (d1), 30-60 cm (d2), 60-90 cm (d3), 90-120 cm (4).

The observations from the analysis revealed Bulk density (BD) showed a uniform increasing trend with increasing depth whereas percentage porosity, pH, organic carbon, available N, available P_2O_5 , available K_2O decreased with increase in soil depth for tea-arecanut and tea grown as monocrop. The values of physico-chemical properties are found to be highest in 30 and 60 cm spacing in both the cropping systems

Soil moisture studies revealed that soil moisture is positively correlated with clay and negative correlation existed with porosity, pH, organic carbon, available N, available P_2O_5 , available K_2O in both tea-arecanut and tea grown as monocrop.

The quality attributes of tea grown as monocrop system viz. plucking point density, number of pruning sticks, thickness of pruning sticks were found to be higher than that of tea-arecanut cropping system however the latter cropping system provides an additional output of arecanut when compared to the former ones.

Abstract of M. Sc. Thesis

Department : Tea Husbandry and Technology

Major Advisor : Dr. M. Deka

Morphological and biochemical assessment of tea [*Camellia sinensis* (L) O. Kuntze] germplasm maintained in the Field Gene Bank of AAU

Shelika Chakma

Tea (*Camellia* spp.) is one of the most important plantation crops of India. At present three basic types *viz.* China, Assam and Cambod or their hybrids are cultivated. Tea plant is cross pollinated plant, it forms a variety of the tea germplasm constantly in the long-term breeding process. Since morphological characteristics are influenced by environmental factors exhibiting a continuous variation and a high degree of plasticity, difficulties arise in the identification of discrete taxonomic groups. Biochemical characters may be used to assess variability for the efficient management and proper utilization of germplasm in the breeding programmes. Therefore, identification and screening of excellent tea germplasm become particularly important. Collection and conservation of germplasm is gaining importance all over the world with the objective of preserving and utilizing the genetic resources in the on going or future plant improvement.

In the present investigation, an effort was made to characterize and estimate the variation of 20 tea germplasm (coded as THT 001 to THT 020) growing in the Experimental Garden for Plantation Crops, AAU, Jorhat on the basis of physiological, morphological and biochemical characters. Three types of tea indigenous to the geographical regions of South-East Asia *viz.* China, Assam and Cambod types were considered as standards.

Numerical taxonomic studies were carried out using various morphological, physiological and biochemical characters adopting both dimensional method and using morphological descriptors as per recommendation of the International Plant Genetic Resources Institute (IPGRI) Rome, Italy (1997).

The correlation similarity co-efficient matrix value utilizing physiological and morphological characters has been found to range between 0.961 to 1.000 indicating low degree of variation whereas for the biochemical characters, it has been found to range between 0.000 to 1.000 indicating high degree of variation among the germplasm. The

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Department : Tea Husbandry and Technology

Major Advisor : Dr. S. C. Barua

lowest similarity value for morphological characters was observed between THT 005, THT 006 and THT 014, whereas highest similarity value could be found between THT 001 and THT 004, THT 003 and THT 007 and THT 018 and THT 020. In case of biochemical characters, lowest similarity value was observed between THT 014 and THT 020, whereas highest similarity value was observed between THT 001 and THT 014, THT 005 and THT 017 and between THT 012 and THT 015.

Cluster analysis using morphological and biochemical characters of the germplasm studied have been produced two dendrogram showing five clusters in each. Few germplasm have been found to formed a discriminate cluster. This indicates that the characters studied are influenced by environment and show continuous variation and hence may not be adequate enough to discriminate these germplasm even if they are genetically different.

Characterization of some popular tea cultivars under moisture stress condition

Shyamal Kumar Phukon

Tea requires a moderately hot and humid climate. Tea grows in a variety of climate conditions and has very wide ecological amplitude. Climate influences yield, crop distribution and quality. Tea plant is affected by both excess and shortage of water. The average annual rainfall in North East India ranges from 2000-4000 mm. However, more than the total amount, it is the distribution of rainfall that matters most for sustained high yield of tea throughout the season. In the cold weather, the rainfall is either insufficient or absent in a number of tea growing areas to meet the evapo-transpirational demands. Therefore the present study was undertaken, which could be an aid to screening cultivars capable of performing well under moisture stress (droughty) conditions.

In the study, responses of some physiological, biochemical and water related parameters to drought stress were studied in few selected popular tea cultivars which included eleven clones and four bicultural seed stocks. All the cultivars were grown in pots and the experiment was laid in factorial 2CRD with two treatments *viz.* normal condition and moisture stress condition. Observations were made in 7 days interval for Relative Leaf Water Content (RLWC), Water Saturation Deficit (WSD), Leaf Water Potential (LWP), Photosynthesis, Stomatal Conductance, Intercellular CO₂ Concentration, Transpiration Rate, Total Chlorophyll and Proline Content.

The results of the study revealed that drought stress caused a gradual decline in RLWC, LWP, photosynthesis, stomatal conductance, transpiration and total leaf chlorophyll but increase in WSD and Proline. The intercellular CO₂ was varying with the induction of drought stress. Among the cultivars TV23, TV25 and TS520 showed a high degree of tolerance to drought followed by TV1, TV9, TV17, TV19, TV20, TV22, TS462, TS463, whereas TV21, S₃A₃ and Teenali 17/1/54 showed a high degree of susceptibility to drought stress.

For detailed anatomical study of the cultivars reaction to drought stress, six cultivars were selected for Scanning Electron Microscope (SEM) studies which included TV23, TV25 and TS520 as drought tolerant and Teenali 17/1/54, TV21 and TS463 as drought susceptible based upon the above mentioned studies.

Abstract of M. Sc. Thesis

Department : Tea Husbandry and Technology

Major Advisor : Dr. R. P. Bhuyan

Impact of climate change on tea productivity- A case study in undivided Sivasagar district

Supriya Sonowal

The impact of climate change has stood as a barrier in tea production. Tea production in Assam region has decline in recent year, although the area under tea cultivation has risen. Taking into consideration the impact of climate change on tea production, a economic study was conducted in undivided Sivasagar district (*viz.* Sivasagar, Jorhat and Golaghat). To select the samples for the study, a random sampling technique was followed. A sample of 15 tea estates were selected from undivided Sivasagar district and five tea estates were selected from each district. Keeping in view the main objectives of the study, both primary and secondary data have been collected and used for the study from published and unpublished sources for the duration of 1986-2015. The data were categorized into two periods *i.e.* Period I (1986-2000) and Period II (2001-2015). Area, production and productivity data were collected from the tea estates of each district for the duration of 1986-2015 and the long term weather data were collected from the both Meteorological observatory of Tocklai Tea Reasearch Institute and Assam Agricultural University, Jorhat. Under the long term weather data, the climatic parameters like temperature, rainfall, sunshine, evaporation and relative humidity were taken for the research study. The study revealed that the variability of different climatic parameters indicated that rainfall, maximum temperature, BSSH and evaporation were higher in the Period II in comparison with the Period I. In case of the climatic parameters minimum temperature, relative humidity were less variable in the Period II. The compound annual growth rate of production in Sivasagar and Golaghat district were higher in the Period I, but it was less in Jorhat district in that period. In all the periods the compound annual growth rates were significantly positive in all the districts. In case of production Sivasagar and Golaghat district had showed lower variability in the Period II and Jorhat district had higher variability during the period. The climatic parameters, maximum temperature and relative humidity were found to have significant positive effect on productivity of tea in Sivasagar district, but the minimum temperature and evaporation had negative effect without significance in the Period I. In case of Period II, there was no significant effect of climatic parameters on productivity of tea. The climatic parameters, maximum temperature and relative humidity were found to have significant positive effect on productivity of tea in Sivasagar district, but the minimum temperature and evaporation had negative effect without significance in the Period I. In case of Period II, there was no significant effect of climatic parameters on productivity of tea.

Abstract of M. Sc. Thesis

Department : Tea Husbandry and Technology

Major Advisor : Dr. I. P. Sahewalla

Involvement of Rural Women in Poultry Farming

Bondipa Dutta

The present research study entitled the “Involvement of rural women in poultry farming” was carried out in Jorhat district of Assam. The objectives of the study were 1. To study the personal and socio-economic characteristics of rural women. 2. To explore the extent of participation of rural women in different activities of poultry farming. 3. To study the decision making pattern of rural women in different activities of poultry farming. 4. To identify the problems faced by the rural women in poultry farming. From the selected district 2 (two) block was selected from which 6 (six) villages were selected for the research study. Thus total numbers of respondent were 120. Data were collected with the help of interview schedule. Statistical technique *viz.*, frequency, percentage, mean, standard deviation and co-efficient correlation were used for analysing the data. The study revealed that 45.84 per cent respondents were of lower middle age group, had nuclear (48.33%) and small family (49.17%) and 35.83 per cent educated up to middle school. Majority (82.50%) were married, 87.50 per cent belonged to OBC category, farming was the main occupation for 37.50 per cent of respondents with marginal land holding (88.33%) and ownership was in the name of husband (64.16%) and 40.83 per cent did not have membership in any organization. A large majority (79.17%) of respondent reared poultry for both commercial and household purpose, 66.66 per cent had small sized poultry, 66.67 per cent contacted with friends and neighbours sometimes for getting any poultry related information. Only 1.67 per cent maintained records of poultry farming that too sometimes. Findings further showed that respondents spent average 5 hours 40 minutes time in household activities followed by 3 hours in poultry farming activities and majority (80.00%) had medium level of knowledge on scientific rearing of poultry. Data revealed that majority of the respondents were performed independently in different regular activities such as feeding and watering (63.33%), closing the bird in the poultry shed (62.50%), cleaning and maintaining of poultry shed (60.83%), collection of eggs (60.00%), keeping the eggs for hatching (58.33%), culling (58.33%), selection of poultry bird for breeding (57.50%) and marketing activities such as selling of eggs (48.33%), selling of poultry birds (46.67%) and fixing the price of produce (45.00%). Data also revealed that

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Department : Extension and Communication Management, (H.Sc)

Major Advisor : Dr. (Mrs) Manoshi Baruah Deka

independent decision was taken by the respondents in different regular activities such as feeding and watering (66.67 %), closing the bird in the poultry shed (65.84%), collection of eggs (63.34%), cleaning and maintaining of poultry shed (63.33%), culling (61.67%), keeping the eggs for hatching (61.67%) and selection of poultry bird for breeding (60.83%) and marketing activities such as place of selling (58.33%), number of chicks to be sold (53.34%), number of eggs to be sold (53.34%), number of birds to be sold (51.67%), purchasing of poultry (50.83%) and number of eggs and poultry for household use (50.83%). Findings showed that sudden outbreak of disease was ranked as first and most important problem faced by the respondent followed by lack of training. Findings also showed positive and significant relationship between selected independent variables such as education, organizational membership, land holding, material possession and purpose of rearing with knowledge of rural women on scientific rearing of poultry.

Role Performance of Women Teachers of Selected Educational Institutes of Assam in Household Activities

Dorjee Dema Khumu

The present study entitled “Role Performance of Women Teachers of selected Educational Institutes of Assam in Household Activities” was undertaken with the following objectives: 1. To study the profile of the respondents. 2. To ascertain the role performed by the respondents in household activities. 3. To explore the factors affecting the performance of respondents in household activities. The study was conducted in Jorhat district of Assam. Married Women teachers having children with minimum five years experience were selected from ten (10) high schools, (five Government high school and five Private high school) thus the total respondents were 120 women teachers. Data were collected with the help of questionnaire. Statistical techniques viz., frequency, percentage, mean and coefficient correlation were used for analyzing the data. The study revealed that majority of respondents (54.17 per cent) were belonged to 31-40 years, 61.00 per cent were graduate, and majority of the respondents (62.50 per cent) were belonged to nuclear family, and cent per cent respondents had one-two children. Majority of (91.00 per cent) respondents were belonged to Hindu religion, 43.00 percent of respondents had 5-10 years job experience. Majority of respondents 69.00 per cent were not member of any organization. Findings revealed that majority of respondents sometimes involved in purchasing of food items, medicine, appliances and equipment etc. Majority of respondents always involved in cleaning, sweeping, washing and dusting house. Most of the respondents never pay water bills, cable bills and municipality tax. Large majority (96.60 per cent) of respondents regularly involved in washing cloths, 95.00 per cent in cleaning utensils. Majority of respondents (89.17 per cent) regularly teach their children about good habits, majority (65.90) per cent and 46.00 per cent of respondents regularly help elderly to take medicine, cook special food items for elderly. Majority of respondents expressed lack of provision of transportation facilities, computer with printer facility, non-availability of teaching aids and proper security at school. Women teachers were mostly performed religious function at home. There were great criticisms about engaging

Abstract of M. Sc. Thesis

Department : Extension and Communication Management, (H.Sc)

Major Advisor : Dr. (Mrs) Minerva Saikia Baruah

male members in the household activities. Most of the teachers were poor in management of time. There was positive and significant relationship between educational qualification, and factors affecting the performance of respondents in household activities at school. And also negative and highly significant relationship was found between age of children and factors affecting the performance of respondents in household activities at home.

Opinion of outstate students about Assam Agricultural University

Joram Ashu

The present investigation was conducted to study the “Opinion of outstate students’ about Assam Agricultural University” with the objectives to find out the profile of the respondents, to find out the opinion of the respondents about functioning Assam Agricultural University and to explore the suggestion from the respondents for strengthening the functioning of Assam Agricultural University. The study was conducted in Assam Agricultural University, Jorhat campus. College of Agriculture and College of Home Science were purposively selected for the present study. The respondents were selected from both under graduate and post graduate classes. Barring the first year students a total 210 out state students were found, from which ten students were excluded for pre-testing. Thus a total of 200 out state students were the population of the present study. The data were collected through a structured questionnaire prepared by the researcher. Collected data were analyzed by applying frequency, percentage, mean and standard deviation. The findings of the study revealed that a sizable percentage (46.00%) of the respondents belonged to age group 18-22 years and 51.50 per cent of the respondents were female. Majority (78.00%) of the respondents were from North East region and large percentages (66.00%) of the respondents were from to B.Sc. degree programme. A sizable percentage of the respondents (56.00%) belonged to Hinduism religion and a sizable percentage (32.50%) of the respondents passed their time by listening to music. Majority (80.50%) of the respondents after completion of the study would like to do Government Job and a large percentage (67.00%) of the respondents head of family were engaged in government service. Large percentage (71.00 %) of the respondents belonged to nuclear family and a sizable percentage 32.00 per cent of the respondents family income between rupees thirty six thousand one to fifty thousand and a sizable (54.00%) percentage of the respondents parents were graduated. The findings revealed that overall functioning of Assam Agricultural University, a large percentage (70.50%) of the respondents had favourable opinion. It is encouraging to know that a sizable percentage (17.50%) of the respondents also showed high favourable opinion followed by

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Department : Extension and Communication Management, (H.Sc)

Major Advisor : Dr. Daisy Hazarika

small percentage (12.00%) showed unfavourable opinion. This findings clearly shows that the AAU functioning measured by students community is satisfactory probably this is the reason why more and more students from out state particularly North-East region come to join for various courses offered in AAU. It is observed from the ranking of findings of the present study that statements agreed by the respondents were 'the office staffs help us to clarify the doubts whenever it is needed', 'Supporting staffs are friendly and courteous', 'Lighting facility provided in the library is satisfactory', 'Good lighting facility in the hostel room gives better learning environment' and 'Post office facilities provided within the campus is satisfactory'. Large percentage (73.50%) of the respondents had suggested that the fee structure for out state students should be reduced, majority percentage (87.00%) of the respondents suggested that teachers should use English and Hindi language for better understanding of the subjects and should not use regional language, the majority (81.50%) of the respondents suggested that printer should be provided in library on payment basis and majority (83.00%) of the respondents suggested that to provide more street light in the campus. Age and class of the respondents showed positively high significant relationship with opinion regarding administrative, hostel and surrounding environment, opinion regarding functioning of academic environment age and class showed positive significance. There was no significant relationship regarding the functioning of library with the selected variables.

Buying Behaviour of Consumer in Online Shopping

Manorama Devi

The present study on “Buying behaviour of consumer in online shopping” was undertaken with the following objectives- (1) To study the factors influencing consumers for online shopping. (2) To study the consumer decision making process in online shopping. (3) To identify the category of population inclined for online shopping. (4) To study the category of products preferred by consumers to buy online.

A multistage purposive cum random sampling method was adopted to carry out the study. Jorhat Municipality area was considered from which four wards were selected randomly. From each of the wards, by following the probability proportionate to size method the samples were selected purposively and a total of 120 respondents were selected for the study. Interview method was used for data collection.

The findings of the personal and socio-economic characteristics of the respondents showed that majority of the respondents (74.17%) belonged to the age group in between 21-30 years. Majorities (53.33%) of the respondents were female and 49.17 per cent of the respondents were educated up to graduation. Majority of the respondents (62.5%) were students. Majority of the respondents (46.67%) belonged to the families earning Rs. 50,001 and above monthly.

It is evident that majority of the respondents involved in online shopping were female, wealthier and from younger age group. In case of background information regarding online shopping, 42.5 per cent of the respondents were found to be using internet from last 2-3 years for online shopping. Majority of the respondents (80.83%) were found to be using laptop as a device for online shopping and 49.17 per cent of the respondents often purchase through online.

Among all the products available in the online shopping site, majority of the respondents (80.33%) purchased clothes through online. Majority of the respondents (89.16 %) collected information by going through the reviews of the customer. Highest number of respondents (66.66%) considered price while comparing products for online shopping. Majority of the respondents were found to be taking individual decision for online shopping

Abstract of M. Sc. Thesis

Department : Family Resource Management, (H.Sc)

Major Advisor : Dr. Leena Das

With regard to the factors influencing consumer for online shopping, cash on delivery was ranked first. This was followed by website design/ feature as an influential factor for online shopping.

Majority of the respondents (65%) showed average online shopping behaviour. Age was found to be negatively correlated with online shopping behaviour and education and income were found to be positively correlated with online shopping behaviour.

Lighting, color preferences and color perception – a study at residential units

Mayur Rani Devi

Light and color are integral part of every residential interior. The present study was carried out to study the lighting, color preferences and color perception of house wives/ female respondents of residential units. A sample size of 60 female respondents from residential units was selected by purposive cum random sampling procedure from Jorhat district of Assam. The main objectives of the study were a) To assess the natural light and artificial light sources used in selected activity areas. b) To find out color preferences of respondents as applied to selected areas. c) To determine awareness of respondents on role of surface reflectance in enhancing lighting performance in interior space. d) To evaluate the visual perception of color under day light and in changing luminous conditions. Data were gathered by interview cum observation method. An awareness scale was developed to determine awareness of the respondents on the role of surface reflectance in enhancing lighting performance in interior space. To evaluate the visual perception of color under day light and in changing luminous conditions, an integrative experiment was carried out in three well controlled artificial luminous conditions for selected colors i.e. Yellow, blue and red.

Finding pertaining to color preferred and applied in selected activity areas reflected that majority of respondents preferred and used off white color in walls of both living rooms (75%) and kitchens (81%). Maximum respondents (70%) preferred and used off white colour in floors of living room while in kitchen 60% preferred and used brown colour in floors. In both living room furniture (80%) and kitchen cabinets (46.6%), respondents mostly preferred and used brown colour. Awareness of the respondents on the role of surface reflectance in enhancing lighting performance in interior space was found to be average. Employed and highly educated female respondents had high awareness on the role of surface reflectance in enhancing lighting performance in interior space. Data pertaining to visual perception of respondents in respect to three colours showed that colour perception of respondents vary under different luminous conditions. Analyses of data revealed that significant positive relationship existed between education ($r=0.80^{**}$), occupation ($r=0.60^{**}$) and awareness level of the respondents on the role of surface reflectance in enhancing lighting performance in interior space. This study can be useful for color consultants, interior architects, designers and lighting designers who use light in order to create different atmospheres in a space. The results also may concern the researchers who study color, and its effects on human perception.

Abstract of M. Sc. Thesis

Department : Family Resource Management, (H.Sc)

Major Advisor : Dr. Ruplekha Borah

Stress and Work ability of workers engaged in different occupations

Pubali Saikia

Prevalent work related stress and reduced work ability of workers lead to different problems at work, results in low productivity, impaired health and safety of workers and sometimes early retirement. Therefore, improving work ability is one of the most effective ways to enhance the ability and preventing disability and early retirement. Keeping this in view a study was conducted on 60 workers engaged in two selected sectors of occupations (30 respondents from bank and 30 respondents from hospital) were selected purposively based on the criteria from the selected district of Assam namely Jorhat with the following objectives- 1. To study the work Ability Index (WAI) among the workers engaged in different occupations. 2. To ascertain the factors affecting work ability among the selected workers. 3. To suggest measures to improve work ability in selected sectors of occupation. Data were gathered by interview method. The workers engaged in both the service sectors i.e.; bank and hospital, were exposed to different work stressors-aspects of work and work environment which lead to reduced work ability. The aspects of work were studied with the help of a 5 point rating scale. Analyses of work aspects revealed that presence of mental load is more in bank than hospital and in hospital, physical effort is more as compared to bank. Work ability index was used to study the work ability of workers. Work ability index (WAI) of workers engaged in selected service sectors i.e., bank and hospital was found as good and moderate respectively. Very less percentage of workers had excellent work ability index. Work related musculoskeletal problems were prevalent among the workers. The cervical pain was found very common among the workers engaged in bank and in hospital the workers were found to have back pains along with shoulder, wrist, and leg pains. The study indicated that those who have more number of pains in their body have lower work ability than those who have less pain. Analyses of data revealed that significant negative relationship existed between age, BMI, work related stress and WAI. So it could be concluded that there is a relationship between WAI with variables age, BMI and work related stress. Preventive measures for improving work ability were compiled. In the process of compilation of preventive measures, relevant people in selected service sectors, the workers, and the literatures were consulted.

Abstract of M. Sc. Thesis

Department : Family Resource Management, (H.Sc)

Major Advisor : Dr. Nandita Bhattacharyya

Assessment of microbiological attributes of commercially available ice creams in Jorhat town

Arundhati Mishra

The present investigation entitled Assessment of microbiological attributes of commercially available ice creams in Jorhat Town was under taken with specific objective to assess the microbiological quality of ice cream samples. Twenty seven ice cream samples of three different flavour namely (vanilla, strawberry, chocolate) were purchased from street vendors, departmental store and ice cream parlour, out of which twelve samples were locally produced, six samples collected were industrially produced (packaged) and nine samples were industrially produced (scooped) ice cream. The hand swab of ice cream sellers hand and air counts around the vended ice cream shops as well as of the parlours and departmental stores were also collected for microbiological analysis. The microbiological assay of the collected samples was conducted following the standard protocols and methodologies to test the presence of *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli* and Fungus. The confirmation and characterization of the isolates was done using morphological and molecular characterization test using standards protocols. The total viable count of microorganisms isolated from scooped vanilla ice cream samples sold by vendors from different areas of Jorhat showed positive growth of *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli* and Fungus. The presence of *Escherichia coli* was highest in all the samples and ranged from $(220 \times 10^3 \pm 11.31 \times 10^3 \text{ cfu/gm})$ to $(277 \times 10^3 \pm 12.02 \times 10^3 \text{ cfu/gm})$ followed by *Staphylococcus aureus* ($218 \times 10^3 \pm 12.02 \times 10^3 \text{ cfu/gm}$ to $242 \times 10^3 \pm 12.72 \times 10^3 \text{ cfu/gm}$), Fungus ($43 \times 10^3 \pm 9.89 \times 10^3 \text{ cfu/gm}$ to $58 \times 10^3 \pm 18.38 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($40 \times 10^3 \pm 14.14 \times 10^3 \text{ cfu/gm}$ to $54 \times 10^3 \pm 16.97 \times 10^3 \text{ cfu/gm}$). Similarly, the scoop strawberry and chocolate flavoured ice cream samples also showed a similar trend. The total viable count of *E. coli* ranged from $(226 \times 10^3 \pm 4.24 \times 10^3 \text{ cfu/gm})$ to $(281 \times 10^3 \pm 9.91 \times 10^3 \text{ cfu/gm})$ and $(230 \times 10^3 \pm 1.14 \times 10^3 \text{ cfu/gm})$ to $(287 \times 10^3 \pm 4.94 \times 10^3 \text{ cfu/gm})$ in strawberry and chocolate flavoured ice cream. *Staphylococcus aureus* ranged from $(223 \times 10^3 \pm 9.19 \times 10^3 \text{ cfu/gm})$ to $(264 \times 10^3 \pm 5.65 \times 10^3 \text{ cfu/gm})$ and $(228 \times 10^3 \pm 5.65 \times 10^3 \text{ cfu/gm})$ to $(257 \times 10^3 \pm 2.12 \times 10^3 \text{ cfu/gm})$ and *Bacillus cereus* ranged from $(45 \times 10^3 \pm 5.35 \times 10^3 \text{ cfu/gm})$ to $(55 \times 10^3 \pm 3.53 \times 10^3 \text{ cfu/gm})$

Abstract of M. Sc. Thesis

Department : Food Science and Nutrition (H.Sc)

Major Advisor : Dr. Mamoni Das

cfu/gm) and $(48 \times 10^3 \pm 4.14 \times 10^3 \text{ cfu/gm})$ to $(58 \times 10^3 \pm 7.77 \times 10^3 \text{ cfu/gm})$ in strawberry and chocolate flavoured respectively. The fungal growth of both the flavoured ice cream ranged from $(51 \times 10^3 \pm 8.48 \text{ to } 66 \times 10^3 \pm 12.72 \text{ cfu/gm})$ and $(56 \times 10^3 \pm 7.07 \times 10^3 \text{ to } 67 \times 10^3 \pm 12.02 \times 10^3 \text{ cfu/gm})$, respectively. Microbiological profile of industrially produced (packaged) ice cream samples sold by Departmental store of Jorhat revealed that the vanilla flavoured ice cream of Rollicks was highly contaminated with *E. coli* ($228 \times 10^3 \pm 8.48 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($54 \times 10^3 \pm 18.38 \times 10^3 \text{ cfu/gm}$), Fungus ($65 \times 10^3 \pm 24.74 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($44 \times 10^3 \pm 14.44 \times 10^3 \text{ cfu/gm}$). Similarly in strawberry and chocolate flavoured ice creams, the growth of *E. coli* was highest ($225 \times 10^3 \pm 10.60 \times 10^3 \text{ cfu/gm}$ and $232 \times 10^3 \pm 5.65 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($70 \times 10^3 \pm 21.22 \times 10^3 \text{ cfu/gm}$ and $76 \times 10^3 \pm 16.97 \times 10^3 \text{ cfu/gm}$), Fungus ($58 \times 10^3 \pm 15.55 \times 10^3 \text{ cfu/gm}$ and $62 \times 10^3 \pm 12.72 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($48 \times 10^3 \pm 11.31 \times 10^3 \text{ cfu/gm}$ and $53 \times 10^3 \pm 7.77 \times 10^3 \text{ cfu/gm}$), respectively. Vanilla flavoured ice cream of Creambell was highly contaminated with *E. coli* ($230 \times 10^3 \pm 14.44 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aereus* ($79 \times 10^3 \pm 28.99 \times 10^3 \text{ cfu/gm}$), Fungus ($64 \times 10^3 \pm 8.48 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($49 \times 10^3 \pm 14.84 \times 10^3 \text{ cfu/gm}$). Similarly in strawberry and chocolate flavoured ice creams of creambell also showed highest growth of *E. coli* ($230 \times 10^3 \pm 14.44 \times 10^3 \text{ cfu/gm}$, $233 \times 10^3 \pm 12.02 \times 10^3 \text{ cfu/gm}$ and $240 \times 10^3 \pm 7.0 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($79 \times 10^3 \pm 28.99 \times 10^3 \text{ cfu/gm}$, $80 \times 10^3 \pm 28.28 \times 10^3 \text{ cfu/gm}$, and $94 \times 10^3 \pm 18.38 \times 10^3 \text{ cfu/gm}$), Fungus ($60 \times 10^3 \pm 8.99 \times 10^3 \text{ cfu/gm}$, $64 \times 10^3 \pm 8.48 \times 10^3 \text{ cfu/gm}$, and $68 \times 10^3 \pm 18.38 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($49 \times 10^3 \pm 14.84 \times 10^3 \text{ cfu/gm}$, $51 \times 10^3 \pm 13.43 \times 10^3 \text{ cfu/gm}$, and $65 \times 10^3 \pm 3.53 \times 10^3 \text{ cfu/gm}$), respectively. Similarly microbiological profile of industrially produced (scooped) ice cream namely Rollick, Kwaliti and Creambell sold by different ice cream parlours namely Amul parlour, Scoop parlour and Chill point revealed that all the brands of industrially produced Scoop ice creams showed highest growth *Escherichia coli* followed by *Staphylococcus aureus*, Fungus and *Bacillus cereus*. The vanilla flavoured (scooped) Rollicks ice cream sold in Amul parlour of Jorhat showed highest growth of *E. coli* ($224 \times 10^3 \pm 11.31 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($216 \times 10^3 \pm 9.89 \times 10^3 \text{ cfu/gm}$), Fungus ($57 \times 10^3 \pm 10.60 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($44 \times 10^3 \pm 16.97 \times 10^3 \text{ cfu/gm}$). Similarly, in strawberry and chocolate flavoured ice creams, the growth of *E. coli* was highest ($227 \times 10^3 \pm 9.91 \times 10^3 \text{ cfu/gm}$ and $237 \times 10^3 \pm 2.12 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($222 \times 10^3 \pm 5.65 \times 10^3 \text{ cfu/gm}$ and $225 \times 10^3 \pm 3.53 \times 10^3 \text{ cfu/gm}$), fungus ($58 \times 10^3 \pm 9.89 \times 10^3 \text{ cfu/gm}$ and $68 \times 10^3 \pm 2.82 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($49 \times 10^3 \pm 13.33 \times 10^3 \text{ cfu/gm}$ and $57 \times 10^3 \pm 7.77 \times 10^3 \text{ cfu/gm}$), respectively. Similarly, vanilla flavoured Kwaliti ice cream (scoop) sold in Scoop parlour of Jorhat was highly contaminated with *E. coli* ($221 \times 10^3 \pm 10.60 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($84 \times 10^3 \pm 39.59 \times 10^3 \text{ cfu/gm}$), Fungus ($77 \times 10^3 \pm 27.57 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($53 \times 10^3 \pm 23.23 \times 10^3 \text{ cfu/gm}$). In strawberry and chocolate flavoured ice cream the growth of *E. coli* was highest ($226 \times 10^3 \pm 7.07 \times 10^3 \text{ cfu/gm}$ and $228 \times 10^3 \pm 5.65 \times 10^3 \text{ cfu/gm}$) followed by *Staphylococcus aureus* ($88 \times 10^3 \pm 36.76 \times 10^3 \text{ cfu/gm}$ and $102 \times 10^3 \pm 26.87 \times 10^3 \text{ cfu/gm}$), fungus ($81 \times 10^3 \pm 21.21 \times 10^3 \text{ cfu/gm}$ and $88 \times 10^3 \pm 19.79 \times 10^3 \text{ cfu/gm}$) and *Bacillus cereus* ($56 \times 10^3 \pm 13.33 \times 10^3$

cfu/gm and $60 \times 10^3 \pm 18.38 \times 10^3$ cfu/gm), respectively. The vanilla flavoured Creambell ice cream (scooped) sold in Chill point parlour of Jorhat was highly contaminated with *E. coli* ($237 \times 10^3 \pm 9.91 \times 10^3$ cfu/gm) followed by *Staphylococcus aureus* ($218 \times 10^3 \pm 8.48 \times 10^3$ cfu/gm), Fungus ($88 \times 10^3 \pm 29.69 \times 10^3$ cfu/gm) and *Bacillus cereus* ($56 \times 10^3 \pm 21.21 \times 10^3$ cfu/gm). In strawberry and chocolate flavoured ice cream the growth of *E. coli* was highest ($241 \times 10^3 \pm 6.36 \times 10^3$ cfu/gm and $245 \times 10^3 \pm 3.53 \times 10^3$ cfu/gm) followed by *Staphylococcus aureus* ($224 \times 10^3 \pm 4.24 \times 10^3$ cfu/gm and $227 \times 10^3 \pm 2.21 \times 10^3$ cfu/gm), fungus ($97 \times 10^3 \pm 23.33 \times 10^3$ cfu/gm and $103 \times 10^3 \pm 19.09 \times 10^3$ cfu/gm) and *Bacillus cereus* ($62 \times 10^3 \pm 16.97 \times 10^3$ cfu/gm and $64 \times 10^3 \pm 15.55 \times 10^3$ cfu/gm), respectively. From the study it was observed that among the different flavoured ice creams, chocolate flavoured ice cream irrespective of brands and types (scoop/packaged) showed highest contamination of *E. coli* followed by *Staphylococcus aureus*, Fungus and *Bacillus cereus*. Among the different industrially produced ice cream (packaged) the total viable count of *E. coli* was highest in all the flavoured creambell ice cream when compared with Rollick. From the different industrially produced ice cream (scooped) the total viable count of *E. coli* was highest in all the flavoured creambell ice cream when compared with Rollick and kwality. Comparison of microbiological profile of ice cream samples from different sources with Food Safety Standard Specification (FSSAI) revealed that 100% of the local scooped ice cream, industrially produced packaged and industrially produced scooped had highest growth of *E. coli* and *Staphylococcus aureus* which was above the prescribed limit of FSSAI where as the total viable count of fungus and *Bacillus cereus* were within the prescribed limit. Hand swab analysis revealed that the total viable count of microorganisms present in the seller's hands irrespective of sources was high when compared with Bureau of Indian Standard (BIS) specification (d'' 100 cfu/gm). The total microbial count of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and Fungus of air in different ice cream unit were showed positive growth. Morphological test confirmed the presence of *S. aureus*, *B. cereus* and *E. coli* were confirmed by Gram staining. *S. aureus* appeared as gram positive bacteria with Cocci in grape-like clusters under microscope *B. cereus* appeared as large gram positive bacilli in short to long chain; spores are ellipsoidal, centre to sub terminal and do not swell sporangium and

E. coli as gram negative small red coloured rods under the microscope. Presence of *Penicillium* appeared as single chain celled conidia, divergents or columns, hyaline or greenish, smooth or rough walled. Biochemical test confirmed the presence of *Staphylococcus aureus* by Carbohydrate fermentation test (mannitol). *Bacillus cereus* by Lactose gelatine test and Gelatine liquefaction test. The presence of *E. coli* by using KB001 HiLMViC™ kit. Molecular characterization of isolated Organisms revealed that *S. aureus* have 96 to 97%, *Baccillus cereus* have 99% similarity, *E. coli* have 98% similarity with other known isolates of the same species. *Penicillium* also had 96 to 98% similarity with other known isolates of the same species.

Food safety of street vended foods in Jorhat town, Assam

Chandrama Baruah

The present investigation entitled “Food safety of street vended foods in Jorhat town, Assam” was undertaken with specific objective to assess the handling and vending practices of the street food vendors and microbiological analysis of food samples which involves more handling during preparation and serving namely *Panipuri*, *Chanachur*, *Aloo chaat* and *Papri chaat*. Fifty four street food vendors were randomly selected from four sites namely- Baruah Chariali, Garali, A.T. Road and K.B. Road for interview to elicit information on their handling, vending practices and food safety knowledge and attitude. All the street food vendors operating in Jorhat town were male with 51.00 per cent belong to the age group of 35-45 years. It was observed that 81.48 per cent of the selected vending stalls were mobile and 68.51 per cent of the selected street food vendors had open vending stalls. Cent per cent of the selected street food vendors were registered under FSSAI provided by Office of Joint Directorate of Health Services, Jorhat and none of them acquire any training on food safety. 39.66 per cent of the selected street food vendors sold *Panipuri* followed by *Chanachur* (24.14%), fast foods like *Roll*, *Fried rice*, *Momo* (15.52%), *Chaat* (10.34%), *Platters* (3.44%) and *Tea*, *Ice-cream* (6.9%). Street food vendors of Garali attended the highest number (125) of customers per day and vendors of K.B. Road attended the least i.e. 55 numbers per day. Regarding the source of water used for food preparation it was observed that 42.59 per cent of the selected street food vendors use river water followed by 31.48 per cent who uses tube well water and 25.93 per cent use water supplied by municipality. 79.63 per cent of the selected street food vendors brought pre prepared food to the stall for sale and 20.37 per cent of the vendors reheat the food before serving which mainly depends on the type of food sold by the vendors. Moreover, 72.22 per cent of the vendors had dirty preparation surfaces. Cent per cent of the selected vendors use cold soapy water kept in tub for washing utensils followed by rinsing in plain water. Vending practices of the selected street food vendors revealed that 79.63 per cent of the vendors served food with bare hands. The most commonly used serving material was found to be newsprint paper (70.70%).

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Department : Food Science and Nutrition (H.Sc)

Major Advisor : Dr. Ruma Bhattacharyya

Regarding use of leftover foods, 33.33 per cent of the selected street food vendors use the leftovers in the next day while 62.96 per cent had no leftover at all and 3.71 per cent throw it. Cent per cent of the selected street food vendors do not wear hand gloves, apron, hair cover and only 26.7 per cent of the vendors have short and clean nails. The toilet habits of the selected street food vendors were unsatisfactory as none of them wash their hands with soap after using toilets. It was also found out that 22.22 per cent of the selected street food vendors wash hands with water after each serving of food while 77.78 percent do not wash hands with water rather wipe out with hand towels. The surroundings of 85.20 per cent of the selected vending sites were found to be dirty i.e. exposed refuse dumps, solid waste, domestic animals, rodents and insects, drainage systems etc. Disposable bins were used by 18.5 per cent of the selected street food vendors to dispose of the waste generated during food preparation and remaining 81.5 per cent do not have waste disposable bins. The overall knowledge and attitude of the selected street food vendors on food safety highlighted that 50.00 and 59.26 per cent of the selected street food vendors respectively had poor knowledge and attitude on food safety. 44.44 and 37.04 per cent had average knowledge and attitude and only 5.56 and 3.70 per cent of the vendors had good knowledge and attitude on food safety respectively. No significant relationship was found between the age of the selected street food vendor and their food safety knowledge and attitude ($r = -0.280$ and -0.253). Whereas, educational level of the selected street food vendors is significantly related to their food safety knowledge and attitude ($r = 0.912$ and 0.905). Microbiological assay revealed high microbial loads in all the collected samples viz., *Panipuri*, *Chanachur*, *Aloo chaat* and *Papri chaat*. *B. cereus* was found in all the samples with a mean load range from 52×10^3 to 191×10^3 cfu g^{-1} or ml^{-1} . *E. coli* and *Salmonella* spp. were highest in hand and utensil swab. Highest population of *C. perfringens* (590×10^3 cfu g^{-1} or ml^{-1}) was found in *Panipuri* whereas *S. aureus* population (93×10^3 cfu g^{-1} or ml^{-1}) was isolated from *Chanachur*. Unhygienic food handling practices, lack of proper personal hygiene and environmental hygiene may be the cause for such a high bacterial load.

Development of value added products from Bael (*Aegle marmelos* Correa)

Gayatri Sharma

The present investigation was undertaken with an aim to develop value added products from bael fruit and to study the physico-chemical, sensory and storage quality of the products. A series of laboratory experiments were carried out to find the nutritional properties of the bael and its value added products. The bael fruit is round and spherical in shape, greenish yellow in fruit colour with light yellow pulp, having 218.33±54.84 g fruit weight, 76.13±12.18 g rind weight, 125 ± 25.00 g pulp weight and 12.84 ± 4.35 g seed weight. Total soluble solid was 12.2 %°Brix and pH was 4.8. It was found that the bael fruit contains moisture 71.09±0.35%, carbohydrate 24.97±0.11 g/100g, protein 1.49 ± 0.10 g/100g, crude fat 0.25 ± 0.02 g/100g, crude fibre 1.08 ± 0.02 g/100g, total mineral 1.12 ± 0.07 g/100g, iron 0.93 ± 0.01 mg/100g and calcium 101.68 ± 0.84 mg/100g. Three value added products of bael fruit namely bael powder, bael jam and bael RTS with two variation each i.e. mature green and ripe powder, high and low sugar ratio jam and RTS with 10% and 15% TSS were standardized and developed by using standard procedure. Sensory evaluation of the products was done through 9 point Hedonic scale by 10 panel members. Ripe powder, high sugar jam and 15% RTS were found better in overall acceptability and were selected for further analysis. Further the physico-chemical characteristics of the selected products were studied. Physico-chemical characteristics of bael powder (4.2 pH, 0.18% acidity and 8.62 mg vitamin C), jam (4.55 pH, 72% TSS, 0.51% acidity and 22.80 mg vitamin C) and RTS (3.95 pH, 20% TSS, 0.62% acidity and 18.20 mg vitamin C) was recorded. Also colour characteristics of the products was observed for powder (L*- 66.22, a*- 15.76, b*- 31.15), jam (L*- 35.60, a*- 10.42, b*- 15.93) and RTS (L* 29.12, a* 4.55, b*- 7.14). Bael powder was also analyzed for its proximate composition and antioxidant activities and results showed that it contains moisture 2.97 ± 0.85%, carbohydrate 79.64 ± 0.52 g/100g, protein 6.56 ± 0.75 g/100g, crude fat 1.10 ± 0.18 g/100g, crude fibre 4.78 ± 0.27 g/100g, total mineral 4.95 ± 0.04 g/100g, iron 4.11 ± 1.06 mg/100g and calcium 446 ± 0.04 mg/100g. The DPPH free radical scavenging activities (% inhibition) in bael powder was 72.07%. Physical observation and sensory evaluation of

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Department : Food Science and Nutrition (H.Sc)

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products across storage shown that jam and RTS were acceptable upto 30 days and 15 days of storage respectively whereas powder remained almost of same characteristics. Microbial studies revealed that jam and RTS were safe for consumption upto 30 days and 15 days of storage respectively. On the other hand, powder can be stored upto 60 days without any marked growth of microorganisms. So from the present study it can be concluded that bael fruit has high nutritional as well as medicinal value and also have unlimited potential in its processed form.

Physico-chemical and functional properties of proso millet (*Panicum milliaceum* L.)

Papori Bora

The present study entitled “Physico-chemical and functional properties of proso millet (*Panicum miliaceum* L.) was undertaken to assess the physical characteristics, functional properties, chemical composition and its impact on plasma lipid in proso millet samples collected from Gosaigaon, Kokrajhar district of Assam. Proso millet samples were milled to obtain dehusked and polished grains and powdered to flour to evaluate its quality.

The physical characteristics of proso millet grains in terms of size revealed that milling significantly reduced the grain sizes. Length got reduced from 2.99 mm in whole grain to 2.18 mm in dehusked grain and 2.00 mm in polished grain. Similarly breadth got reduced from 1.98 mm in whole grain to 1.86mm in dehusked grain and 1.56 mm in polished grain. Thickness got reduced from 1.41 mm in whole grain to 1.04 mm in dehusked grain and 1.00 mm in polished grain. For the colour of grains mean L* (lightness) and b* (yellowness) value were highest in polished grain (63.04 and 25.17) followed by dehusked grain (62.14 and 24.46) and whole grain (56.37 and 18.46), respectively. Mean a* (redness) value was found to be highest in whole grain (4.18) than in dehusked grain (1.93) and polished grain (0.79). Whole grain possessed significantly highest weight (4.94 g/1000 grains) and volume (6.64 ml/1000 grains), than dehusked (4.23 g and 5.0 ml/1000 grains) and polished (4.24 g and 4.9 ml/1000 grains) grains. No significant difference was found in bulk density of whole grain and dehusked grain, but polished grain (0.89 g/ml) showed significantly highest bulk density than both whole (0.80 g/ml) and polished grains (0.80 g/ml).

The nutrient composition of proso millet showed that whole grain contained 8.31% moisture, 3.20% ash, 13.67% protein, 3.96% fat, 6.14% crude fibre, 64.90% carbohydrate and 348.29 kcal/100g energy. Dehusked proso millet contained 8.95% moisture, 1.46% ash, 14.69% protein, 5.32% fat, 0.21% crude fibre, 69.42% carbohydrate and 383.78 kcal/100g energy whereas polished grain contained 10.05% moisture, 1.19% ash, 13.94% protein, 2.57% fat, 0.07% crude fibre, 72.15% carbohydrate and 367.51 kcal/100g energy. The amylose content of proso millet was 5.50% in whole grain, 6.00 in dehusked grain and 6.60 in polished grain. The amylopectin content were 94.50% in whole, 94.00% in dehusked and 93.40% in polished grains.

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Department : Food Science and Nutrition (H.Sc)

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The total phenolic content was present significantly higher amounts in whole (164.46 mg GAE/100g) and dehusked (145.81 mg GAE/100g) grains than polished grain (69.37 mg GAE/100g). Phytate content was highest in dehusked grain (682.50 mg/100g) than whole (574.74 mg/100g) and polished (194.00 mg/100g) grain. Whole grain possessed significantly highest total antioxidant capacity (281.79 mg TE/100g) than dehusked (156.93 mg TE/100g) and polished (144.94 mg TE/100g) grains.

Functional properties indicated that water absorption capacity was highest in whole grain flour compared to dehusked (102.54 g/100g) and polished grain flours (93.65 g/100g). The oil absorption capacity was 152.63 g/100g in whole grain flour, 104.30 g/100g in dehusked grain flour and 100.17 g/100g in polished flour. Bulk density was highest in polished grain flour (0.775 g/ml), followed by dehusked (0.712 g/ml) and whole (0.691 g/ml) grain flours.

The results of impact of supplementation of proso millet based diets (both whole and dehusked) on plasma lipid profile of experimental rats showed significant improvements in plasma high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, total cholesterol and triglycerides level after maintaining a 28 days of feeding period, in comparison to the group feed with only high fat diet (HFD). The overall increase in mean and percent total cholesterol and LDL- cholesterol level in rats fed with HFD ranged from 12.15 mg/dl (16.15%) to 88.50 mg/dl (117.61%) and 11.04 mg/dl (23.98%) to 56.02 mg/dl (121.68%), respectively as the days progressed from 7 to 28 days. Whereas HDL-cholesterol level decreased from 0.44 mg/dl (2.74%) to 3.88 mg/dl (23.95%) from 7 to 28 days. Plasma triglyceride (TG) level showed non-significant change. The overall increase in mean and percent HDL-level in experimental rats fed with whole grain proso millet (WGPM) diet were 1.45 mg/dl (8.43%) in 10%, 3.94 mg/dl (24.67%) in 20% and 6.11 mg/dl (37.39%) in 40% and with dehusked proso millet (DPM) diet were 0.44 mg/dl (2.55%) in 10%, 1.32 mg/dl (8.26%) in 20% and 3.86 mg/dl (22.41%) in 40% incorporation into HFD in comparison to HFD control group at the end of intervention period of 28 days. It was observed that LDL-level gradually increased in all the experimental groups, but in comparison to HFD control group, it was seen that all the test diet treated groups had lesser extent of increase and found that overall mean and percent increase in LDL-cholesterol in supplementation with proso millet at 10%, 20% and 40% dietary level were 45.90 mg/dl (98.90%), 40.94 mg/dl (90.43%) and 33.70 mg/dl (74.52%) in WGPM and 51.05 mg/dl (109.74%),

48.20 mg/dl (106.42%) and 45.17 mg/dl (98.73%) in DPM, respectively which were lower than the percent elevation of LDL- cholesterol level observed in HFD group at the end of intervention period. In proso millet supplementation at 10%, 20% and 40% dietary level along with HFD possessed mean and percent increase in total cholesterol level as 78.04 mg/dl (103.34%), 73.09 mg/dl (96.37%) and 67.15 mg/dl (88.88%) in WGPM diet and 85.10 mg/dl (114.06%), 81.81 mg/dl (108.20%) and 78.67 mg/dl (103.79) in DPM diet, which were also lower than the elevation of total plasma total cholesterol level produced by HFD control group at the end of intervention period. The overall mean and percent decrease in plasma triglycerides level in experimental rats fed with whole grain proso millet with HFD were 4.03 mg/dl (4.16%) in 10%, 8.64 mg/dl (12.08%) in 20% and 14.53 mg/dl (17.16%) in

40% incorporation whereas in experimental rats fed with dehusked proso millet with HFD were 2.89 mg/dl (3.86%) in 10%, 5.78 mg/dl (6.08%) in 20% and 7.95mg/dl (12.07%) in 40% incorporation into HFD in comparison to the HFD control group, after maintaining for 28 days of intervention period. Therefore, it is evident from the present study that the proso millet is nutritious, healthy and versatile and hence would be a healthy addition to one's diet.

Effect of Colour on Attention and Memory of Young Children

Ankita Dutta

Most of the child psychologists pay greater attention to the pre-school age because it is the time when children undergo the greatest development. Learning in this period is critical to their subsequent development throughout their lives. Coloured presentation of information is considered by many studies as an important and stimulating cue for learning in children. Colour has the potential to increase the chances of environmental stimuli to be encoded, stored and retrieved successfully.

With this background the present study entitled, “Effect of colour on attention and memory of young children” was undertaken in Jorhat district during 2014-2016 with the objectives: 1. To analyze the frequently used colours in existing instructional materials of young children. 2. Preparation of instructional materials using different colours. 3. To identify the colours which facilitate attention and memory of young children. 4. To develop guidelines for using colours in instructional materials of children.

A total of 30 children aged 4 to 5 years, with average intelligence level and without any chronic illness, signs of inattention and impulsivity were selected for the study. The sample was selected from 180 respondents from six preschools of Jorhat district. Data was collected from the respondents using a questionnaire and a tool with subtests Prose Memory and Test Card to assess the health status of the respondents and identify the colours which facilitate attention and memory of young children respectively. Culture Fair Intelligence Test was also used to screen out the children with average intelligence. The books of four preschools were analyzed to find out the frequently used colours in existing instructional materials of young children.

Upon completion of data collection, the results indicated that the most frequently used colour in the existing preschool books is yellow, followed by red, green, blue, light blue, natural, black brown, purple, pink, orange and lastly grey. The results of the responses to colours in the Prose Memory sub-test reveal that natural colour may facilitate most attention and memory in young children, followed by red, green, blue, light blue, yellow and black.

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Department : Human Development and Family Studies (H.Sc)

Major Advisor : Dr. Juri Baruah

Test Card results also reveal that natural colour may facilitate most attention and memory in young children, but followed by red, green, yellow, blue, light blue and black. Females responded more to colours of red and yellow than male respondents. And males responded more to green, blue, light blue and natural colours than females. There was no gender difference in response to black colour. On the basis of the findings of the study, few guidelines were recommended in the area of use of colour in instructional material for children

Work-Family Role Conflict among Working Women

Ms. Gitanjali Gualla

In our changing society, more and more women are entering into workforce outside home. Working women have to fulfill satisfactorily the unique duties of wife and motherhood along with her job responsibilities. Working mothers of today fulfil family responsibilities and also try to get fully involved in their careers. They have to perform multiple roles which result in work family conflict.

With this background the present study entitled, “Work-Family Role Conflict among Working Women” was undertaken in the Jorhat sub-division during 2014-2016 with the following objectives:

1. To find out the conflict areas in role performance of working women.
2. To study the effect of different professions on performance of multiple roles of women.
3. To find out association between type of profession and role conflict.

A total of 100 married working women were selected with the help of multi stage sampling. Respondents so selected were nurses, doctors, college teachers and bank employees according to profession. Data was collected from the respondents by using role conflict scale and an interview schedule for collecting background information and conflict areas in role performance of working women.

The findings of the study revealed that majority of working women had conflict in management of home, care of children, care of elderly, husband-wife relationship and maintenance of hobbies. It was also observed that significant association existed between different professions and management of home, care of children, care of elderly, husband-wife relationship, and maintenance of hobbies. A positive and significant association existed between type of profession and role conflict.

Abstract of M. Sc. Thesis

Department : Human Development and Family Studies (H.Sc)

Major Advisor : Dr. (Mrs) Minoti Phukan

A study on marital adjustment among working and non-working women

Sagarika Swain

Marriage is a very divine and pure thread which binds two souls together. Individual is a universe and marriage merge two universe and permits them to move parallel. Marital adjustment denotes emotional stability, intellectual efficiency and social effectiveness of people. Marriage is the key to whole some adjustment involvement and satisfaction. Marital adjustment seems complex than it may appear. Basically, in marriage, two persons adjust to each other's sensory, motor, emotional and intellectual capacities. In the process of married life adjustment plays an important role especially in the life of women. As a result of modernisation, globalisation, urbanisation, the present scenario of women has changed a lot as compared to few years back. Social changes have also improved the status of women. Education has brought revolutionary changes among women. More and more women prefer to be engaged in some kind of employment. A working woman has to perform two roles. Firstly, a mother as well as a housewife and secondly of an employee. Both the roles demand on her time and energy In case of non-working women, they are full time housewives. So they can manage their household activities according to their convenience. The employment of working women not only affects their entire personality but also their family relationship and is also liable to face crisis of adjustment which can result in depression. Therefore, marital adjustment is very important for getting a better married life.

With this background the present study entitled, "A study on marital adjustment of working and non-working women" was undertaken in Jagatsinghpur sub-division during 2014-2016 with the following objectives:

1. To study the marital adjustment of working women.
2. To study the marital adjustment of nonworking women.
3. To compare the marital adjustment of working and nonworking women.

The sample of the study comprised of 120 women, out of which 60 working and 60 non-working married women with children and having husband. Data were collected from the respondents by using a standardised scale named as marital adjustment questionnaire

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Department : Human Development and Family Studies (H.Sc)

Major Advisor : Dr. Mala Handique

developed by Dr. Promod Kumar and Dr. (Km.) Kanchana Rohatgi. The inventory had 25 items covering three aspects of marital adjustment namely sexual, social, emotional areas and a self structured questionnaire was also used for collecting background information of the respondents. The collected data were compiled, tabulated and analysed statistically.

The findings of the study revealed that majority of the respondents both working and non-working women had average level of marital adjustment in sexual, social and emotional areas. Along with that, the significant difference was found between working and non-working women in the areas social and emotional area excluding the sexual area.

Study on mixture of selected natural dyes on mulberry silk yarn

Gitanjali Boruah

The art of dyeing has played an important role in adding beauty to the textile. Dyeing is the art of imparting particular hues and tints to thread, fabric and other materials by employing coloring matters. Owing to environmental degradation and pollution caused due to synthetic dyes, people across the globe have turned their attention to natural dyes. Natural dyes are eco-friendly and aesthetically appealing, particularly obtained from renewable and eco-friendly sources. Natural dyes produce different shades which have soothing effect and also people feel a kind of satisfaction to remain with the nature, while using naturally dyed textile materials.

Recently the art of natural dyeing are becoming an important branch in fashion design. Considering the importance of natural dyes all over the world, the present investigation entitled “Study on mixture of selected natural dyes on mulberry silk yarn” was undertaken to assess the following objectives:

- To extract the colorant from the selected natural dyes
- To optimize and standardize dyeing condition of mix dyes
- To study the colour fastness properties of the dyed yarn
- To study the physical properties of the dyed yarn

To carry out the study, combination of henna leaves and bark of monkey jack were used as natural dyes to develop variety of harmonizing natural shades on mulberry silk yarn using alum, copper sulphate, ferrous sulphate and stannous chloride as mordants. The evaluation of colour fastness and physical properties for mordanted and dyed yarn were determined.

Different dye proportions selected for the study were (Monkey jack: Henna) 25:75, 50:50 and 75:25. Colour fastness was found to be influenced by all the mordants used in the study. Colour fastnesses of all the dyed samples were found to be satisfactory.

As regards physical properties of the dyed samples, maximum interaction effect was recorded in SnCl₂ mordanted henna dyed sample which showed the highest denier, tenacity

Abstract of M. Sc. Thesis

Department : Textiles and Apparel Designing (H.Sc.)

Major Advisor : Dr. Ava Rani Phukan

and elongation compared to rest of the treatments and combinations. From the study it was also observed that 75:25 proportions showed the highest O.D value and optimum physical properties than the other proportions.

Silk yarn dyed with mixture of bark of monkey jack and henna leaves were produced different shades of brown colour, beige as well as green colour.

Hence, from the study it can be concluded that mixture of bark of monkey jack and henna leaves could be used effectively for the colouring of mulberry silk yarn.

Study on combination of natural dyes on eri silk fabric

Saradi Jyotsna Gogoi

The rebirth of natural dyes as an alternative to the hazardous synthetic dyes has received a worldwide attention. This is virtually a global hunt for eco friendly dyes as they are non-toxic, biodegradable and safe. It produces mostly subtle or dull colour. Bright colours are generally not found in natural dyes, but one or two are exceptional. Therefore an attempt has been made to combine two natural dyes to get different shades of colour.

The present research work was carried out on, "Study on combination of natural dyes on eri silk fabric". With the following objectives:

1. To optimize the dyeing conditions of selected dye for eri silk fabric.
2. To optimize the dyeing conditions of combination of selected dye.
3. To evaluate the colour fastness properties of dyed fabric.
4. To study the physical properties of dyed fabric.

Two sources of natural dye namely tea (*camellia sinensis*) and annatto (*Bixa orellana*) were selected for the study. Different dyeing conditions such as extraction medium, extraction time, dye material concentration, dye ratio, dyeing time, mordant concentration, mordanting time, mordanting methods such as pre, simultaneous and post were optimized for tea leaves dye based on absorption of dye by the eri fabric. Combination dyeing was done with optimum dyeing conditions and different shades of brownish yellow and brownish orange colour e.g. straw, sepia, gold metallic, coyote, field drab, bistra, dark goldenrod, old gold, taupe, tuwny, amber, fulvous etc were obtained.

Combination dyeing was carried out with different dye ratios of tea and annatto e.g. 10:90, 20:80, 30:70,40:60,50:50and vice versa and dye ratio of 70:30 & 10:90 were selected for the study based on dye absorption of by the fabric.

A series of experiments were carried out to optimize the different dyeing conditions such as physical and colourfastness properties for (tea:annatto) 70:30 and 10:90 combination of selected dyes. The fastness properties of washing, crocking (dry and wet), pressing (dry and wet), perspiration (acidic and alkali) and sunlight of the dyed sample were rated fair to

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Department : Textiles and Apparel Designing (H.Sc.)

Major Advisor : Dr. Nabaneeta Gogoi

good. The tenacity and elongation of dyed fabric were decreased due to breakdown of inter molecular forces during dyeing and other processes. The thickness moisture regain and wicking height of dyed fabric were found to increase after dyeing and the count and thickness showed decreasing trend.

Hence, from the study it was found that, combination of natural dyes produced different shades of colour and being eco friendly can be effectively used for dyeing eri silk fabric, in turns it gives a new look to the fabric so as to help in product diversification.

Designing and construction of sari blouse for women

Suravi Konwar

Clothing is one of the primary needs of mankind like food and shelter. The dress of an individual is a kind of “sign language” that communicates a complex set of information and on which immediate impressions are formed. Fashion is more than just clothing; it reflects the wider spectrum of aesthetics, art and design trends in contemporary society. The growth of fashion around us including sari and sari blouse for different occasions, it becomes a potential field of research study. Considering the above points, the investigator selected a study on “Designing and construction of Sari blouse for women”. The main objectives of the study were to develop designs for sari blouse, to construct blouses out of suitable fabrics based on preferences and to assess the preference of respondents regarding the constructed blouses.

The collected designs were displayed in front of judges for their preferences. The selected five designs for each group through rank order were constructed out of suitable fabrics available in the local market of Jorhat town. After construction of blouses again the preferences were taken from the same judges for suitability of designs and other elements of blouses. In both the cases interview schedule was used to take the preferences. The responses of judges were analyzed in rank order and percentage. For bust size 80-84 cms, Design no. 1 secured first rank followed by Design 3, 4, 2 and 5 respectively as well as for 84-88 cms, Design no. 2 got secured first rank followed by Design no. 1, 5, 4 and 3 respectively. All the designs selected were constructed out of fashionable fabrics and accessories. The cost of each blouse was found out.

Abstract of M. Sc. Thesis

Department : Textiles and Apparel Designing (H.Sc.)

Major Advisor : Dr. Bulbul Baruah

Effects of different level of dietary protein on growth performance of stunted fingerlings of IMC in growout phase

Begum Rehena Parvin

The present study was conducted to measure the growth performance in terms of weight and length, feed conversion ratio, protein efficiency ratio of three Indian major carps *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* stunted fingerlings for period of 90 days. The stunted fingerlings were stocked in unmanured cement cisterns with 1m water level. Two hundred eighty eight stunted fingerlings of three Indian major carps were divided into four groups of seventy two fingerlings in each group. Each group was further sub divided into three replicates of having twenty four fingerlings of three different species. Four different diets (Dc, D1, D2 and D3) prepared with conventional feed ingredients having different levels of protein (30, 24, 36 and 42%) were fed to the four different groups (Tc, T1, T2 and T3) of stunted fingerlings, 30% protein level taken as a reference diet. Out of three different treatment, the best growth of fish was recorded in treatment group T2 (36% CP), which was significantly higher than the other two groups (24 % and 42% protein level). The feed conversion ratio was significantly higher in T2 (2.18) group fed with diet containing 36% crude protein than T1 and T3. However, the protein efficiency ratio was better in treatment group T1 (1.70). That ammonia- nitrogen concentration was significantly higher (0.28) in T3 group fed with diet containing 42% protein level. However, the temperature, pH and dissolved oxygen were not affected by the level of protein in the diet. These findings suggest that diet containing 36% crude protein appears to be sufficient for obtaining optimum growth in Indian major carps in unmanured pond condition.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Dipak Sarmah

Effect of High Stocking Density of Indian Major carps on Growth, Survival & Production in Polyculture System

Dhiren Nath

In fish culture stocking densities, species combinations, carrying capacity and intensity of management operation are important issues and stocking density often ensure the growth performances. This study tries to investigate the effects of some of the common stocking densities of Indian major carps fingerlings to the growth performances, survivability and total production with respect to varied stocking densities ranging between 10000 to 50000 fingerlings ha⁻¹ along with 5500 fingerlings ha⁻¹ as control, in eighteen cisterns of 0.003 ha each for a period of 90 days under standard conditions of polyculture system with probable impacts of other environmental criteria. It was observed that growth of all the species decreased with increase in stocking densities, with mean size of harvest recorded the highest in control group (167.77± 1.50 g) and the lowest in treatment V group (74.79± 1.46 g). Stocking density of 5500 fingerlings ha⁻¹ was significant (P<0.05) for growth and survivability and stocking density of 50000 fingerlings ha⁻¹ was significant (P<0.05) for total production. Similarly, specific growth rate (SGR) of control group (2.28± 0.01) was significantly (P<0.05) higher than the other groups and treatment V group had the lowest values (1.38± 0.03). The highest gross yield and net yield recorded was 3.08± 0.01 and 2.02± 0.01 ton ha⁻¹ at treatment V group and the lowest was 0.91± 0.01 and 0.78± 0.02 ton ha⁻¹ at control group, respectively and were found to have significant (P<0.05) effect on the different stocking densities. The mean temperature, transparency, pH, dissolved oxygen, carbon-di-oxide, total alkalinity and total ammonia nitrogen values recorded in the treatments were in the range of 29.40 – 31.36°C, 20.83 – 27.67 cm, 6.13 – 7.93, 2.60 – 4.70 mg l⁻¹, 1.27 – 1.97 mg l⁻¹, 65.83 – 74.67 mg l⁻¹ and 0.03 – 1.62 mg l⁻¹ respectively. The values of the water quality parameters such as temperature, transparency, pH, carbon dioxide and total alkalinity were not found to be significantly (P>0.05) differing in different stocking densities except in the case of dissolved oxygen and total ammonia nitrogen which was found to fluctuate significantly (P<0.05) in different stocking densities. This study suggests that managing ponds based on the stocking density in polyculture system, may be more important to overall production efficiency and alteration of desirable water quality parameters to increase the production.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Kamaleswar Kalita

Effects of Probiotics as supplemented feed on Growth Performance and Survival Rate of *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.)

Dipanjali Bora

The aim of the present study was to evaluate the effects of a commercial probiotic (BioSyn AQ™) on the growth performance, survivability, feed conversion, water quality, plankton production and total bacterial count. The experiment was conducted with two Indian major carps rohu (*Labeo rohita*, Ham.) and mrigal (*Cirrhinus mrigala*, Ham.) for a period of 90 days. One hundred ninety two fingerlings of each *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.) were divided into 4 groups (TR, TM, CR and CM) with 4 replicates in each. Two diets D₁ and D₂ were prepared with conventional feed ingredients. D₁ diet was without probiotic whereas D₂ diet was supplemented with probiotic. D₁ diet was fed to CR and CM whereas D₂ was fed to TR and TM groups. The results revealed that rohu and mrigal fingerlings showed maximum increase in weight gain (255.00±1.00 and 224.00±0.71 g), SGR (1.587±0.002 and 1.447±0.002), survivability (72.92±2.08 and 75.00±3.40%) and FCE (45.04±0.08 and 45.66±0.09%) whereas minimum in FCR value (2.220±0.004 and 2.190±0.009) in 0.2% probiotic fed diet. The plankton population and total bacterial count of the gut significantly (p<0.05) higher on feeding probiotic supplemented diet. Water quality parameters found better in cisterns reared with fishes fed with probiotic supplemented diet then the cisterns reared with fishes fed without probiotic supplemented diet. The results placed an important role in maintaining water quality parameters and plankton population as well as increase growth, survivability and feed conversion efficiency of rohu and mrigal fingerlings.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Krishna Kanta Tamuly

Nutritional Evaluation of *Ipomea aquatica* as non conventional Fish Feed ingredient on the Growth Performance of Indian Major Carp (IMC) Fingerling

Lila Kanta payun

A study was conducted to assess the possibility of substituting Mustard oil cake (MOC) with water spinach (*Ipomea aquatica*) in the diets of IMC fingerlings. Four iso-nitrogenous diets (25% Crude Protein) containing (i) 55% Ipomea (T-II), (ii) 60% Ipomea (T-III) and 65% Ipomea (T-IV) were prepared, keeping MOC based diet(T- I) as control for 90 days in cement cistern(2.5m×1.5m×1.75m). Fingerlings of *Catla catla* (11.33±1.15gm), *Labeo rohita* (10.33±0.57gm) and *Cirrhinus mrigala* (11.33±0.57 gm) were stocked at the ratio 4:3:3 with a combined stocking density of 1.5 fish per m⁻³. Stocked fishes were fed daily in the morning @ 4% of the body weight of the fish and the feed ration was adjusted at fortnightly sampling. Parameters pertaining to water quality were also done during fortnightly sampling and data were recorded. The growth of fish was comparatively good with diet containing 55% *Ipomea aquatica* (T-II) although no significant difference was observed with the reference diets (T-I). The fish fed with diets T-III and T-IV showed significant difference in growth with diets T-I and T-II. The SGR, FCR, PER values ranges between 2.16 & 2.38, 1.29 & 1.32 and 0.97 & 0.99 respectively. Statistical analysis showed that no significant difference exist for SGR and PER values among the treatments. However, the PER values for the diet containing 65% *Ipomea* (T-IV) is significantly different from the other treatments. The present experiment indicates that Mustard oil cake can be substituted with *Ipomea aquatica* in the diets of IMC fingerlings. The substitution may range between 55% and 65%, although the lower level of substitution may prove more meaningful in terms of growth and feed cost. Further, the cost analysis of the diets revealed that *Ipomea aquatica* based diets are much cheaper than MOC based diets. Thus, the *Ipomea aquatica* based diet can very well be used as fish feed ingredients of IMC fingerlings and this will reduce the production cost of carps.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Sushanta Borthakur

Effect of different Doses of pig dung on the growth performance of Indian Major Carps

Parag Mani Deka

To optimize the dosage of pig dung on the growth performance of Indian Major Carps, the effects of four different dosages of pig dung at the rate of 10000 kg $\text{ha}^{-1}\text{yr}^{-1}$, 15000 kg $\text{ha}^{-1}\text{yr}^{-1}$, 20000 kg $\text{ha}^{-1}\text{yr}^{-1}$ and 25000 kg $\text{ha}^{-1}\text{yr}^{-1}$, was carried out for a period of three months (July – October) at the College of Fisheries fish farm, keeping the stocking density at the constant rate of 8000 no. ha^{-1} at the ratio of 4:3:3. Earthen ponds were used in the experiment and depending on the pH value, liming was done at the rate of 500 kg $\text{ha}^{-1}\text{yr}^{-1}$, one third of which was applied initially and the rest in 11 equal installments monthly. After 7 days, pig dung was applied in each experimental ponds viz. T₁, T₂, T₃, and T₄, respectively. One third of pig dung was applied as 1st installment; remaining dung was divided in to 22 equal installments and was applied at 15 days interval. No supplemental feed or other fertilizers were used in study. After 10 days fishes were stocked and water quality parameters were monitored at weekly interval. Both qualitative and quantitative analysis of plankton and growth performance of the fishes was measured at fortnightly interval. Water temperature was within the tolerance limit of the carps during the experimental period. Free Carbon di-oxide was low in pig dung treated ponds, while in the control its values were significantly high. Other water quality parameters were in favourable range, except in case of T₄, where pig dung load was 25000 kg $\text{ha}^{-1}\text{yr}^{-1}$, the values of morning DO and Ammonia was higher. The results clearly indicated that in the indirect integration system of pig-fish farming, where fresh pig dung contains 0.61% nitrogen, 0.50% phosphate-phosphorus (PO₄-P), the dung load of 20000 kg $\text{ha}^{-1}\text{yr}^{-1}$ is optimum for satisfactory growth of Indian Major Carps, which yield on average production of 5354.00 kg $\text{ha}^{-1}\text{yr}^{-1}$. The study also indicates that under eco-climatic conditions of Raha locality more than 20000 kg $\text{ha}^{-1}\text{yr}^{-1}$ organic load in the form of fresh pig dung, deteriorate water quality, which will have negative effects on final production profile.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Krishna Kanta Tamuly

Prevalence of Helminthes Parasites in Bottom Dwelling Fishes of Kalong River

Sanjoy Tamuli

A study was conducted to record the prevalence and pathology of helminth parasites in bottom dwelling fishes of Kolong river, Nagaon, Assam from May 2014 to April 2015. Three species of bottom dwelling fishes viz. *Mastacembelus armatus*, *Notopterus notopterus* and *Wallago attu* was undertaken during the investigation. The study included to record the light, scanning electron microscopic morphology and histological study of the helminth parasite, its gross pathology and histopathology.

A total of 120 numbers of fishes were collected from seven different sampling centres located within Nagaon district. Examination by standard method revealed presence of a helminth parasites in the three bottom dwelling fish species under investigation. The per cent prevalence of the helminth parasite was found to be 96.67%, 87.58% and 70.00% in *M. armatus*, *N. notopterus* and *W. attu*, respectively.

Light microscopic morphological studies and histological studies on the helminth species recovered during the study confirmed to be *Isoparorchis hypselobagri*, Billet 1898. Ultrastructural study conducted on *I. hypselobagri* revealed surface morphological features for the first time hitherto unknown.

Tissue alteration in *I. hypselobagri* infection in the three bottom dwelling fish species, *M. armatus*, *N. notopterus* and *W. attu* was studied by gross pathology and histopathology revealed presence of cyst and black pigmentation in most of the internal organs of these fish species with mild cellular infiltration. A single parasite could be seen within each cyst.

An EDAX study was carried to reveal the elemental deposits at the parasite host tissue interface. A total of 7 element was recorded at the site of infection which included two heavy metals i.e., Hg and Al.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Binod Kalita

Effect of natural carotenoids on colour enhancement of selected indigenous ornamental fish *Colisa lalia* (Hamilton)

Soma Roy Prodhani

Fishes in general cannot synthesize carotenoid pigments within the body. As they ingest natural food organisms of the food web, the carotenoids contained therein are utilized to produce the specific carotenoids required to impart colour and pigments in the body of the fishes. Fishes reared in captive indoor condition for ornamental purposes with supplementary diets, unless are provided natural or synthetic carotenoids normally get faded and lose their aesthetic value. In this investigation carrot (*Daucus carota*) powder at the rate of 7.50 g, 15.00 g and 30.00 g 100 g⁻¹ was added to a 35 % protein containing supplementary feed and fed to acclimatized fish *Polycanthus lalius*. All the treatments for a period of 90 days indicated that they are significant ($p < 0.05$); however a linear progress in carotenoid accumulation had been observed with increase of the dosages of the ingredient. The positive response of the natural carotenoid in colour retaining and enhancement in *P. lalius* however requires further studies and standardize the dose, time, application modalities etc.

Abstract of M. F. Sc. Thesis

Department : Aquaculture

Major Advisor : Dr. Binod Kalita

Molecular evaluation of bull semen in relation to certain fertility amrkers

Dr. Indrani Borgohain

The present study was conducted for molecular evaluation of bull semen and to study its relationship with different semen characteristics. Fresh semen samples were collected from six breeding bulls. A total of six ejaculates were collected from each of six healthy breeding Jersey bulls at 4 days interval. Immediately after collection, the samples were subjected to physio-morphological and biomolecular evaluation. Percentage of Hypo-osmotic Swelling Test (HOST) positive spermatozoa and acrosome-intact sperms increased with an increase in initial sperm motility. Biochemical evaluation indicated that seminal plasma protein, sperm protein and sperm cholesterol concentration increased with higher motility. The protein profiling revealed the highest band intensity of a 25 kDa protein in both seminal plasma and sperm membrane of all the bulls. Whereas, proteins of 104-92 kDa molecular mass were absent in the bulls with initial sperm motility below 80 per cent in both seminal plasma and sperm membrane. Expression of Chaperonin Containing T-complex protein 1, subunit 8 (*CCT8*) gene was found to be negatively correlated with sperm motility, whereas the expression of Adenylate Kinase 1 (*AK1*) gene did not show any significant relationship with sperm motility.

Abstract of M. V. Sc. Thesis
Department : Animal Biotechnology
Major Advisor : Dr. Devojayoti Dutta

Effect of antioxidants on *In-vitro* maturation of vitrified Bovine oocytes

Dr. Joyshikh Sonowal

A total 717 'A+B' grade oocytes were collected by aspiration cum slicing techniques from 294 numbers of cattle ovaries obtained from abattoir within 1-2 hours of slaughter. A total 651 'A+B' grade immature oocytes were vitrified by two-step vitrification technique with combination of ethylene glycol and glycerol @ 7M concentration. Five hundred twenty eight numbers of normal vitrified-thawed bovine follicular oocytes were classified into 8 experimental groups consisting of 66 numbers of oocytes in each and conducted *in-vitro* maturation as vitrified control (without antioxidant) and supplemented with different concentration of Vitamin E (50µM, 100µM, 200µM) and vitamin C (50µM, 100µM, 200µM) and combination of vitamin E (100µM) + vitamin C (100µM) groups. Non-vitrified 66 numbers of oocytes were used for *in-vitro* maturation in media without supplementation that served as control media.

The rate of cumulus cells expansion and polar body formation was significantly ($P < 0.01$) higher in non-vitrified control (85.18 ± 2.57 and 65.38 ± 1.83 , respectively) group than vitrified (51.67 ± 1.94 and 30.26 ± 0.16 , respectively) control group of bovine follicular oocytes. The effect of addition of antioxidants *viz.* vitamin E and vitamin C in media at different concentrations (50µM, 100µM, 200µM) were studied separately. The rates of vitrified bovine follicular oocytes with cumulus cells expansion and polar body formation were 56.39 ± 3.49 , 69.95 ± 3.20 and 54.44 ± 4.73 per cent and 34.62 ± 1.83 , 56.23 ± 1.61 and 31.62 ± 4.50 per cent in medium supplemented with 50µM, 100µM and 200µM of vitamin E, respectively and 52.79 ± 1.39 , 71.19 ± 2.63 and 51.17 ± 3.59 , per cent and 33.56 ± 2.18 , 54.57 ± 1.69 and 30.43 ± 2.01 , per cent in medium supplemented with 50µM, 100µM and 200µM of vitamin C, respectively. The mean percentage of cumulus cells expansion and polar body formation was significantly ($P < 0.01$) higher in media supplemented with 100µM of vitamin E or vitamin C group than 50µM and 200µM of vitamin E or vitamin C groups and vitrified (without antioxidant) control group of oocytes. The rate of cumulus cells expansion and polar body formation of vitrified bovine follicular oocytes was significantly ($P < 0.01$) higher in group supplemented with combination of vitamin E + vitamin C @ 100µM of each (83.23 ± 3.00 and 61.25 ± 3.38 , respectively) than vitrified control (51.67 ± 1.94 and 30.26 ± 0.16 , respectively) group. While

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Department : Animal Biotechnology

Major Advisor : Dr. P. M. Barua

comparing the best concentration groups of all experimental groups, DMRT indicated that the mean percentage of cumulus cells expansion and polar body formation was significantly ($P < 0.01$) higher in combination of vitamin E @ 100 μM + vitamin C @ 100 μM group and non-vitrified (control) group than vitamin E @ 100 μM , vitamin C @ 100 μM groups. Vitrified control group was significantly ($P < 0.01$) lower than the other experimental groups.

The result of the present study showed that the rate of vitrified bovine follicular oocytes in respect of cumulus cells expansion and polar body formation was significantly ($P < 0.01$) higher when antioxidants like vitamin E @ 100 μM or vitamin C @ 100 μM were added as compared to vitrified (without antioxidant) control. Each of vitamin E (100 μM) and vitamin C (100 μM) supplemented in TCM-199 improved the rate of *in-vitro* maturation of vitrified bovine follicular oocytes. Vitamin E @ 100 μM + vitamin C @ 100 μM supplemented in TCM-199 showed the highest rate of *in-vitro* maturation of vitrified bovine follicular oocytes.

Characterization of *Clostridium perfringens* membrane vesicles and their immunogenic potential in mice

Dr. Nirab kumar Deuri

The present study was undertaken with a view to characterize as well as evaluate the immuno-protective potential of the Membrane Vesicles (MVs) of *Clostridium perfringens* Type 'A'. A total of five isolates of *C. perfringens* from the repository of Department of Microbiology, College of Veterinary Science, Khanapara, Guwahati were revived and reconfirmed based on gross morphology, staining characteristics and amplification of *16S rRNA* and *cpa* genes by polymerase chain reaction. One isolate of *C. perfringens* belonging to Type A was selected and grown in TPGB and RCMB media. MVs were extracted at 4, 8, 12 and 24 hrs of growth. Study of protein profile based on SDS-PAGE revealed the appearance of one band at 4 and 8 hrs of growth and 7 bands in MVs extracted at 12 hrs of growth on TPGB. No bands were observed in MVs extracted at 24 hrs of growth in TPGB. Molecular weight of the protein bands were ranging from 43.3 kDa to 75.2 kDa. The MVs extracted from RCMB media revealed the appearance of one protein band in 4 and 8 hrs and 6 bands from 12 hrs of culture growth. The 24 hrs growth culture in RCMB also revealed no bands in SDS-PAGE. The RCMB protein bands were also ranging from 43.3 kDa to 75.2 kDa.

The extracellular proteins and cell lysate proteins were extracted from the cultures grown on BHI broth and compared the protein profile of MVs as revealed by SDS-PAGE. The protein profile revealed 15 distinct bands in cell lysate proteins 11 bands in MVs and 4 bands in extracellular proteins. Cell lysate protein bands were ranging from 17.2 kDa to 75.0k Da, whereas MVs and extracellular protein bands were ranging from 43.3 kDa to 75.0k Da and 44.1 kDa to 75.0 kDa, respectively.

The DNA content of MVs was released by GES reagent and PCR was done targeting to *16S rRNA* and *cpa* (alpha toxin) genes yielding two distinct bands of 795 bp and 324 bp. Immunization of mice to group A1 and B1 was done with the vaccine prepared from MVs at the dose rate of 20 µg/0.2 ml while group A2 and B2 was done with that of 40 µg/0.2 ml through intraperitoneal (i/p) route at 0, 14, and 28 days. The protective efficacy of the MVs

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Department : Animal Biotechnology

Major Advisor : Dr. R. K. Sharma

vaccine was studied by challenging the immunized mice on 42nd day post-primary vaccination with 3×10^8 CFU and 6×10^8 CFU of *C. perfringens* Type A. The challenge trial revealed that the 20.0 μ g and 40.0 μ g /0.2ml dose of vaccines could confer 100.0 percent protection in the immunized mice following homologous challenge with 3×10^8 CFU. However, the challenge trial with 6×10^8 CFU of homologous strain of *C. perfringens* Type A revealed only 66.66 and 33.33 percent protection in the mice immunized with 40.0 μ g and 20.0 μ g / 0.2 ml vaccine doses, respectively.

Molecular diversity among *salmonella* isolates from man and animals with special reference to non-host specific serovars

Dr. Purnima Gogoi

Salmonellae are important food-borne pathogens responsible for diseases in animals and man. It is an important zoonotic pathogen and a leading cause of many outbreaks and infections around the globe. It is a major cause of human gastroenteritis worldwide. The present study was undertaken with a view to isolate *Salmonella* from various sources including animals, birds and human, to study their virulence gene profiles based on a multiplex PCR assay developed for the purpose and to compare three molecular typing methods, viz. rep-PCR, PFGE and plasmid profiling for their efficacy to discriminate and subtype *Salmonella* isolates belonging to different serovars.

Out of a total of 332 samples from various sources examined, 10 (3.01%) were found to be positive for *Salmonella*. The isolates belonged to three different serovars, *Salmonella* Enteritidis being the most predominant (40%), isolated from cattle, pig and Human. The other serovars recovered were Weltevreden (30%) and Newport (10%), while the remaining isolates were untypable (20%).

A multiplex PCR assay was developed for rapid detection of nine important virulence genes of *Salmonella*, viz. *sipA*, *sipB*, *sipC*, *stn*, *sefC*, *spvA*, *spvB*, *spvC* and *sopB*. Isolates belonging to different serovars showed variable results in respect of possession of different virulence genes. The virulence genes *sipA*, *sipB*, *sipC*, *stn* and *sopB* were detected in all (100%) the *Salmonella* isolates under the present study, while the *sefC* gene was present in only 34 (45.94%) of the 74 isolates. The rest three virulence genes *spvA*, *spvB*, and *spvC* were found to be present in 24 (32.43%) isolates. Most of the isolates (17) carrying all the nine genes under the study were recovered from poultry.

On application and analysis of three molecular typing methods, viz. rep-PCR, PFGE, plasmid profiling, it was found that PFGE could clearly differentiate among the strains belonging to different serovars and rep-PCR could differentiate between strains belonging to different serovars as well as between strains within the same serovar, while plasmid profiling had comparatively lower discriminatory power. On the basis of the findings of the present study, it could be suggested that a combination of PFGE and rep-PCR would prove to be more useful and appropriate for molecular typing of *Salmonella* isolates during epidemiological investigations.

Abstract of M. V. Sc. Thesis

Department : Animal Biotechnology

Major Advisor : Dr. Probodh Borah

Studies on body conformation, fibre characteristics and polymorphism of kap 8.2 gene in Nagaland long haired goat

Dr. J.C.K Sheetal

The present work was undertaken to study body conformation, body weight and important fibre characteristics as well as to identify polymorphism in genomic sequences of KAP 8.2 gene and its association with fibre traits on Nagaland Long Haired Goat of Nagaland. A total of 75 animals of both sex constituted the material of the study for body conformation, body weight and fibre characteristics, whereas polymorphism of KAP 8.2 gene were studied on 25 animals.

The pooled averages for length of horn, distance between horns at base, distance between horns at middle, distance between horns at tip, circumference of horn at base, circumference of horn at middle, and circumference of horn at tip were 11.165 ± 0.036 , 2.827 ± 0.046 , 5.818 ± 0.049 , 8.818 ± 0.049 , 8.996 ± 0.119 , 6.096 ± 0.029 , 2.423 ± 0.020 cm respectively in age group G4. The corresponding value for the above traits were 11.933 ± 0.078 , 3.203 ± 0.035 , 6.203 ± 0.035 , 9.203 ± 0.179 , 9.161 ± 0.063 , 6.332 ± 0.048 , 3.433 ± 0.188 cm respectively in age group G5. The pooled averages for length of head, breadth of head and eye to eye space were 13.766 ± 0.179 , 6.742 ± 0.040 and 6.525 ± 0.049 cm respectively in G1; 14.225 ± 0.029 , 6.921 ± 0.040 , 6.604 ± 0.038 cm respectively in G2; 14.404 ± 0.029 , 7.167 ± 0.027 and 7.035 ± 0.134 cm respectively in G3; 14.798 ± 0.031 , 7.398 ± 0.028 and 7.766 ± 0.219 cm respectively in G4; 15.280 ± 0.330 , 7.611 ± 0.025 and 8.445 ± 0.116 cm respectively in G5. The pooled averages for length of body, height at withers and heart girth were 35.675 ± 0.146 , 32.850 ± 0.367 and 36.515 ± 0.170 cm respectively in G1; 38.312 ± 0.205 , 36.401 ± 0.241 and 38.066 ± 0.639 cm respectively in G2; 41.363 ± 0.148 , 40.446 ± 0.375 and 42.072 ± 0.211 cm respectively in G3; 44.385 ± 0.197 , 42.721 ± 0.357 and 46.305 ± 0.265 cm respectively in G4; 47.531 ± 0.406 , 44.626 ± 0.308 and 48.450 ± 0.347 cm respectively in G5. The pooled averages for tail length and body weight were 10.208 ± 0.126 cm and 3.625 ± 0.167 kg respectively in G1; 10.941 ± 0.277 cm and 4.683 ± 6.328 kg respectively in G2; 11.424 ± 0.150 cm and 8.211 ± 0.127 kg respectively

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Department : Animal Genetics and Breeding

Major Advisor : Dr. Abdul Aziz

in G3; 12.161 ± 0.117 cm and 12.369 ± 0.303 kg respectively in G4; 12.991 ± 0.085 cm and 13.812 ± 0.119 kg respectively in G5. The pooled averages for fibre length and fibre diameter were 4.117 ± 0.054 cm and 0.087 ± 0.049 g respectively in G1; 5.242 ± 0.042 cm and 0.099 ± 0.047 g respectively in G2; 5.943 ± 0.095 cm and 0.147 ± 0.028 g respectively in G3; 9.367 ± 0.180 cm and 0.228 ± 0.084 g respectively in G4; 13.245 ± 0.526 cm and 0.228 ± 0.084 g respectively in G5.

Genetic variations of KAP 8.2 gene studied on 25 animals (11 male and 14 female) revealed polymorphism. The goats with AB genotype had significantly thicker fibre diameter as compared to those with AA genotype.

Growth performance and nutrient utilization of crossbred calves on feeding of paddy straw and stover based feed block

Dr. Sangmirlin Terangpi

Eighteen male cross bred calves of about 9 to 10 months of age weighing average 72.2 kg body weight were randomly distributed into three treatment groups as T₁, T₂ and T₃ respectively with 6 animals in each group by using randomized block design (RBD). T₁ was fed with 100% paddy stover, concentrate mixture in the ratio 60:40 and green roughage as total mixed ration (TMR), T₂ was fed with feed block consisting of 100% paddy stover, concentrate mixture and molasses in the ratio 60:30:10 and green roughage separately and T₃ was fed with feed block consisting of 50% paddy stover, 50% paddy straw, concentrate mixture and molasses in the ratio 60:30:10 and green roughage separately. The three treatment groups were fed the same concentrate mixture containing 17.07 per cent DCP and 79.04 percent TDN for 90 days. Towards the end of the experiment a metabolism trial was conducted for 5 days. The average daily gain and FCE of different treatment groups were 94.44±3.18, 140.0±1.07 and 250.4±2.38 g; 19.32±0.74, 14.46±0.18 and 8.69±0.16 in T₁, T₂ and T₃ groups respectively. Highly significant (P<0.001) difference were observed among the treatment groups in respect of gain per day and FCE. DM intake was highest in T₃ followed by T₂ and T₁ (P<0.001). Digestibility coefficient of OM, CP and NDF were higher in T₂ and T₃ groups when compared with T₁ (P<0.01). The digestibility coefficient of DM, CF and ADF in T₂ and T₃ higher (P<0.01) when compared with T₁, however, no significant difference were observed between T₂ and T₃ groups. Digestibility coefficient of NFE was highest in T₃ and lowest in T₁ group (P<0.05) but no significant difference was observed between T₁ and T₂ and T₂ and T₃ groups. The EE digestibility were 62.99% in T₁ and 67.91% in T₃ and differences were non significant (P>0.05). All the animals of different treatment groups were in positive nitrogen, calcium and phosphorus balance. The blood constituent viz. serum glucose, serum total protein, serum albumin, serum globulin were within the normal range for crossbred calves but were highest in T₃ followed by T₂ and T₁ (P<0.001). The serum cholesterol level was highest in T₁ (P<0.001). The albumin/globulin

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Department : Animal Nutrition

Major Advisor : Dr. R. Bhuyan

ratio which was non significant ($P>0.05$) among the treatment groups. Plane of nutrition revealed that protein and energy received by the different treatment groups of animals (T_1 , T_2 and T_3) were adequate for maintenance on the basis of metabolic body weight. The cost per kg gain in body weight was lowest (Rs. 91.96) in T_3 group in comparison to T_1 (Rs. 133.40) and T_2 (Rs. 137.42). The result suggested that crossbred calves can be reared on feeding of complete feed block having 50% paddy straw, 50% paddy stover (out of 60% roughage) and concentrate with molasses in the ratio 60:30:10, plus *ad lib* green roughage with economic advantage.

Pattern of synchronized oestrus and subsequent re-productive performance in hampshire crossbred pig

Dr. (Mrs) Rina Baishnob

A total of 37 apparently healthy cyclic Hampshire crossbred pigs ranging from 7 months to 2 years of age maintained at All India Co-ordinated Research Project on Pig, Mega Seed Project on Pig and 30-Sow Unit, College of Veterinary Science, Khanapara, Guwahati-22 were selected randomly and used for the present study.

The experimental animals were divided irrespective of stage of oestrous cycle into Group I and Group II. A total of 25 animals that included 16 gilts and 9 sows of Group I were injected i/mly with 400 IU PMSG (Folligon) and 200 IU hCG (Chorulon). The animal which exhibited oestrus within 7 days from the day of treatment (10 gilts and 3 sows) was utilized for further study. For the Group II, a total of 12 pigs comprising 8 gilts and 4 sows were selected and were not assigned to any treatment. They were observed for natural occurrence of estrus and considered as untreated control.

The percentage of pigs showing synchronized oestrus was 62.50 in gilts and 33.33 in sows. The mean interval from oestrus synchronization treatment to onset of oestrus was 3.00 ± 0.15 days in gilts and 4.00 ± 0.58 days in sows. The mean duration of oestrus in synchronized gilts was 81.6 ± 3.49 hrs while in untreated control gilts it was 51.00 ± 1.96 hrs. In sows the mean duration was 112.00 ± 4.00 hrs in synchronized and 90.00 ± 3.46 hrs in control animals. The duration of oestrus in both gilts and sows was longer in treated animals than in untreated control. Most frequent behavioural signs of synchronized oestrus were nervousness, frequent grunt, seeking male and lordosis response occurring in the frequencies of 100, 90, 100 and 100 respectively in gilts and 100, 100, 100, and 100 respectively in sows. Corresponding frequencies were 87, 75, 75 and 62.50 per-cent in control gilts and 50, 75, 75 and 50 percent in control sows. Swelling of vulva, pinkish vulva and vaginal mucous discharge were the most common physical signs of estrus exhibited by all gilts and sows following synchronization treatment. Intensity of oestrus was more following synchronization treatment in both gilts and sows as compared to that in untreated control animals.

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. K. Ahmed

The mean gestation length was recorded as 113.67 ± 0.29 and 114.38 ± 0.71 days in synchronized and control gilts respectively while in synchronized and control sows the figures were 114.33 ± 0.33 and 114.00 ± 0.00 days respectively. Statistical analysis revealed no significant difference in the mean gestation length between synchronized and control animals. The mean litter size at birth in oestrus synchronized gilts was recorded as 11.66 ± 1.41 and in control gilts it was 8.63 ± 0.37 . In the case of synchronized sows it was recorded as 12.66 ± 0.33 and in control sows 10.00 ± 0.71 . The difference in mean litter size at birth between synchronized and control gilts were highly significant ($P \hat{=} 0.01$) whereas in case of sows it was significant ($P \hat{=} 0.05$). The mean litter weight in synchronized and untreated control gilts were recorded as 10.62 ± 0.36 and 10.01 ± 0.64 kg respectively. The values were 13.73 ± 0.41 and 11.40 ± 0.57 kg for synchronized and control sows respectively. Results of $t_{1/4}$ test revealed significant difference in mean litter weight between synchronized and control sows only. The incidence of still birth was 7.62 and 2.90 per cent in treated and control gilts while in case of sows it was 2.60 and 2.50 per cent in synchronized and control animals respectively. The incidence of runt piglet was 4.75 and 1.45 per cent in synchronized and control gilts respectively while it was not recorded in sows. Conception rates in all synchronized as well as control pigs were above 90 per cent.

Effect of media on *in-vitro* maturation of bovine oocytes

Dr. Arunima Das

The present research was planned to study the effect of different concentrations of Vitamin E and Oestrous cow serum and their combination on *in-vitro* maturation of bovine follicular oocytes incubated in TCM-199 medium containing Follicular fluid, Oestradiol-17 α , p-FSH, Gentamicin, Sodium Pyruvate, Cysteamine and Fetal Bovine Serum at 38.5 °C with 5% CO₂ for 24 hours in a CO₂ incubator. A total of 825 oocytes were recovered from slaughterhouse ovaries of cattle by aspiration cum slicing technique and graded as A, B, C and D with the recovery rates of 77.64 ± 0.02 , 11.60 ± 0.01 , 6.84 ± 0.01 and 3.91 ± 0.01 per cent, respectively. A total of 704 oocytes of grade A and B were used in the study. Maturation of oocytes was determined on the basis of rate of cumulus cell expansion and polar body formation.

Vitamin E concentrations at 0, 100 and 150 μ M levels in the maturation medium resulted in cumulus cell expansion rate of 74.46 ± 2.68 , 74.28 ± 1.66 and 73.59 ± 0.78 per cent, respectively, while polar body formation rates were found to be 44.02 ± 4.37 , 50.06 ± 2.40 and 45.43 ± 4.20 per cent, respectively. Oocytes maturation rates both in terms of cumulus cell expansion and polar body formation were not affected by levels of Vitamin E supplementation in the *in-vitro* maturation medium. Oestrous Cow Serum supplementation at 0, 20 and 30 per cent levels to the *in-vitro* maturation medium resulted in the cumulus cell expansion rate of 74.46 ± 2.68 , 68.41 ± 2.40 and 63.90 ± 3.49 per cent, respectively; corresponding figures for polar body formation rate were 44.02 ± 4.37 , 32.10 ± 2.84 and 29.50 ± 0.67 per cent. Addition of either 20 or 30 per cent Oestrous Cow Serum in the maturation medium did not improve the oocytes maturation rate both in terms of cumulus cell expansion as well as polar body formation. Cumulus cell expansion and polar body formation rates were recorded as 67.20 ± 3.45 and 38.26 ± 2.28 per cent, respectively when 100 μ M Vitamin E and 20 per cent Oestrous cow serum combination was used in the *in-vitro* maturation medium. The corresponding rates for the control medium (without supplementation) were 74.46 ± 2.68 and 44.02 ± 4.37 per cent.

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. P.M. Barua

A study of reproductive disorders in crossbred cattle with special reference to repeat breeding

Dr. Chiranjeevi Acharya

The present study was conducted in the crossbred cattle maintained in I.L.F (Cattle), College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati and private farms in and around Guwahati, Assam to find out the incidence of various reproductive disorders, to record oestrus signs, to address repeat breeding using certain hormonal treatments and to study the applicability of cryscope in improving the conception rate in crossbred cattle. Out of a total of 3553 crossbred cows and heifers, 1074 (30.23%) had one or the other reproductive disorders. The incidences of different reproductive disorders *viz.*, retention of placenta, repeat breeding, prolonged oestrus, silent oestrus, anoestrus, dystocia, abortion, post-partum prolapse of uterus, pre-partum cervico-vaginal prolapse, foetal mummification/maceration were 7.23, 6.98, 5.43, 5.21, 1.83, 1.55, 0.84, 0.65, 0.42 and 0.08 per cent, respectively. Out of the animals with reproductive disorders, the incidences of major disorders *viz.*, retention of placenta, repeat breeding, prolonged oestrus, silent heat, anoestrus and dystocia were 23.93, 23.09, 17.97, 17.23, 6.05 and 5.12 per cent, respectively.

The percentage frequency of different behavioural signs of oestrus *viz.*, restlessness, mounting, bellowing, loss of appetite, and licking of genitalia was 91.67, 66.67, 45.81, 8.33, and 0 per cent, respectively in normal animals and 96.88, 60.93, 28.12, 6.25, and 3.12 per cent, respectively in repeat breeding crossbred cattle. Out of the different physical signs of oestrus the most conspicuous signs were congested vulvar mucus membrane, swollen vulva, free flowing vaginal mucus, thick vaginal mucus, open cervix and mature Graafian follicle in normal and repeat breeding crossbred cattle. The repeat breeding crossbred cattle were divided into four groups for studying the effect of hormonal treatments on the conception rate, serum cholesterol and mineral profile. The repeat breeding crossbred cattle in Groups I and II received buserelin acetate and human chorionic gonadotropin (hCG), respectively on day 0 and 11 post A.I. Group III animals were administered hydroxyprogesterone caproate on day 5 and 11 post A.I. while Group IV animals were kept as untreated control. The

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. B.C. Deka

conception rate following administration of buserelin acetate, hCG, hydroxyprogesterone caproate and in control group was 60.00, 70.00, 50.00 and 20.00 per cent, respectively. Statistical analysis revealed that mean serum cholesterol, iron, magnesium and inorganic phosphorus levels did not differ significantly between before and after treatment in all the treatment and control groups. The mean values of serum iron and magnesium on the day of oestrus before administration of hormone differed significantly between treatments. The values of serum cholesterol and magnesium on day 11 of oestrous cycle after treatment varied significantly between treatments.

For studying the applicability of cryscope, the normal as well as repeat breeding crossbred cattle were divided into three groups. Group I animals were inseminated on revealing typical fern pattern in oestrus mucus observed using the cryscope. Group II animals were inseminated 7-8 hours after the exhibition of typical fern pattern in oestrus mucus and Group III animals were inseminated at 12-15 hours after the onset of oestrus without the use of cryscope. The conception rates in Groups I, II and III of normal and repeat breeding crossbred cattle were 75.00, 50.00 and 62.50 per cent and 37.50, 25.00 and 12.50 per cent, respectively.

Effect of additives in medium on *in-vitro* maturation and fertilization of goat oocytes

Dr. Dharitri Borah

A total of 2539 oocytes were recovered from 712 goat ovaries obtained from slaughter house soon after sacrifice and the mean recovery rate of oocytes per ovary was 3.43 ± 0.06 , 4.21 ± 0.08 and 3.24 ± 0.78 by aspiration, slicing and puncture techniques respectively, being significantly higher ($P < 0.01$) in slicing as compared to other two techniques. The recovery of good quality oocytes with two or more cumulus cells layers around the oocytes was significantly higher ($P < 0.01$) in puncture ($73.92 \pm 0.92\%$) than that in aspiration ($66.27 \pm 0.68\%$) and slicing ($64.76 \pm 0.92\%$) techniques.

The effect of addition of 10ng/ml EGF + 50 ng/ml IGF-1, 10ng/ml EGF + 600 μ M/ml cysteine and 10ng/ml EGF + 0.2mM/ml sodium pyruvate in TCM-199 + 100 μ l/ml foetal bovine serum + 100 μ M/ml cysteamine + 1 μ g/ml 17 β -Oestradiol + 5 μ g/ml pFSH + 5 μ g/ml oLH + 10 per cent follicular fluid and 10 per cent estrous goat serum (control medium) was studied for *in-vitro* maturation (IVM) of goat oocytes on incubation at 38.5 $^{\circ}$ C for 24 hours in a CO₂ incubator maintaining 5 per cent CO₂ under humidified condition. The IVM rate of oocytes on the basis of cumulus cell expansion and polar body extrusion was found to be significantly higher ($P < 0.01$) with EGF + IGF-I ($88.74 \pm 1.85\%$ and $61.71 \pm 1.61\%$) than that with EGF + sodium pyruvate ($82.86 \pm 0.97\%$ and $54.62 \pm 1.88\%$), EGF + cysteine ($78.58 \pm 1.45\%$ and $49.02 \pm 1.52\%$) and control medium ($75.27 \pm 1.58\%$ and $43.03 \pm 1.48\%$).

The oocytes matured in the IVM media used were fertilized *in-vitro* in Fert-TALP using swimm-up sperm capacitated in sperm TALP. The incidences of *in-vitro* fertilization of oocytes on the basis of two polar bodies and 2-cell stage were also higher when oocytes were matured *in-vitro* using EGF + IGF-I (44.67 ± 8.86 and $15.39 \pm 4.48\%$) than that with EGF + sodium pyruvate (25.51 ± 7.31 and $11.56 \pm 4.72\%$), EGF + cysteine (22.46 ± 8.37 and $11.56 \pm 4.72\%$) and control medium (20.48 ± 4.27 and $8.10 \pm 3.84\%$) although the differences were not found to be significant.

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. R.K. Biswas

Influence of additives on *in-vitro* maturation of bovine oocyte

Dr. Madhurima Bhajoni

A study was conducted to find an effective *in-vitro* culture system based on *in-vitro* maturation of bovine oocytes. Ovaries from slaughter house were utilized to study ovarian biometry, follicular biometry and performance of *in-vitro* maturation of oocyte. Significantly higher weight, length, width and thickness were recorded in ovary with CL than that without CL. The number of large, medium and small follicles was more in ovary without CL than with CL group. The mean number of medium size follicles was significantly ($P < 0.01$) higher in ovary without CL (6.32 ± 0.75) than with CL (3.33 ± 0.18). The recovery rates of grade A (47.58%) and B (37.42%) oocytes were higher than that of grade C (8.82%) and D (6.12%) by aspiration method.

In the present study *in-vitro* maturation of oocytes was done at 38.5°C in humidified atmosphere of 5% CO_2 for 24 hours and matured *in-vitro* in medium-I or control (TCM-199+10% FBS+L-glutamine+sodium pyruvate+Gentamicin+pFSH+ Estradiol 17- β), medium-II (control+5% ECS), medium-III (control+100 μM /ml cysteamine), medium-IV (control+10ng/ml EGF) and medium-V (control+ 5% ECS+ 100 μM /ml cysteamine+10ng/ml EGF). The mean diameter of oocytes with cumulus cells for grade A oocytes varied significantly ($P < 0.01$) after *in-vitro* maturation (IVM) in different media. The medium having either epidermal growth factor or cysteamine as additives showed higher diameter of oocytes after IVM as compared to medium with estrous cow serum or foetal bovine serum or combination of all three additives. The mean diameter of oocyte without cumulus cells before and after IVM did not differ significantly between different media. The increase in diameter of oocytes with cumulus cell for grade A was significantly ($P < 0.05$) higher in medium-III than that of I, II and V and in medium-IV than that of I, II and V. There was no significant difference in increase in diameter of oocyte without cumulus cells for grade A and oocyte with and without cumulus cells for grade B between different media. The rates of maturation based on cumulus cell expansion and nuclear maturation were the highest in the medium-IV (86.92% and 62.36%) containing epidermal growth factor (EGF) followed by medium-III (82.24% and 56.82%) containing cysteamine among all the media, the difference between media III and IV being non-significant.

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. D. Bhuyan

Effect of extender and different sperm numbers per straw on quality of frozen semen in beetal and sirohi bucks

Dr. Manoj kumar Kalita

A total of 80 pooled ejaculates collected from two Beetal and one Sirohi bucks maintained at Goat Research Station, Burnihat were used to study the effect of tris extender containing 20% egg-yolk, 1% soy-lecithin and 1.5% soy-lecithin, and that of 37.5, 50 and 75 x10⁶ sperm / straw on the quality of frozen semen, and also the effect of number of spermatozoa in frozen semen straws on fertility. The freezing of semen was done in French mini straw by rapid horizontal vapour freezing technique using liquid nitrogen.

The overall mean post-thaw per cent sperm motility, live sperm, intact acrosome and HOST-reacted sperm in tris extender containing 20% egg yolk, 1% soy-lecithin and 1.5% soy-lecithin was 61.20 ± 0.45, 57.77 ± 0.54 and 60.20 ± 0.45; 72.32 ± 0.47, 65.40 ± 0.56 and 67.07 ± 0.56; 68.42 ± 0.43, 61.30 ± 0.74 and 63.80 ± 0.58; and 64.35 ± 0.63, 57.35 ± 0.5 and 60.17 ± 0.46 respectively. The post thaw values of tris extender with 20% egg yolk were significantly (P<0.01) higher than that of tris extender containing 1% and 1.5% soy-lecithin for live sperm, intact acrosome and HOST-reacted sperm. However, the difference was not significant between 20% egg yolk and 1.5% soy-lecithin for sperm motility. The post thaw values were significantly (P<0.01) higher for 1.5% than that for 1% soy-lecithin in all the parameters studied.

The overall mean post-thaw per cent sperm motility, live sperm, intact acrosome and HOST-reacted sperm for straws containing 37.5, 50 and 75 x10⁶ sperm/ straw was 56.02 ± 0.47, 57.50 ± 0.41 and 65.57 ± 0.58; 67.42 ± 0.62, 70.55 ± 0.55 and 73.45 ± 0.57; 61.12 ± 0.69, 64.37 ± 0.66 and 68.25 ± 0.66; and 59.00 ± 0.62, 62.77 ± 0.52 and 65.57 ± 0.58 respectively. The post-thaw values of semen with 75 x10⁶ sperm/ straw were significantly (P<0.01) higher than that of 50 and 37.5 x10⁶ sperm / straw for all the sperm parameters studied. The post thaw values with 50 x10⁶ sperm/ straw was significantly (P<0.01) higher than that with 37.5 x10⁶ sperm /straw for sperm motility, intact acrosome and HOST-reacted sperm but not for live sperm. The fertility rate based on non-return rate was the highest at 75 x10⁶ sperm /straw in both Beetal and Sirohi goats. It was revealed from the present study that the quality of frozen semen was superior in tris extender containing 20% egg yolk to that containing 1% or 1.5% soy-lecithin. The post thaw quality and fertility of goat semen was significantly superior for 75 x10⁶ sperm / straw to 50 x10⁶ and 37.5 x10⁶ sperm / straw.

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Department : Animal Reproduction, Gynaecology and Obstetrics

Major Advisor : Dr. S. Sinha

Marketing practices of goat and chevon in Kamrup (metro) district of Assam

Dr. Sushil Ekka

A study entitled “Marketing practices of goat and chevon in Kamrup (Metro) district of Assam” was conducted in order to explore the marketing of goats in kamrup (Metro) district and to assess the status of marketing of goat meat /chevon in an around Guwahati city. For the first purpose four goat markets viz Bhoothnath, Panikheti, Chandrapur and Sonapur were selected. From each of these four markets 30 buyers and 30 sellers were taken to make the sample size 240 and data were collected from them with the help of a specially prepared interview schedule. Similarly for the second purpose four meat markets were selected viz. Khanapara, Six mile, Beltola and Narengi. From each of these four meat markets 15 number of butchers were selected and from them data regarding identifying the marketing procedure of meat, edible and inedible by-products yield and value were collected. The study revealed that majority of the sellers sold goats of age groups of 6-12 months in all the markets as the consumers preferred meat of this age category due to tenderness of meat. The average market weight was found to increase with the advancement of age. In respect of seller category majority of the sellers were middlemen in Bhoothnath market whereas in other markets producers dominated the seller categories. On the other hand butchers were the majority buyers who visited the market regularly to meet their day-to-day demand of meat supply. So far as the transportation of animals was concerned mini truck/ pickup van was used for transporting goats in the Bhoothnath market where goats were brought from different districts. Except this, Auto van was the most frequently used mode of transport in all the markets. In case of Bhoothnath and Panikheti market river route was also used. However in other markets bicycle/rickshaw was also a frequently used mode of transportation. Regarding marketing channel the most prevalent channel was producer-middleman-butcher-consumer in all the markets except Sonapur where the popular channel was producer-butcher-consumer. In respect of the criteria of price fixation of goats, the study revealed that majority of the sellers cited muscle thickness as the most important

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Department : Livestock Production and Management

Major Advisor : Dr. R. Roychoudhury

criterion for price fixation although a small number of them also mentioned status of castration as the basis of price fixation. The educational level of the sellers was also studied in the present study and it revealed that majority of the sellers read upto M.E. School and this business was yet to attract the educated unemployed youths.

In the present study the average value for live weight, carcass weight; edible offals, head, shank and skin were significantly higher ($P < 0.01$) in adult goats compared to the young group. The average live weights of young and adult goats were found to be 7.97 ± 0.26 and 12.58 ± 0.38 kg. The percent value of edible offals in adult group was found to be significantly higher ($P < 0.01$) than the young group of goats. The percent value of head was significantly higher ($P < 0.01$) in young groups of goats compared to the adult goats. The average live animal price of adult goats was significantly higher than the young animals. The study also revealed that 85.68 to 86.55 percent of the total sale proceeds were obtained from the carcass meat and 6.15 to 6.52 percent were obtained from edible offals. Therefore it was evident that only $> 10\%$ sale proceeds came from inedible offals.

Development of duck meat patties incorporated with black gram (*Vigna Mungo L.*) flour

Dr. Kalpita Saikia

Duck meat patties were prepared by incorporating three different levels of hydrated (1:1 w/w) Black Gram Flour (BGF) along with other non-meat ingredients to find out the best formulation/combination which can be stored for reasonable time at refrigeration temperature without affecting its physico-chemical, Sensory and bacteriological qualities. The formulations attempted were – C_T (0% BGF), T₁ (5% BGF), T₂ (10% BGF) and T₃ (15% BGF). A total of five batches of patties of each formulation were prepared and evaluated. Patties were cooked in hot air oven at 185 ± 5°C till the internal temperature reached 75 ± 2°C. Thereafter, these were packed in food grade polyethylene bags, stored under refrigeration and evaluated for various quality traits *viz.*, Water Holding Capacity (WHC), p^H, Water Activity (a_w), Thiobarbituric acid (TBA) value, Sensory qualities, Total Viable Count (TVC), Total Viable Psychrophilic Bacterial Count (TVPBC) and Colititre value on 1st, 5th, 10th and 15th days of storage. In addition, Emulsion Stability, Cooking Loss, Proximate Composition, Colour Profile and Texture Profile of the products were estimated on the day of production (1st day). Besides above, the Calorie value and production cost of duck meat patties were calculated out.

Emulsion stability (ES) was significantly (P < 0.01) higher in T₃ formulations compared to the C_T. Increasing levels of Black Gram Flour resulted in marked decrease (P < 0.01) of cooking loss in the treated groups. The WHC of the patties significantly (P < 0.01) increased along with the increased levels of BGF. There was significant (P < 0.01) decrease in the WHC after 5th day along with the increase in the storage periods. The p^H values did not differ significantly in the treated formulations although there was significant (P < 0.01) decrease of products p^H values after 5th days on storage upto 15 days. Addition of BGF resulted in decrease of a_w. The highest a_w was recorded in the control and the lowest values in T₃ formulations. Irrespective of the C_T & treated formulations the a_w decreased significantly (P < 0.01) from 1st to 15th day of storage. The TBA values however, increased significantly (P < 0.01) during the storage period. Proximate composition study of duck meat patties

Abstract of M. V. Sc. Thesis

Department : Livestock Products Technology

Major Advisor : Dr. S. K. Laskar

revealed significant ($P < 0.01$) decrease in the per cent moisture, crude protein and ether extract content from the control to the treated groups. On the contrary, the per cent total ash content increased non-significantly ($P > 0.05$) from the control to the treated formulations. The study revealed a non-significant ($P > 0.05$) decrease in calorie value of duck meat patties from the control product to the treated ones. The taste panel evaluation studies in respect of the overall acceptability score of duck meat patties involving all the eating qualities revealed that the treated products had the lowest overall acceptability scores than the control one, although the scores recorded for all others were within the acceptable limit. Among the treated products, formulation T_1 registered highest overall acceptability scores. The TVC for the duck meat patties showed significant ($P < 0.01$) increase in bacterial load from day 1st to 15th day of storage. The TVPBC was not detected on 1st day, although the TVPBC for the duck meat patties showed significant ($P < 0.01$) increase in bacterial load from day 5th to 15th day of storage. Colititre counts were negative for all the product formulations and on storage upto 15th day. With increased incorporation of BGF the lightness (L) value increase from C_T to the treated products and the redness (a) and yellowness (b) values decreased from C_T to treated products. With increased incorporation of black gram flour the hardness, springiness, chewiness and resilience values increase but fracturability and cohesiveness decrease from control to the treated products.

Estimation of production cost of duck meat patties indicated that products containing T_3 were more economic than the control and other treated products. Based on the result obtained in the study it might be concluded that duck meat patties could be prepared satisfactorily on addition of upto 15% levels of BGF and can be stored upto 10 days under refrigeration, without adversely affecting the quality of the products, besides, obtaining a relatively cheaper, black gram flour enriched duck meat patties.

Development of a duck meat loaf incorporated with kumura (*Benincasa hispida*)

Dr. Jyotishka Kumar Das

The study was conducted in the Department of Livestock Products Technology, Assam Agricultural University, Khanapara, Guwahati-22 to develop a value added ready-to-eat duck meat loaf incorporating Kumura (*Benincsa hispida*) at 3 different levels viz 5%, 7.5% and 10% along with the control without affecting the physico-chemical, microbial, organoleptic qualities and shelf life of the products.

A total of five batches of cooked duck meat loaves comprising of 4 different formulations in each batch were prepared. The lean meat was substituted by Kumura (*Benincasa hispida*) at the levels of 5%, 7.5% and 10%. Ducks were collected hygienically; slaughtered, deboned, minced, cured and processed. Different formulations of loaf emulsion were prepared by thoroughly mixing Kumura with required amount of meat, non-meat ingredients, spices, and ice to form a stable meat emulsion. The meat emulsion was stuffed into rectangular stainless steel boxes covered with aluminium foil and cooked in hot water at 85°C for 45 minutes. And cooled to room temperature by showering. The meat loaves were packed in food grade packaging (polyethylene) bags separately for each formulation, stored at 4±1°C. and evaluated for different quality attributes. Different parameters such as cooking loss, emulsion stability, water holding capacity, pH, thiobarbituric acid value, proximate composition, organoleptic quality, microbial quality, shelf life including cost of the products were studied. The results of the investigation are as follows:

Emulsion stability of the Kumura incorporated duck meat loaf emulsions were found to be significantly ($P < 0.01$) higher when compared to control sample without added Kumura. Mean percent cooking loss was found to be gradually increasing as the percentage of Kumura was increasing in the samples. The cooking loss was non significantly lower in control sample (6.20 ± 0.59) compared to treated samples with kumura. The duck meat loaf with higher level of Kumura showed significantly ($p < 0.01$). higher water holding capacity. The highest (65.59 ± 2.02) water holding capacity was shown by sample with 10% Kumura followed by T_2 , T_1 and control.

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The results with respect to pH of the loaves has shown that the product with 10% incorporation of Kumura had the lowest pH value followed by samples with 7.5 percent, 5% and control sample. The pH decreased significantly ($P < 0.01$) with increased incorporation of Kumura. The results pertaining to TBA values indicated that the control sample had the significantly ($P < 0.01$) highest rancidity effect than the other treated samples with Kumura. The TBA values significantly ($P < 0.01$) increased with increase in the storage period in all samples. The percentage of moisture increased, protein decreased, fat decreased and ash also decreased in treated samples as compared to the control samples. M:P ratio (Moisture: protein ratio) increased in the treated samples as compared to the control.

The bacterial counts (TVMBC and Psychrophilic counts) decreased in the treated samples as compared to the control. No yeast and mould were recorded upto 5th day of storage. However yeast and mould were found on 10th day. With respect to the texture and colour profile no significant differences were found among the samples.

The panel members offered almost equal scores for sensory attributes for all the samples as there were no significant ($P > 0.05$) differences among the means of sensory scores. The average shelf life of the samples kept at refrigerated temperature ($4 \pm 1^{\circ}\text{C}$) was below 5 days. The cost of the loaves were Rs 528.22/kg for control, Rs 511.70/ kg for T_1 , Rs .503.11/ kg for T_2 and Rs. 494.14/kg for T_3 .

Based on the investigation, it can be concluded that an acceptable ready-to eat duck meat loaf can be developed for future commercial exploitation.

Evaluation of hepatoprotective and hypolipidemic properties of *Alternanthera sessilis*

Dr. Anurag Borthakur

The aqueous and methanolic extracts of *Alternanthera sessilis* were evaluated for hepatoprotective, hypolipidemic activities in rats. The effects of the extracts were also observed in guinea pig ileum and rat ileum.

The Botanical Survey of India, Shillong had identified and authenticated the plant as *Alternanthera sessilis* (*A. sessilis*). The dried and pulverized fine powder of *A. sessilis* leaves which was subjected to cold aqueous and cold methanolic extract treatment yielded 11.45 and 5.98 grams per 100 grams of dry powder, respectively. The extracts of *A. sessilis* were found to be positive for phlobatannin, saponin, terpenoids, steroids, flavonoids when subjected to qualitative phytochemical analysis. The calculated LD₅₀ was found to be greater than 2500 mg.kg⁻¹ body weight as per OECD guidelines.

For evaluation of hepatoprotective activity of *A. sessilis* in rats, hepatotoxicity was induced by carbon tetrachloride (CCl₄ + Liquid Paraffin 50% v/v) 2ml/kg body weight subcutaneously twice a week for 3 weeks in all the groups except group I (control). Group I served as normal control, whereas group II as treated control with only CCl₄, Group III as standard and group IV, V and VI were treated with varying doses of aqueous extract at 100, 300 and, 900 mg.kg⁻¹ body weight respectively. Similarly in another experiment, group IV, V and VI were treated with varying doses of methanolic extract at 100, 300 and 900 mg.kg⁻¹ respectively. The treatment for group I (control), Group II (treated control) and group III (silymarin treated) was done exactly the same way as in the previous setting. The parameters studied were aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase, total bilirubin.

The effects of both aqueous and methanolic extracts of *A. sessilis* in CCl₄ induced hepatic damage, in a dose dependent manner was found to lower, the cellular enzymes, viz. Aspartate aminotransferase (AST), alanine aminotransferase (ALT) and serum alkaline phosphatase (ALP). The efficacy in lowering the various cellular enzymes leaking into the serum after hepatic damage was not significantly different between the methanolic and the

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Major Advisor : Dr. P. Mohan

aqueous extract. The hepatoprotective activity of extracts of *A. sessilis*, as depicted by reduction in the plasma level of some cellular enzymes viz. AST, ALT, and ALP, including drop in total bilirubin level, may be due to its free radical scavenging activity of certain plant constituents like flavonoids, terpenoids etc.

For evaluation of hypolipidemic activity of *A. sessilis* in rats, the animals were placed in six different groups with each group consisting of 6 rats. The group I was kept as control with normal feeding and *ad libitum* water. The group II was kept as treated control with high fed diet (20% coconut oil in feed) being fed to induce hypercholesterolemia. The group III was treated with atorvastatin @ 10 mg.kg⁻¹ body weight. The group IV, V and VI were treated with varying doses of aqueous extract @ 100 mg.kg⁻¹, 300 mg.kg⁻¹, 900mg.kg⁻¹ body weight respectively. The hypolipidemic effect in the groups treated with the aqueous extract was discernable from the 2nd weeks onwards with the highest dose of *A. sessilis* showing comparable effect with the group subjected to atorvastatin treatment. The possible mechanism via which it produces its hypolipidemic effect may be due to increased functioning of the hepatocytes thereby facilitating the excretion of cholesterol through bile.

The extracts of *A. sessilis* did not produce any effect when subjected to guinea pig ileum neither could it block the histaminic effect when treated in the presence of extract. The extracts also did not show any effect when it was subjected to rat ileum. Neither could it block the effect of acetylcholine when treated in presence of the extracts.

Toxic potential of profenofos in broiler chicken

Dr. Arjun Kafle

The present investigation was undertaken to study the acute and subchronic toxicity of Profenofos in broiler chicken. A total of 30 numbers of broiler chickens were included in the experiment which were divided into 3 groups (Group A, B and C), each comprising 10 chickens. Group A birds served as acute toxicity group and were administered a single LD₅₀ dose of Profenofos i.e., 16 mg/kg body weight orally while group B served as subchronic toxicity group and were administered dose of 1.6 mg/kg body weight orally daily for a period of 60 days. Group C served as control. For acute toxicity study, blood was collected at 0, 3, 6, 12, 24 and 36 hours whereas blood was collected at weekly interval for subchronic toxicity study. In case of acute toxicity group, within 3 hours of Profenofos administration birds exhibited clinical signs which included depression, anorexia, diarrhea, gasping, excessive salivation, drooling, curved position and rigid stance with drooping of wings. Progressively the birds were unable to stand and sat on their hocks with curled toes followed by tremor, incoordination, convulsions and death. However the signs observed in Group B were less pronounced except the birds exhibited sitting on hock posture, staggering gait, leg weakness, limb paresis and diarrhea were noticed in the latter part of the experiment. Curled toes were seen in some of the birds. The haematological parameters (Haemoglobin, Total Erythrocyte Count, Total Leucocyte Count and Heterophil) were significantly increased in both the treated groups compared to the control. However the level of lymphocyte was found to be decreased in both acute and subchronic toxicity group compared to the control group. Significant increase in serum enzyme activities (Alanine Amino Transferase, Aspartate Amino Transferase, Alkaline Phosphatase, Total Cholesterol and Uric acid) were observed in both the treated groups. However the level of Serum Cholinesterase was found to be significantly reduced in treated groups as compared to the control. On postmortem, gross changes on liver, kidney, lung, and brain were recorded and mostly included congestion, haemorrhage in lung, kidney and brain while distention of gall bladder was observed in the liver in both the groups. Histopathological study of liver showed congestion and infiltration of inflammatory cells, kidney revealed coagulative necrosis, hydropic degeneration and distention of the tubules. Mild congestion and haemorrhage were observed in the lung while

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the brain revealed congestion, neuronophagia and satelliosis. The level of residue was assessed by Ultra High Performance Liquid Chromatography technique in which the level of Profenofos was found to be maximum in brain in acute toxicity study while in subchronic toxicity, the liver was detected with the maximum residue. The level of residue was found to be least in muscle in both acute and subchronic toxicity studies. In acute toxicity study the concentration of Profenofos in brain showed MRL level (0.05µg/g) while in subchronic toxicity study the concentration detected were below the MRL in all the samples tested

Evaluation of nanocurcumin and tea waste extract on experimentally induced caecal coccidiosis in broiler chicks

Dr. Champak Gogoi

The anticoccidial efficacy of three different doses of nanocurcumin (100 mg/kg bodyweight, 200 mg/kg bodyweight and 300 mg/kg bodyweight), three different doses of tea waste extract (100mg/kg bodyweight, 200mg/kg bodyweight and 300 mg/kg bodyweight) and curcumin (300 mg/kg bodyweight) were tested against *Eimeria tenella* infection in broilers. A total of 100 numbers of day old Broiler birds (weighing 40-50 g) were procured. All the birds were kept in deep litter system in a small group of 10 birds each. Birds were fed with standard balanced ration and clean drinking water *ad libitum* and were vaccinated for Ranikhet Disease at 4th day with F-strain vaccine and maintained in a standard laboratory conditions (at ambient temperature ranging between 22-25 °C). Groups 1,3,4,5,6,7,8,9 and 10 were challenged with 10,000 sporulated oocysts of *E. tenella* at day 10 of age, while group 2 served as the uninfected unmedicated control. From the day of challenge infection, the birds belonging to group 3 treated with standard drug amprolium and group 4,5,6,7,8,9 and 10 were treated with different doses of nanocurcumin, curcumin and tea waste extract. From 5th day post infection, the birds showed some symptoms of diarrhoea, anorexia and weakness. From 6th day post infection, the birds started to show bloody diarrhoea, anorexia, weakness and death. A total of 22 birds died during the experiment. The negative control group (infected+untreated group) showed highest mortality (100%). The second highest mortality was found in group 7 (infected+treated with tea waste extract 100mg/kg b.w.) i.e. 40%. Other groups showed less mortality specially the curcumin and nanocurcumin treated groups. The positive control group (treated with amprolium) and group 6 (treated with nanocurcumin 300 mg/kg b.w.) showed no mortality. It was seen that Group 2 (Normal control) showed highest body weight (2260±52.64). Subsequently, Group 3 (treated with amprolium) showed a bodyweight (2175.00 ± 49.75) which has no significant difference with Group 2. Group 6 (treated with nanocurcumin 300 mg) showed the highest bodyweight among the experimental groups (2015.00 ± 43.02). However, Groups treated with tea waste extract showed a significant drop in weight gain (1197.00 ± 95.37, 1106.00 ± 30.46, 1347.00 ± 30.84). Group 2 (normal control) showed highest FCR (1.64). Blood parameters were recorded and analysed and found significant difference between the groups (p<0.001). It was concluded that the effect of nanocurcumin was significantly better than tea waste extract and can be compared with the standard drug i.e. Amprolium.

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Role of nanocurcumin on experimentally Induced hepato toxicity in rats

Dr. Farida Rahman

The present study evaluated the protective effect of nanocurcumin against carbon tetrachloride (CCl₄) and paracetamol induced hepatotoxicity. A total of 96 albino rats of Wistar strain were divided into two groups each for CCl₄ and paracetamol having eight subgroups consist of six rats per group. In CCl₄ induced hepatic model, Group I served as normal control group [olive oil i/p, at the dose rate of 2 ml/kg body weight on the day of administration of CCl₄ to the treatment groups and CMC (1% w/v) p.o., 1 ml/100g body weight for 4 weeks], Group II served as positive control (CCl₄ 2 ml/kg in olive oil by i/p), Group III (CCl₄ 2 ml/kg in olive oil by i/p + silymarin 100 mg/kg p.o.), Group IV (CCl₄ 2 ml/kg in olive oil by i/p + nanocurcumin 40 mg/kg p.o.), Group V (CCl₄ 2 ml/kg in olive oil by i/p + nanocurcumin 80 mg/kg p.o.), Group VI (CCl₄ 2 ml/kg in olive oil by i/p + nanocurcumin 160 mg/kg p.o.), Group VII (CCl₄ 2 ml/kg in olive oil by i/p + curcumin 160 mg/kg p.o.), Group VIII (CCl₄ 2 ml/kg in olive oil by i/p + turmeric 160 mg/kg p.o.) for four consecutive weeks. In the paracetamol induced hepatotoxicity model, Group I served as the normal control group (CMC 1 ml/100g body weight), Group II served as positive control (paracetamol 500 mg/kg in CMC p.o.), Group III (paracetamol 500 mg/kg in CMC p.o. + silymarin 100 mg/kg p.o.), Group IV (paracetamol 500 mg/kg in CMC p.o. + nanocurcumin 40 mg/kg p.o.), Group V (paracetamol 500 mg/kg in CMC p.o. + nanocurcumin 80 mg/kg p.o.), Group VI (paracetamol 500 mg/kg in CMC p.o. + nanocurcumin 160 mg/kg p.o.), Group VII (paracetamol 500 mg/kg in CMC p.o. + curcumin 160 mg/kg p.o.), Group VIII (paracetamol 500 mg/kg in CMC p.o. + turmeric 160 mg/kg p.o.) for four consecutive weeks. Blood and liver samples were collected for biochemical and histopathological analysis respectively. The present study revealed that CCl₄ and paracetamol elevated the activities of LDH and liver enzymes (AST, ALT, ALP) and increased bilirubin, uric acid and malondialdehyde (MDA) level. On the other hand, CCl₄ and paracetamol decreased the biochemical parameters, such as total protein, albumin, and globulin. After treatment with nanocurcumin (40, 80, 160 mg/kg body weight) it was found that the activity of liver enzymes (AST, ALT, ALP), LDH, bilirubin, uric acid and MDA level decreased significantly, where as the level of total protein, albumin, and globulin was found to be increased significantly in a dose dependent manner with the nanocurcumin treatment. In the histopathological study it was observed that administration of nanocurcumin decreased the fatty and necro-inflammatory changes of liver.

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Effect of topic: feeding garlic (*Allium sativum*) as prebiotic on the performance of commercial broiler chicken

Dr. (Mrs) Bondana Borgohain

This study was undertaken to investigate the effect of feeding garlic (*Allium sativum*) as prebiotic on the performance of commercial broiler chicken. One hundred and forty four day-old commercial broiler chicks (Cobb-400 Y) having similar body weight from a single hatch was procured. The chicks were randomly divided into four groups viz. T₀, T₁, T₂ and T₃ containing 36 chicks in each groups. Each group was further subdivided into 3 replicates of 12 chicks in each group. The chicks were wing banded and reared under deep litter system of management throughout the experimental period following standard and uniform managerial practices. The birds under T₀ group were offered basal diet without addition of garlic powder. The birds under T₁, T₂ and T₃ groups were given garlic powder with feed at the rate of 0.5, 1.0 and 1.5% level respectively. All the experimental groups were provided commercial brand of probiotic powder (Probios) at the recommended dose of 1g/litre of drinking water. For preparation of garlic powder, garlic bulbs were peeled off and sun-dried for three days. Then these bulbs were dried in Hot Air Oven at a temperature of 50°C. The dried substances were ground to obtain the dry garlic powder and were stored at room temperature and used in the feeds of broiler chickens for a period of six (6) weeks. The garlic powder was incorporated into the diets at 0, 0.5, 1.0 and 1.5% levels (on dry matter basis). All the birds under control and treatment groups were offered *ad libitum* feed and water throughout the experimental period. The birds of all the four groups were reared separately and maintained under uniform managerial condition.

During the six (6) weeks of experimental period, following parameters were studied: performance traits like weekly feed intake and feed consumption, weekly body weight and body weight gain, Feed Conversion Ratio (FCR), Broiler Performance Efficiency Index (BPEI) and Livability, economics of production, carcass traits like carcass quality traits, relative organ weights including lymphoid organs, haematological parameters like hemoglobin, Packed Cell Volume, total RBC count, total WBC count and WBC differential count

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(Neutrophil, eosinophil, monocyte, lymphocyte) and biochemical parameters like total serum cholesterol, HDL, LDL, triglycerides, serum glucose and ALT.

The total feed consumption per broiler for different experimental groups was highest in T₂ group (3633.23g) and lowest in T₀ group (3390.96g). The final body weight per broiler was highest in T₂ group (2175.00± 31.90 g) followed by T₃ (2008.3± 34.13 g), T₁ (1986.11± 30.85 g) and T₀ (1904.86± 27.05 g). The overall FCR of the entire period of the experimental groups was best in T₂ group (1.67) followed by T₃ (1.74), T₀ (1.78) and T₁ (1.80) group. Among the different experimental groups, T₂ showed the highest BPEI (130.24) followed by T₃ (115.45), T₁ (110.28) and T₀ (106.96) group. The per cent livability of all the experimental groups was cent per cent (100).

The cost of production per broiler including the additional cost of garlic powder was highest in T₃ (Rs. 167.87) than T₂ (Rs. 166.31), T₁ (Rs. 157.59) and T₀ (Rs. 144.70). However, gross profit per broiler was found to be highest in T₂ group (Rs. 51.19) followed by T₀ (Rs. 45.73), T₁ (Rs. 41.01) and T₃ (Rs. 32.93) group.

All carcass quality traits (live weight, dressed weight and dressing percentage and giblet weight) except per cent yields of giblet did not differ significantly among different experimental groups. The giblet yield (%) was significantly higher in T₀ group (5.61± 0.17) than T₁ (5.08± 0.10), T₂ (4.88± 0.05), T₃ (4.85± 0.09). The per cent yield of cut-up parts like neck, wing, back, breast, thigh and drumstick did not differ significantly among different treatment groups.

The per cent weights of relative organs of broiler chicken on dressed weight basis did not differ significantly among different treatment groups except the per cent weights of liver, gizzard, lungs and abdominal fat. The per cent weights of liver, gizzard, lungs and abdominal fat of T₀ group (2.41, 2.48, 0.97 1.31 per cent) were higher than the garlic fed groups. Among the lymphoid organs, both bursa and thymus showed no significant difference in per cent weights between the different treatment groups except the per cent weights of spleen. The spleen weight decreased significantly (P<0.05) in T₂ (1.68±0.07) and T₃ group (1.72± 0.07) as compared to T₀ (2.31±0.05) and T₁ (2.27± 0.04).

All the haematological parameters except haemoglobin and total RBC recorded in the present study differed significantly among different treatment groups. The total WBC was significantly higher in T₂ (85.69 ± 2.18) and T₃ groups (85.11 ± 1.46) as compared to T₀ (71.12 ± 1.82) and T₁ group (72.52 ± 1.93). The WBC differential count (Neutrophil, Eosinophil, Monocyte and Lymphocyte) was significantly higher in T₂ (Neutrophil- 4.52 ± 0.11, Eosinophil- 0.76 ± 0.09, Monocyte- 1.08 ± 0.06 and Lymphocyte- 70.58 ± 1.00 million/mm³) and T₃ groups (Neutrophil- 4.69 ± 0.11, Eosinophil- 0.89 ± 0.09, Monocyte- 1.12 ± 0.03 and Lymphocyte- 71.89 ± 0.97 million/mm³) as compared to T₀ (Neutrophil – 4.16 ± 0.14, Eosinophil – 0.52 ± 0.07, Monocyte – 0.91 ± 0.03 and Lymphocyte – 64.19 ± 1.78) and T₁ group (Neutrophil- 4.32 ± 0.13, Eosinophil-0.63± 0.06, Monocyte- 0.99 ± 0.03 and Lymphocyte-66.26 ± 1.65 million/mm³).

The values of all the biochemical parameters (total serum cholesterol, HDL, LDL, triglycerides and ALT) except serum glucose recorded in the present study differed

significantly ($P < 0.01$) among different treatment groups. The total serum cholesterol was found lowest in T_3 and T_2 (109.48 and 110.89 mg/dl) as compared to T_0 and T_1 group (165.01 and 146.48 mg/dl). The values of HDL in T_2 and T_3 (82.02 and 83.13mg/dl) were significantly higher as compared to T_0 and T_1 group (47.42 and 57.47 mg/dl). The LDL level was significantly ($P < 0.01$) lowest in T_2 (18.27 ± 3.85 mg/dl) and highest in control group (96.85 ± 4.88 mg/dl). The serum triglycerides level was significantly ($P < 0.05$) lowest in T_3 (50.43 ± 3.11 mg/dl) and T_2 (53.74 ± 2.76 mg/dl) and highest in control group (103.74 ± 2.91 mg/dl). The ALT levels was significantly ($P < 0.05$) lowest in T_2 (24.27 ± 0.55 U/ml) and highest in control group (26.29 ± 0.74 U/ml).

Thus, it is concluded that garlic powder can be used effectively as prebiotic in feed at the level of 1.0% to improve the overall performance of broiler chicken.

Managemental approach in alleviating microbial diseases of commercial broilers in Kamrup (metro) and Kamrup (rural) districts of Assam

Dr. Mridul Kumar Borah

A study was conducted in order to find out the common microbial diseases of the broiler farms and managemental influence on their occurrences if any, in two districts of Assam namely, Kamrup (Metro) and Kamrup (Rural) district. For the present study, a total of 100 farms were selected randomly, 50 from each district, with the condition that they have a total raising capacity of at least 500 chicks per batch. The data were collected during the period from end November, 2013 to mid December, 2014.

The clinical signs of the diseased flocks were recorded separately for each farm in separate sheet. Farmers were interviewed for any other symptoms they noticed earlier too. In case of any mortality during the personal visit it was either opened on the spot or taken to Department of Veterinary Pathology, College of Veterinary Science, Khanapara, Guwahati-22, for post mortem examination and the gross pathological changes were noted. From the affected flock blood samples were collected for microbiological study in the Department of Veterinary Microbiology, College of Veterinary Science, Khanapara, Guwahati-22. The data so obtained were then correlated to the various managemental components namely, Housing, Litter material, Managemental operation, Biosecurity measure and Farmers' knowledge about poultry.

The study showed that broiler farms during the period of study encountered various microbial diseases where highest incidence recorded was Hydropericardium syndrome (HPS) (16.75%) followed by Omphalitis (13.40%), Colibacillosis (11.11%), Chronic Respiratory Disease (CRD) (10.93), Infectious Bursal Disease (IBD) (10.58%), Bronchitis (9.88%), Necrotic Enteritis (6.35%), Bacillary White Diarrhoea (5.11%), Newcastle Disease (4.59%), Brooder Pneumonia (3.70%), Gangrenous Dermatitis (2.82%), Laryngotracheitis (2.12%), Coryza (1.59%) and Bumble foot (1.06%). Kamrup (Rural) district encountered comparatively higher disease incidences than Kamrup (Metro) district. Highest disease incidence was

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recorded in dome shaped house (38.80%) with the least incidence in Gable type houses (13.40%). Disease occur more in Kutcha floor (74.07%). Disease occurred more (67.66%) in house which was constructed in North-South direction. Also there is more incidence (41.16%) of diseases when the distance between farm was within 100 meters. Similarly 62% Paddy Husk users faced highest total incidence of microbial diseases (55.20%). Those, reusing the litter faced slightly lower incidence of diseases (46.38%) than fresh litter users (53.62%). Disposal of litter material within the farm premises showed to have highest microbial disease incidence. In terms of management farms following Multiple batch pattern of placement encountered the highest incidence of microbial diseases (66.49%). High disease occurrences was noted in higher stocking density (Floor space <1sq ft) (70.90%) and those farms Sharing Workers (55.20%) and Equipments (64.02%). Disease incidences of microbial origin are slightly higher in the farm with no protective Fenced boundary (58.37%), without Foot Bath (91%) and without Drainage facility (77.24%). Mode of disposal of biodegradables showed that those disposing Inside the campus in open suffered the highest incidences (49.73%) and those following burial the least (5.64%). In terms of disinfection the highest incidences were recorded in the farms where it is practiced only before placement of new flock (67.01%) as against the lowest record of the Weekly practisers (5.11%). Vaccination showed that only three vaccines are used by the farmers and despite vaccination farmers faces outbreak of Newcastle Disease (3.88%), Infectious Bursal Disease (7.93%) and Infectious Bronchitis (3.70%).

As far as poultry knowledge of the farmers is considered 92% farmers know that germs are the causes of disease and disease spread through contact about 45%, through air about 22%, through water about 20%, Fomites about 11%. Most of the farmers (89%) did not have any formal training on broiler farming. However, most of them (87%) were aware that some of the poultry diseases may be transmitted to human also.

Sex separate rearing in relation to the performance of commercial broiler chicken

Dr. Sanghamitra Kalita

An experiment was carried out on the topic “Sex separate rearing in relation to the performance on commercial broiler chicken”. 210 day-old commercial broiler chicks (Cobb-400 Y) having similar body weight from a single hatch was procured. The straight run commercial broiler chicks were reared from day-old to 21 days of age under standard management practices. Sex separation was done by observing the early appearance of comb in case of male birds. At 22 days of age, 180 birds were randomly selected from the flock and it was categorized into three treatment groups *viz.*, T₀ (60 Straight run or mixed sex i.e. 30 males and 30 females), T₁ (60 males) and T₂ (60 females). Each group was divided into 3 replicates with 20 chicks each. The chicks were wing banded and reared under deep litter system of management throughout the experimental period following standard management practices. All the birds were offered *ad libitum* drinking water and commercial feed throughout the experimental period.

During the 6 weeks’ trial period following parameters were studied: body weight, body weight gain, feed intake, feed conversion ratio, broiler performance efficiency index, cost of production, uniformity, survivability, carcass characteristics and organoleptic evaluation.

The final body weight per broiler was highest in T₁ (male) group (2509.17 ± 22.24 g) followed by T₀ (mixed-sex) group (2322.11 ± 33.38 g) and T₂ (female) group (2226.67 ± 19.64 g). The highest weight gains at 6th week was observed in T₂ (female) group (281.50 ± 15.41 g) followed by T₁ (male) (254.50 ± 18.31g) group and T₀ (mixed-sex) (230.87 ± 12.07 g) group. At 4th and 5th week of age the weekly average feed intake was highest in T₁ (male) group (915.66 and 1509.55 g) followed by T₀ (mixed-sex) group (888.83 and 1410.5g) and T₂ (female) group (824.66 and 1234.5 g). At 6th week of age the highest feed intake was observed in T₂ (female) group (607.166g) followed by T₀ (mixed-sex) (495.33g) and T₁ (male) (488 g) group.

The overall F.C.R was best in T₁ (male) group (1.77, 1.90 and 1.91) followed by T₀ (mixed-sex) (1.77, 1.92 and 2.11) and T₂ (female) (1.83, 1.94 and 2.15) group.

Abstract of M. V. Sc. Thesis

Department : Poultry Science

Major Advisor : Dr. Kula Prasad Kalita

Broiler performance efficiency index was found to be highest in T₁ (male) group (108.15) followed by T₀ (mixed-sex) (98.81) and T₂ (female) group (87.26). The livability was cent percent in T₁ (male) and T₂ (female) group. In T₀ (mixed-sex) livability was 85 percent.

The cost of production per broiler was higher in T₁ (male) group compared to T₂ (female) and T₀ (mixed-sex) respectively. However, the gross profit per broiler was higher by Rs. 23.21 in T₁ (male) group and Rs.14.53 in T₀ (mixed-sex) as compared to T₂ (female) group.

At the final body weight the highest uniformity was observed in T₁ (male) (90%) group compared to T₂ (female) (80%) and T₀ (mixed-sex) (70.17 %) respectively. The carcass quality traits namely live weight, gizzard percent yield and heart percent yield of different treatment groups did not differ significantly and dressed percent yield, liver percent yield and gizzard percent yield was differed significantly. The dressed percent yield was significantly higher in T₁ (male) group (71.56 ± 0.01) compared to T₀ (mixed-sex) (70.22 ± 0.05) and T₂ (female) (69.31 ± 0.07). The highest liver percent yield was observed in T₁ (male) group (1.74 ± 0.13), T₂ (female) (1.66 ± 0.03) and T₀ (mixed-sex) (1.33 ± 0.03). Significantly higher value of giblet was observed in T₁ (male) group (3.17 ± 0.14) compared to T₂ (female) (3.06 ± 0.07) and T₀ (mixed-sex) (2.70 ± 0.05). Among the cut up parts the neck and breast percent yield showed the significant difference. The highest neck percent yield was observed in T₀ (mixed sex) (5.43 ± 0.24) compared to T₁ (male) (4.82 ± 0.10) and T₂ (female) (4.54 ± 0.12) compared to T₀ (mixed-sex) (36.02 ± 0.58) and T₁ (male) (33.75 ± 0.79).

The average score for organoleptic character such as tenderness, juiciness, and overall acceptability of meat of broilers observed no significant difference ($P < 0.05$) except flavor. The flavor was significantly higher in T₁ (male) group (7.26 ± 0.09) as compared to T₀ (mixed-sex) (7.16 ± 0.07) and T₂ (female) (6.89 ± 0.08) group.

Hypothyroidism in dog and its therapeutic management

Dr. Amit Kr Pandey

The present work was conducted to study the prevalence of hypothyroidism, haemato-biochemical alteration and its therapeutic management in the affected dogs.

The study was conducted from December 2014 to May 2016 at TVCC and the samples were collected from suspected dogs based on history and clinical signs. A total of 9695 dogs were registered during the study period of which 56 dogs resulted positive and the overall prevalence was recorded as 0.57 per cent. The highest prevalence of 11.60 per cent was recorded in the age group of 1.5 to 5 years, with the Golden Retriever dogs documenting the highest prevalence of 13.70 per cent. The duly noted clinical signs were bilateral symmetrical alopecia, erythema, pruritus, scaling, seborrhoea, folliculitis, weight gain, pyoderma, crusts, hyperpigmentation, hyperkeratosis and comedone. The hormonal study disclosed a significant decrease in the level of T_4 and T_3 , and significant increase in the levels of total serum creatine phosphokinase and total serum cholesterol. During the present study, it was found that out of the three treatment schedules, levothyroxine sodium, cephalixin, fluconazole, with kiskin and san coat along with exercise was found to be best followed by levothyroxine sodium, cephalixin, fluconazole with kiskin and san coat and levothyroxine sodium alone on the basis of clinical remission.

Abstract of M. V. Sc. Thesis

Department : Veterinary Clinical Medicine, Ethics and Jurisprudence

Major Advisor : Dr. A. Phukan

Current trend of demodicosis in dog: epidemiology, haemato-biochemical changes and therapeutic management

Dr. Dipsika Pradhan

The present work was performed to study the current trend of demodicosis in dog enclosing the aspects of epidemiology, haemato-biochemical changes and therapeutic management. A total of 166 dogs with dermatitis were examined for *Demodex* infestation, of which 28 dogs resulted positive and the overall prevalence was recorded as 16.87 per cent. Among the diseased dogs, localized form was presented in 32.14 per cent and generalized form was presented in 67.86 per cent of cases. In the present study, there were no significant effects ($P>0.05$) of season, month and sex in the prevalence of the disease. A significant difference ($P<0.05$) in the variation in age wise and breed wise prevalence was revealed. The highest prevalence of 28.57 per cent was recorded in the age group of above 6 month to 1 year, with pure-bred dogs documenting the highest prevalence of 19.66 per cent. The duly noted clinical signs were alopecia, erythema, scaling, pruritis, follicular papules and pustules, crusts, comedones, seborrhea, lichenification and ulceration, with lesions predominantly observed in periocular, trunk and forelimb regions. The haemato-biochemical study disclosed a significant decrease ($P<0.01$) in the levels of haemoglobin, packed cell volume, total erythrocyte count, lymphocytes, total serum protein and serum albumin, and a significant increase ($P<0.01$) in the levels of total leukocyte count, neutrophils, eosinophils, alanine transaminase, aspartate transaminase, alkaline phosphatase, and serum globulin. During the present study, the treatment regimens compared were 10% imidacloprid with 2.5% moxidectin spot-on solution, ivermectin injection, and a combination of ivermectin injection and amitraz wash. Although all the treatment protocols were found to be effective in the management of canine demodicosis, spot-on solution of 10% imidacloprid with 2.5% moxidectin, and a combination of ivermectin injection and amitraz proved to be comparatively better in clinical and parasitological remission. However, combined use of ivermectin injections and amitraz as external wash was found to be the most cost effective treatment of canine demodicosis.

Abstract of M. V. Sc. Thesis

Department : Veterinary Clinical Medicine, Ethics and Jurisprudence

Major Advisor : Dr. A. Phukan

Molecular characterisation of extended spectrum beta lactamase (esbl) producing *escherichia coli* in poultry

Dr. (Ms) Ernestine Basaiawmoit

The study was undertaken to isolate and identify *Escherichia coli* from poultry with or without the history of diarrhoea and to determine the occurrence of extended spectrum beta-lactamase (ESBL) producing *Escherichia coli* in Assam and Meghalaya, India. A total of 182 (67.40%) samples yielded *E. coli* which included 106 (67.08%) samples from Assam and 76 (67.85%) samples from Meghalaya. The samples were obtained from cloacal swabs, faecal samples and intestinal contents of diarrhoeic and non-diarrhoeic poultry birds. All the 182 strains of *E. coli* isolated from diarrhoeic and non-diarrhoeic birds were subjected to antibiotic susceptibility test and were phenotypically confirmed to be ESBL producers by DDST method. A total of 39 (21.42%) samples were confirmed as ESBL producers. Out of these, 19 (17.92%) samples were from Assam and 20 (26.31%) samples were from Meghalaya.

Further, the extended-spectrum beta-lactamase genes *viz.*, bla_{CTX-M} , bla_{TEM} and bla_{SHV} were detected by Polymerase Chain Reaction from the phenotypically confirmed isolates. 17 (9.34%) isolates were found to be positive for at least one of the two resistance genes, *viz.* bla_{TEM} (686bp) and bla_{CTX-M} (585bp). None of the isolates were found to contain the bla_{SHV} gene. Of the 17 isolates, 5 (2.75%) were found to be positive for bla_{TEM} gene, of which 3 (1.65%) were from Assam and 2 (1.09%) from Meghalaya. Similarly, 12 (6.59%) were found to be positive for bla_{CTX-M} gene, of which 5 (2.75%) were from Assam and 7 (3.85%) were from Meghalaya. Prevalence of the resistant genes in poultry birds was found to be slightly higher in Meghalaya in comparison to Assam

Abstract of M. V. Sc. Thesis
Department : Veterinary Microbiology
Major Advisor : : Dr. A.K. Hazarika

Molecular and biological characterization of wild strains of duck plague virus

Dr. Hiramoni Sarmah

Duck plague or duck viral enteritis is an acute and contagious viral disease of ducks, geese swan and other waterfowl. The disease is responsible for significant economic losses in duck husbandry due to decrease in egg production, condemnation and mortality in duck. The present study was undertaken to study the molecular and biological characterization of wild strains of duck plague virus. In the present study 6 wild strains of DPV (DP/As-Km/0010, DP/As-Nal/0012, DP/As-Km/0016, DP/As-Km/0019, DP/As-By/0022, DP/As-Km/0025) were revived in ducklings. All the inoculated ducklings developed distinct clinical signs like nasal discharge, lacrimation, puffed eyelids, greenish watery diarrhea, soiled vents and sometimes sudden death etc. Post mortem examination revealed gross lesions in brain, oesophagus, liver, spleen, heart, bursa of Fabricius and in intestine. Presence of viral nucleic acid was detected by PCR and detection of duck plague virus antigen in post mortem samples was done with indirect FAT. All the isolates revived in ducklings were further propagated in DEF upto 5th serial passage. The clear CPE was observed from 1st passage onwards.

On the basis of DID_{50} and $TCID_{50}$, a VV strain of DPV was selected for further study. DID_{50} of DP/As-Km/0019 was found to be 10^{-2} and DID_{50} in case of DP/As-By/0022 and DP/As-Km/0025 was 10^{-1} . Highest $TCID_{50}$ was found to be $10^{6.33}$ in case of DP/As-Km/0019. On the basis of these parameters (DID_{50} , $TCID_{50}$). The strain DP/As-Km/0019 was selected as VV strain of DPV.

The pathodynamics of the VV strain was studied by using mean clinical and pathological scores and virus excretion pattern in blood and other clinical samples like tracheal swab and cloacal swab, nasal and ocular swab. Highest mean pathological score was observed in Liver and oesophagus (2.33 ± 0.51) and lowest was observed in thymus and bursa (1.00 ± 0.00). Molecular characterization of selected VV strain of DPV was done by sequencing two genes (*UL30*, *US10*) from different region of the virus. Phylogenetic analysis showed close relation with other isolates of DPV and vaccine strain. VNT_{50} titre of VV strain of DPV (DP/As-Km/0019) was found to be 1:223 which is similar to VNT_{50} of the

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Department : Veterinary Microbiology

Major Advisor : : Dr. S.K. Das

vaccine strain and for other moderate virulent strains (DP/As-By/0022 and DP/As-Km/0025), VNT_{50} was 1:188 and 1:112 respectively.

The selected VV strain of duck plague virus was adapted in 9-11 days old embryonated chicken eggs. Different changes like thickening of CAM with extensive haemorrhages, Haemorrhage and congestion throughout the body of infected embryos were observed from 3rd passage onwards. The chicken embryo adapted VV wild strain of DPV was again adapted and propagated in the CEF upto 10th serial passage. The most common CPEs were rounding of cell, vaculation in the cell, syncytia formation and finally detachment of cell monolayer which was observed from 3rd passage onwards

Sero-surveillance and molecular characterization of infectious bursal disease from poultry of assam

Dr. Manisha Medhi

Infectious Bursal disease (IBD) is a highly infectious and contagious disease that primarily affects chicks of 3-6 weeks of age causing immunosuppression by affecting the immune system of poultry where it damages the Bursa of Fabricius, thymus etc. The disease has great economic importance in both broiler and pullet growers as the affected birds are susceptible to minor environmental pathogens leading to high morbidity and mortality. The disease is caused by double stranded bisegmented IBD virus (IBDV) that comes under the genus *Avibirnavirus* of family *Birnaviridae*. The best way to prevent the disease is by vaccination and good managemental practices. However, there are frequent reports of the occurrence of the disease from different parts of India including Assam. So the present study was aimed to assess the infection by detecting presence of antibodies in the serum samples through indirect Enzyme linked immuno sorbent assay (ELISA) which were randomly collected from unvaccinated local birds from different parts of Assam and detection of virus from clinically affected tissue samples by direct Reverse Transcription- Polymerase Chain Reaction (RT-PCR) and by integrated cell culture PCR (ICC-PCR) after isolating it in the chicken embryo fibroblast (CEF) and Vero cell line.

A total of 1093 sera samples were randomly collected from 19 different districts of Assam and screened for presence of antibodies against IBDV using commercial Indirect-ELISA kit. Out of which, 306 samples (27.99%) were found positive. Based on different age groups, collected serum samples were categorized out of which 2-4 weeks of age group meaning young chicks were found to contain antibodies against IBDV.

Clinical samples were collected from different places of Assam which shown characteristic necropsy lesion for IBD infection. Total 23 numbers of clinical samples were collected for diagnosis of IBDV antigen through RT-PCR with specific set of primers. Out of which, 12 samples (52.173%) were confirmed for the presence of IBDV. Samples positive in PCR were stained with DNA loading dye and run under polyacrylamide gel electrophoresis along with DNA ladder. A distinct band was observed at 643 bp size region.

Representative three PCR amplicon from Nalbari, Hajo and Bijoynagar were further sequenced via an out source and a phylogenetic tree was constructed by maximum likelihood

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Department : Veterinary Microbiology

Major Advisor : Dr. Sutopa Das

method along with other IBDV isolates reported from various part of the world. Percent identities were analyzed within the isolates reported from our study, from different parts of India and other parts of the world.

IBDV can be well adapted in CEF and Vero cells. Virus was passaged for five times in primary chicken embryo fibroblast cells before adaptation in Vero cells. Cytopathic effects (CPE) were observed from second passage onwards in both the cell line. IBDV was passaged in both Vero and CEF cells for at least five times and the cell lysates of each passage were checked by performing Integrated Cell Culture -PCR. All positive samples gave similar results to the pairs of primers which were used for the detection of IBDV nucleic acid in the tissue samples. The present study confirms the prevalence of the disease in poultry population of Assam.

Immuno protective potential of partially purified toxoids of *clostridium difficile* in mice

Dr. Parishmita Hazarika

The present study was undertaken to characterize *Clostridium difficile* toxins, in respect to the influence of glucose and stages of growth (incubation period) on release of toxins, cytotoxic activities in Vero cells and the immune-protective potential of partially purified toxoids of *C. difficile* in mice. A total of 10 isolates of *C. difficile* from the repository of Department of Microbiology, College of Veterinary Science, Khanapara, Guwahati were revived and reconfirmed, based on morphological and staining characteristics, and molecular detection of *gluD* gene. Characterization of all the 10 isolates, in respect to certain virulence associated genes revealed presence of *tcdA* (toxin A) and *tcdB* (toxin B) genes in three strains of *C. difficile* each. Another three strains could reveal *tcdA* and *tcdB* together in the same isolate, while one strain was found to be negative for *tcdA* and *tcdB* gene. The protein concentration in the cell free supernatant of toxin A and toxin B positive isolate of *C. difficile* growth in nutrient media without addition of glucose was found to increase with advancement of growth phases and reached the highest conc. during the decline phase of 48 hr (5.24 µg/µl and 5.06 µg/µl, respectively). Similar trend of protein conc. was observed in the cell free supernatants of both the isolates, in presence of glucose in the nutrient media. However, the presence of glucose was found to suppress the protein conc. in the cell free supernatants of toxin A and toxin B of *C. difficile* (3.49 µg/µl and 3.99 µg/µl, respectively). The protein profile of toxin A positive *C. difficile* isolate, in presence of glucose could show 10 protein bands with mol. wt. ranging from 25 to 135 kDa, while the same isolates in absence of glucose in nutrient media revealed 16 protein bands within the range of 22.4 kDa and 100.0 kDa. Similarly, the isolate positive for toxin B revealed 8 protein bands of 35 to 135 kDa range in the cell free supernatant with addition of glucose, while the growth of the same isolate in nutrient media without glucose could exhibit 15 protein bands within the range of mol. wt. 20.0 to 135.0 kDa.

Toxin A, B and AB of *C. difficile* were extracted in thioglycolate media without addition of glucose at 48 hr of incubation and were partially purified by ammonium sulphate

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Department : Veterinary Microbiology

Major Advisor : Dr. R.K. Sharma

precipitation. The partially purified toxins were found to be cytotoxic for Vero cells at two dilution (1:10 and 1:100). Among the three toxins, toxin B was found to be more prominent cytotoxic activities than the other two toxins, A and AB. Complete detoxification was confirmed by testing the monolayer of Vero cells for no cytopathic effect.

The immune-protective efficacy of the three toxoid vaccine preparations were tested by immunization of groups of mice with challenge trial on 34th day of post immunization revealed variable protection level. The immunized groups of mice were found to have 100.0 percent protection against homologous challenge dose of 6.0×10^8 CFU. However, the groups of mice, immunized with toxoid A and B could show 75.0 percent protection against challenge with 9.0×10^8 CFU of homologous strains of *C. difficile*. On the other hand, the vaccine prepared from toxoid AB could confer only 25.0 percent protection in mice, following homologous challenge with 9.0×10^8 CFU. The immunized affected mice, following challenge with 9.0×10^8 CFU dose could show clinical symptoms, suggestive of intestinal disorder, with any mortality. All the affected immunized mice with clinical symptoms were found to recover by the end of the challenge study. The challenge trial with 6.0×10^8 and 9.0×10^8 CFU / dose of homologous strain of *C. difficile* could produce 100.0 percent mortality in the mice of control group during 48 hr of post challenge observation. The affected mice of the control group revealed an initial development of clinical symptoms, suggesting intestinal infection during 24 hr of observation and all the clinically affected mice were died within 48 hr of challenge. Mortality in mice of control group due to inoculated strain of *C. difficile* was confirmed by re-isolation of the inoculated strains from the affected liver as well as haemorrhagic part of intestine and intestinal contents

Expression of certain cytokines in relation to the persistence of foot and mouth disease virus type 'o' in cattle

Dr. Sangeeta Baro

The present study was undertaken to detect foot-and-mouth disease virus serotype 'O' in oro-pharyngeal fluid (OP fluid) and to quantify cytokines IL-1 α , IL-1 β , IFN- α , TNF- α in blood of recovered animal by Real time PCR. Typing of infected clinical samples suspected for FMDV was done by sandwich ELISA followed by simultaneous detection of serotype by multiplex-PCR and detection of antibodies against NSP was done by DIVA ELISA in serum. The Relative Quantification (RQ) values for IL-1 α gene during outbreak was 1.383 ± 0.405 and after one month of post infection the RQ value was found to be 2.0223 ± 0.592 which was found to be upregulated. Subsequently after three month of post infection the expression level of IL-1 α was 23.8788 ± 0.993 which was upregulated. Later the expression level of IL-1 α at 6 month and nine month were 1.0223 ± 0.299 and 1.9899 ± 0.565 respectively. IL-1 β gene expression was studied and the RQ values was found to be 0.0097 ± 0.002 during one month of post infection which is down regulated and subsequently become undetectable during 3 month and in subsequent period of study period. The expression of IL-1 β down regulation was observed in month 1 of post infection, whereas in subsequent period of the study the IL-1 β was undetectable. Expression of IFN- α gene during outbreak was 1.0131 ± 0.296 . Up regulation of IFN- α in the 15 animals were found during 1, 3, 6 and 9 month respectively. The mRNA expression of TNF- α was studied and found to be upregulated during outbreak and during 1, 3, 6 and 9 month and the level of expression was 1.2361 ± 0.362 , 1.6346 ± 0.478 , 3.0521 ± 0.893 , 2.1447 ± 0.628 and 1.3484 ± 0.394 respectively. The present study thus supports the notion that real-time PCR is a powerful technique for reliable detection of persistent FMDV in recovered animals. The findings also indicated that IL-1 α , IFN- α and TNF- α genes were gradually upregulated upto 3 months but IL-1 β found to be down regulated with progression of recovery of the animals from the disease. Down regulation of the genes may be due to subside of the acute infection.

Abstract of M. V. Sc. Thesis

Department : Veterinary Microbiology

Major Advisor : Dr. K. Sharma

Comprehensive study of eimerian coccidia and coccidiosis in chicken

Dr. Aditi Kalita

A field study cum laboratory investigation was conducted to assess the field situation in respect of coccidia and coccidiosis in broiler chickens of Assam. One year study beginning from June, 2015 to May, 2016 included a questionnaire based interview on the disease problem with farmers and veterinary consultants during the visits to 48 randomly selected integrated and non-integrated commercial small scale farms under deep litter system of management in the districts of undivided Kamrup, Morigaon and Darrang. Faecal and litter sample examination, on-farm necropsy, identification of species of coccidia prevalent and their pathogenicity study alone or in association with common bacterial pathogens *Escherichia coli* and *Clostridium perfringens* were the other parameters included in the study. The farmers adopting broiler farming on commercial basis were mostly non-matriculate and had no prior training on poultry farming. A small section of farmers (27.08%) were found aware of the disease coccidiosis which was popularly called “Cocci” that occurred in the caecum of birds. These farmers viewed the problem of coccidiosis in their farms as an occasional occurrence in the recent past.

Microscopic examination of faecal, litter samples, intestinal contents, on farm necropsy and lesion study revealed 83.33% farms as coccidia positive. Out of 62.39% birds positive to coccidia oocysts, coccidiosis was diagnosed in 29.36% birds from 44.44% of the farms studied. Highest farm positivity to coccidia infection was recorded in Morigaon district (100%) followed by Darrang district (85.71%) and lowest in farms of Kamrup district (79.41%). However highest mortality due to coccidiosis in birds was recorded in Kamrup (36.62%) followed by Darrang (16.67%) and Morigaon (14.29%). Incidence of coccidia infection was higher in integration farms (29.17%) than that in non-integration farms (12.50%). Age wise, mortality in birds was recorded at 2-5 weeks of age with highest observation in 4 weeks aged birds. Coccidiosis was recorded in both dry and wet seasons of the year, the incidence being higher in wet season (22.92%) than in dry season (18.75%).

Identification of oocysts by Morphometry, Coccimorph tool and molecular methods employing nested PCR and multiplex PCR revealed presence of *E. tenella*, *E. acervulina*,

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Department : Veterinary Parasitology

Major Advisor : Dr. P.C. Sarmah

E. mitis and *E. maxima* in the birds of the study area. *E. tenella* (62.50%) was the most predominant in single or mixed infection followed by *E. acervulina* (23.43%), *E. mitis* (12.50%) and *E. maxima* (1.56%) in mixed infections. Morphometry could be a useful tool for identification of *Eimeria* species in field diagnosis, however it was not found as efficient as PCR.

E. tenella was recorded as most pathogenic causing 100% mortality in experimental birds when maintained on both commercial and non-commercial non-medicated feeds. Uniform mortality irrespective of feed type suggested acquisition of resistance by the *Eimeria* species to anticoccidial drugs incorporated as additive in the commercial feed.

Escherichia coli and *Clostridium perfringens* Type A were isolated from the coccidia positive enteritic intestines of broiler chickens from the study area. Indigenous chickens recorded infection with *Ascaridia galli* (34.65%), *Raillietina* species (34.65%), *Heterakis gallinarum* (19.80%), *Strongyloides* species (3.96%) and coccidia (1.98%). Presence of *Trichuris* eggs in faeces but without adult parasite in birds might indicate ingestion of *Trichuris* eggs during scavenging on domestic animal's dung.

Experimental infection with *Cl. perfringens* and *E. coli* preceded by coccidia infection resulted exhibition of clinical symptoms viz., depression, ruffled feather, huddling, droopiness, dozing, ceased feeding, bloody diarrhoea, frequent drinking and 66.67% mortality in *Cl. perfringens* infected birds against 16.67% mortality in *E. coli* infected birds. Body weight performance in these two groups were significantly affected at 2-4 weeks post infection in comparison to that observed in infected control groups and healthy control. It is suggested that coccidia infection might predispose the birds to colibacillosis and necrotic enteritis under field condition.

Histopathological alterations due to necrotic enteritis in birds primed with coccidia were degenerative changes like swelling, vacuolar degeneration, nuclear degeneration and necrosis of hepatocytes, congestion in sinusoids and blood vessels and infiltration with polymorphonuclear cells. Intestinal lesions observed due to coccidia infection alone or in concurrence with *Cl. perfringens* or *E. coli* infections were mostly coagulative necrosis, sloughing off villous epithelial cells, haemorrhage, cellular infiltrations and presence of developmental stages of coccidia.

Present findings suggest that coccidia is a common health problem in broiler chickens of Assam and the disease due to coccidia is influenced by lack of awareness, inadequate training on the part of farmers, managerial procedures applied and quality of commercial feed being used in the farms.

Studies on protozoan infection of domestic pigeon (*Columba livia domestica*) in Assam

Dr. Munmi Saikia

To understand the pattern of protozoan disease in domestic pigeon of Assam, a systematic study was conducted for a period of one year. A total of 324 blood samples of pigeons were screened for detection of haemoprotozoan infection and 173 birds were found positive by microscopic examination of blood smear, the overall percentage being 53.39%. Three different species of haemoprotozoa viz. *Haemoproteus columbae*, *Plasmodium relictum* and *Leucocytozoon* sp. were identified in pigeons of Assam. Prevalence of haemoprotozoan infection was analyzed on the basis of age and sex of birds and season of the year.

Examination of body of pigeons for the presence of pigeon fly, *Pseudolynchia canariensis*, the proven vector of *Haemoproteus columbae* showed 15.12% prevalence. Among the haemoprotozoan parasites, *Haemoproteus columbae* was predominant (29.93%) followed by *Plasmodium relictum* (21.29%) and *Leucocytozoon* sp. (2.16%) was recorded least. Morphologically, the three species were identified and confirmed. Age wise, infection was recorded highest in adults (61.81%) and least in squab. Sex wise, female (58.22%) showed more infection as compared to male birds. According to season infection rate was highest (72.55%) in premonsoon season. Microfilaria of *Bhaffilaria ladamii* was also detected during examination of a heart blood smear. Examination of a blood smear also revealed trophozoites of *Trichomonas gallinae* as an accidental case. Haematological parameters recorded in infected and non infected birds due to haemoprotozoan parasites showed significant differences in Hb, PCV, TEC, MCV, MCH, heterophils, lymphocytes, eosinophil values between the two groups.

The prevalence of *Trichomonas gallinae* infection based on throat swab smear examination was recorded as 26.85%. Age wise highest prevalence was found in squab (56.25%) and lowest percentage in adult (10.90%). Sex wise prevalence was higher in female (33.54%) than male birds. Season wise highest prevalence of *Trichomonas gallinae* was found in winter season (34%) and least infection was observed in post monsoon season (21.44%). Prevalence of mixed infection of *Haemoproteus columbae* and *Trichomonas gallinae* were highest (12.34%).

Abstract of M. V. Sc. Thesis

Department : Veterinary Parasitology

Major Advisor : Dr. K. Bhattacharjee

A total of 438 fresh pooled faecal samples were collected from pigeons irrespective of age and sex from four different districts of Assam viz. Kamrup (R), Kamrup (M), Lakhimpur and Dhemaji district for detection of coccidia and other associated helminthic infection. Overall prevalence of coccidia infection was found to be 38.81%. Species wise highest prevalence was recorded due to *Eimeria labbeana* (28.08%), followed by *Eimeria columbarum* (6.84%), *Eimeria columbae* (2.86%), *Isospora* sp.(0.22%). One unidentified *Eimeria* sp. (1.14%) was also put on record having morphological similarity to *E. duculai*. Mixed infection of coccidia and *Capillaria* sp. egg was detected highest (5.93%), followed by *Heterakis gallinarum* (3.19%), *Ascaridia columbae* (1.82%) and *Strongyloides avium* (0.91%). Season wise prevalence rate was recorded highest in premonsoon season (61.22%), followed by monsoon (34.78%), post monsoon (34.73%) and least in winter (28.46%).

Experimental infection of coccidia and *Trichomonas gallinae* done for establishment of pure infection revealed clinical symptoms and presence of parasites. Pathological alterations and the microscopical changes induced by *Trichomonas gallinae* and coccidia were studied on 55 carcasses of pigeons collected from temple premises and households of the present study area. At post mortem, 10 nos. of carcasses (18.18%) showed positive lesion due to coccidia and 14 nos. of carcasses (25.45%) showed lesions due to *Trichomonas gallinae*. Gross pathological changes due to coccidia were haemorrhagic and necrotic lesion in the intestinal mucosa, thickening of intestine and excessive mucus production and in case of *Trichomonas gallinae*, there was accumulation of greenish- white necrotic haemorrhagic lesions in the crop and oesophagus, and areas of necrosis in liver and gizzard.

Histopathology of intestinal mucosa revealed diffuse areas of haemorrhages and detection of oocysts of coccidia. In case of *Trichomonas gallinae* infection, microscopical changes seen in liver were coagulative necrosis and inflammatory reaction. Crop showed areas of moderate haemorrhage and congestion and varying amount of inflammation. In the lung, parenchyma showed thickening, congestion of blood vessels and haemorrhage. Myocardium of heart also showed congestion and focal areas of haemorrhage.

Polymerase chain reaction (PCR) was performed for identification of *cyt b* gene of *Haemoproteus columbae* using oligonucleotide primers. The positive blood samples produced amplification of 207bp. PCR for amplification of mt-*cyt b* gene of *Haemoproteus* spp. and *Plasmodium* spp. was also carried out and positive samples showed the clear band at 525 bp. Amplification of ITS-1 gene for detection of *Eimeria* genus was also performed and the positive samples showed clear band at 510 bp. Similarly, amplification of ITS1/5.8SrRNA/ITS2 gene was done for identification of *Trichomonas gallinae* and clear band at 290 bp was seen in positive samples. On the basis of phylogenetic analysis, local isolate (*Haemoproteus columbae*) is highly dissimilar from reported isolates of nearby and distant countries.

Tick fauna of goat with a reference to their vector status and acaricide resistance

Dr. Rabeya Begam

The present study on tick fauna of goat with a reference to their vector status and acaricide resistance was carried out with an aim to obtain current information on ticks, acaricidal resistance status in ticks and prevalence of haemoparasitic infection in goats reared under different management system from March 2015 to February 2016 in and around Guwahati. Observation on the prevalence of ticks revealed *Haemaphysalis bispinosa* as the only tick found infesting goat of the study area with 53.98% prevalence out of 528 animals examined and availability throughout the year. Tick prevalence was recorded highest in monsoon (71.67%) and lowest in winter (27.42%). Sex-wise, female were found mostly infested (61.59%) then male (8.00%). On the basis of distribution pattern on the body sites of goat ears were found mostly infested (89.82%) and least in tail (12.28%).

Acaricide resistance test by *in vitro* methods AITDD (Adult Immersion Test with Discriminating Doses) was performed against synthetic pyrethroid Deltamethrin which have been used continuously in GRS (Goat Research Station Burnihat) for the past 20 years and also against newly used synthetic pyrethroid Cypermethrin in *Haemaphysalis bispinosa* tick collected from GRS Burnihat. Ticks were also collected from Tetelia goat farm (unorganized farm) to detect acaricide resistance. Results revealed 80% resistance against Deltamethrin and 30% resistance against Cypermethrin in GRS Burnihat and 20% and 0% against Deltamethrin and Cypermethrin in Tetelia farm. Filter paper impregnation method was performed to determine the larvicidal efficacy of Deltamethrin and Cypermethrin at different (0.5, 0.1 and 0.2% concentration) showed 100% mortality of *H. bispinosa* larvae at 0.2% concentration of Deltamethrin in both GRS and Tetelia farm and 100% mortality at 0.2% concentration of Cypermethrin at GRS Burnihat but 100% mortality at 0.1 and 0.2% concentration of Cypermethrin in Tetelia farm as it was not used there as acaricide, indicating more larvicidal efficacy in Tetelia farm.

Prevalence of *Theileria* sp. was determined by microscopic examination of Giemsa stained blood smear and confirmation through PCR by using genus specific primers. Further sequencing confirms the presence of *Theileria luwenshuni* as the first caprine *Theileria* sp. prevalent in the goats of Assam.

Abstract of M. V. Sc. Thesis

Department : Veterinary Parasitology

Major Advisor : Dr. S.K. Talukdar

An attempt was made to determine the *T.luwenshuni* infection in the salivary gland of the *H.bispinosa* by PCR assay but was found negative as level of parasitaemia exists in the blood sample less than 0.0001%. So it was not possible to trace the infection in the salivary gland of the tick.

A total of 16 clinical theileriasis cases caused by *T.luwenshuni* were recorded during the period of study irrespective of different breeds of goats (9 cross bred , 7 Assam local). All the clinical cases were recorded in unorganized farms and smallholders of goats under semi intensive system of management. Based on the status of the animal clinical theileriasis was recorded in 3 lactating goats and one male buck that was having recent history of castration. Animals positive for clinical theileriasis showed symptoms of anorexia ,depression, fever ,pale mucous membrane and weakness. Haematological changes revealed anaemia in goats.

In the present study 39.87% goats irrespective of different breeds were recorded with sub clinical theileriosis without showing any clinical symptoms. Haematological findings revealed moderate anaemia in subclinical carrier goat in comparison to healthy animals. This suggests that *Theileria luwenshuni* is first time emerging as a new *Theileria* species responsible for both clinical theileriasis and subclinical theileriosis in the goats of Assam

Prevalence, pathology and molecular studies of peste des petits ruminants in goats of Assam

Dr. Muzaharul Islam

Peste des petits ruminants is an acute, febrile, emerging and economically important viral disease of goats having high morbidity and mortality rate. In the present investigation, 456 serum samples collected from affected and apparently healthy goats from different places of Assam were screened for seroprevalence of PPR in goats by HI test and c ELISA test. Out of 456 serum samples screened, PPR viral antibody could be detected in 269 samples by HI test (145 serum samples from affected goats and 124 from apparently healthy goats) and 209 samples by c ELISA test (136 from affected goats and 73 from apparently healthy goats). 60 serum samples (9 from affected goats and 51 from apparently healthy goats) showed positive in HI test but were found negative by c ELISA test. In comparative study it was revealed that HI test was more sensitive than c ELISA.

The haematological study of 26 affected goats showed significant increase in total erythrocyte count, haemoglobin, packed cell volume and significant decrease in total leucocytes count. Lymphopenia was constant finding in differential leucocytes count.

Biochemical study revealed significant decrease in serum protein and significant increase in serum potassium level, with nonsignificant increase of serum sodium level.

All the 10 necropsied carcasses showed emaciation and dehydration with soiled hindquarters and sunken eye balls. Ulcerative lesions on gum, lips, dental pad and tongue, enteritis and linear haemorrhages on the crests of the folds of large intestine were invariably observed. The liver was enlarged with engorged gall bladder. Spleen and lymph nodes were enlarged. The lungs showed congestion and consolidation of anterior and cardiac lobes with emphysema in diaphragmatic lobes. On cut section, lung showed large quantities of white frothy exudate particularly in the bronchi.

The histopathological study showed degeneration, necrosis, ulceration and sloughing off lining epithelium in lips, tongue, small intestine and large intestine. Below the ulcerated areas severe infiltration of mononuclear and polymorphonuclear cells were observed. Some cells of stratum granulosum showed presence of intracytoplasmic eosinophilic inclusion

Abstract of M. V. Sc. Thesis

Department : Veterinary Pathology

Major Advisor : Dr. D. C. Pathak

bodies. Hepatocytes showed coagulative necrosis with cytoplasmic and nuclear degeneration. The lungs showed broncho-interstitial pneumonia and presence of intracytoplasmic eosinophilic inclusion bodies. Renal tubular degeneration with coagulative necrosis and atrophy of glomeruli were observed. Edema in both the cortical and medullary areas with severe depletion lymphocytes was observed in the lymph node. Syncytial giant cells were also found in the lymph nodes. Spleen showed depletion of lymphoid population. Some lymphoid follicles were completely destroyed, leaving cystic cavities.

In RT-PCR, out of 79 post mortem samples, 58 showed amplification of PPR viral nucleic acid at 463 bp for N gene using N gene specific primers.

Studies on the prevalence, pathology and molecular diagnosis of duck virus enteritis in Assam

Dr. Parag Jyoti Sahariah

Duck plague or duck viral enteritis is an acute and contagious and economically important viral disease of ducks having high morbidity and mortality rate. A total thirty nos. of duck plague outbreaks occurring in certain district of Assam were attended during the period of February, 2014 to March 2016. Out of a total 5252 ducks at risk, 2956 (56.28%) were affected clinically and 2449 (46.62%) died. The overall morbidity and mortality were 56.28% and 46.62% respectively, however the cause specific mortality for DP in the present study was found to be 82.85%. Highest mortality was recorded in duckling (55.80%) followed by grower (51.24%) and adult ducks (35.43%) respectively.

In the present investigation, altogether 445 serum samples were collected from the ducks from affected as well as some other ducks from the surrounding areas of the outbreak from different parts of Assam. All the serum samples were subjected to indirect ELISA test for detection of the duck plague viral antibody. Out of the total 445 serum samples tested for detection of DP viral antibody, 171 (38.42%) serum samples showed positive in ELISA. A total of 131 numbers of duck carcasses were subjected to necropsy examination. Externally, the carcasses were markedly emaciated, the vent was soiled with greenish-white faecal materials and ocular-nasal discharges were also observed. Grossly, the vascular changes were invariably present in all the visceral organs including the brain. The longitudinal folds of the esophagus showed presence of thick yellowish-white patchy diphtheritic membrane. In a few cases, the intestinal annular bands appeared as intensely reddened rings due to haemorrhages and were visible from external and internal surfaces. The liver was moderately enlarged with presence of scattered petechiae and focal greyish-white necrotic areas. The coronary vessels of the heart were engorged. There was presence of petechiae to echymotic haemorrhages in the epicardium particularly in and around the coronary groove, which give the heart a characteristic paint brush appearance.

Microscopic lesions were characterized by haemorrhages, congestion, degeneration and necrotic changes of the parenchymatous organs. Liver showed varying degrees of degeneration with multiple areas of focal coagulative necrosis. Intra-nuclear, eosinophilic

Abstract of M. V. Sc. Thesis

Department : Veterinary Pathology

Major Advisor : Dr. T.N. Upadhyaya

inclusion bodies with a distinct halo were observed inside the degenerated hepatocytes. Congestion of the blood vessels in the myocardium, haemorrhages between the muscle fibres and epicardium of heart were evident. There were rupture of the blood vascular wall and escape of blood into the surrounding musculature. The intestinal annular band showed congestion, haemorrhages and depletion of the lymphocytic cell populations. Lymphocytic depletion was also observed in the splenic and bursal follicles.

For in-situ demonstration of the DP virus Fluorescence Antibody Test was used. On fluorescent microscopy (FAT) DP virus was demonstrated in the liver, spleen, bursa of Fabricius, brain, thymus and intestinal annular band.

A total of 380 numbers of samples were collected from clinically affected (107) and dead ducks (273) for molecular diagnosis of the disease. Out of total 380 samples, 231 (84.61%) post mortem samples and 68 (63.55%) clinical samples showed positive for duck plague virus specific nucleic acid. Highest numbers of tissue samples that showed positive for PCR were liver (91.80%) and spleen (91.53%). In clinical samples 79.10 per cent was positive in whole blood, 40.91 percent was positive in cloacal swabs and 33.34 percent in tracheal swab.

In biochemical study, the ALT and AST activities in serum and tissues were significantly higher in DP affected ducks in comparison to the healthy ducks.

The virus could be successfully isolated in 9-11 day old duck embryos from the field samples. The infected CAM and the embryos showed extensive haemorrhages throughout the body. Embryopathy was observed within 4-8 days post infection.

Pathology of hepato-renal dysfunction in dogs (*Canis lupus familiaris*)

Dr. Tari Chubita Umesh

An investigation was carried out in naturally occurring hepatic and renal dysfunctions in dogs from in and around Guwahati city; to study the prevalence, clinical symptoms, hemato-biochemical changes, urine pathology, gross and histopathology and histoenzymic activity.

During the period from June, 2015 to May, 2016; a total of 9564 dogs were surveyed for incidence of hepato-renal dysfunction; 511(5.34%) were recorded as positive out of which 148 (1.55%) were positive for hepatic, 182 (1.82%) for renal and 181 (1.89%) for hepato-renal dysfunction. This revealed that hepato-renal dysfunction is prevalent in the dogs of Guwahati region. In a detailed examination of 155 dogs, 87 (56.13%) were reported positive for both hepatic and renal dysfunctions, out of which 31 (20%) were positive for hepatic, 35 (22.58%) for renal and 21 (13.54%) were positive for hepato-renal dysfunctions.

Hepatic dysfunction showed highest prevalence in pre-monsoon season (21.95%); renal dysfunction showed highest prevalence in winter season (27.02%) and hepato-renal dysfunction showed highest prevalence in post-monsoon (23.08%) season. The age-wise prevalence for hepatic dysfunction was highest in dogs belonging to age group of 1-3 years of age (33.33%), for renal dysfunction it was the age group of 9 years and above (37.04%) and in hepato-renal dysfunction highest prevalence was seen in the age group of 6-9 years (23.53%). Sex wise prevalence of hepatic dysfunction was higher in males (22.47%) whereas prevalence of renal dysfunction was higher in females (25.76%). But the prevalence of hepato-renal dysfunction was found to be almost equal in both males (13.48%) and females (13.64%). Breed wise prevalence of hepatic dysfunction was highest in German Shepherd breed, for renal dysfunction it was highest in Pug breed and for hepato-renal dysfunction, highest prevalence was also seen in German Shepherd breed. Mortality due to hepatic, renal and hepato-renal dysfunction was found to be 18.06%, with 3.87% mortality for hepatic dysfunction, 3.22% mortality for renal dysfunction and 10.96% mortality for hepato-renal dysfunction.

The clinical symptoms observed were elevated body temperature, anorexia, dehydration, dull and depressed appearance, rough body coat, pale mucous membrane,

Abstract of M. Sc. Theses

Department : Veterinary Pathology

Major Advisor : Dr. S. M. Tamuli

rapid pulse rate, shallow breathing, emaciation, anaemia, vomiting, diarrhoea, edema, melena, dark yellow to coffee colored urine. Some cases showed exclusive hepatic dysfunction signs of jaundice, ascites and abdominal pain. Some cases showed signs of renal dysfunction like stranguria, oliguria, urea breath and ulcers in the mouth.

Giemsa's stain and Modified Knott's method were used for detecting hemoparasites like *Babesia gibsoni*, *Babesia canis*, *Ehrlichia canis* and *Dirofilaria immitis* in the blood of affected dogs.

Hematological parameters like hemoglobin, packed cell volume, total erythrocyte count, mean corpuscular volume and mean corpuscular hemoglobin concentration revealed that dogs suffered from normocytic and normochromic anaemia. Biochemical markers included in liver and kidney function tests revealed that affected dogs showed mild to severe dysfunction of liver and kidneys.

Postmortem study revealed several changes in liver like centrilobular necrosis, bridging necrosis, steatosis, acute hepatitis, portal cirrhosis, Glissonian cirrhosis, biliary cirrhosis, cholangitis, hemosiderosis and glucocorticoid hepatopathy; and also in kidneys like acute interstitial nephritis, acute glomerulonephritis, chronic interstitial nephritis, membranous glomerulonephritis, membrano-proliferative glomerulonephritis, sclerotic glomerulonephritis, protein losing nephropathy, oxalate nephrosis, amyloidosis and calcification of tubules and glomeruli. Other organs like spleen, lungs, heart, stomach, intestine and brain were also observed to be affected. Three dogs revealed neoplastic changes like hepatocellular carcinoma, renal carcinoma and metastatic cancer of liver, kidneys and lungs.

Special stains like Masson's Trichome, Periodic acid Schiff's, Von Kossa's and Prussian blue stains were used to differentiate the specific changes in the affected tissues which did not appear very pronounced by routine staining methods.

Histoenzymic study revealed mild to no activity of LDH in degenerated cells and AKP enzyme showed moderate to high activity in the degenerated cells and sinusoidal spaces of the liver and kidneys.

Sero-prevalence of Japanese encephalitis in pigs correlating with mosquitoes and its human occurrence in some selected endemic localities of Assam

Dr. Aditya Baruah

Japanese encephalitis (JE) is a re-emerging mosquito-borne flaviviral zoonotic disease and a major cause for concern to childhood mortality and morbidity in countries of Southeast Asia including India. The disease has appeared in sporadic as well as epidemic forms since 1976 in Assam. The present study was envisaged to study the sero-prevalence of JE in pigs, the density pattern of mosquito vectors in JE endemic localities and to draw an association between the occurrence of JE in humans with serological studies in pigs and mosquito density.

A total of 335 blood samples of pigs were collected during the study period from 8 districts of Assam with special reference to Sivasagar district and Hajo area of Kamrup (Rural) district. Out of these many samples screened, 31.34% were found positive for antibodies against JEV. The highest sero-prevalence of JEV was observed during monsoon (50.40%) and no sero-prevalence was recorded in the months of December, January, February and March. Sex-wise sero-prevalence showed higher sero-prevalence in males (39.84%) than females (35.38%). Large Black cross breed of pigs (26.00%) were found to carry JEV infection. Based on the topography of the pig farms, the sero-positivity was recorded significantly higher in wet land (47.79%) than that of dry land (23.67%). JEV sero-prevalence of pigs in farms, which were located nearer to the rice fields and stagnant water showed significantly higher sero-positivity (39.77%) than the farms located away from the rice fields and stagnant water (22.01%). Based on rearing practices of pigs, the sero-positivity was recorded highest in free-range system (47.37%) and least in tethering (21.00%) practice. Distribution of JEV infection in pigs was recorded highest in Sivasagar district (35.20%) and least in Hajo area (9.89%) of Kamrup (Rural) district. An additional study on sero-prevalence of JEV in other domestic animals including horses, cattle and goats recorded a very high sero-positivity (60.00%) in horses.

Densities of *Cx. gelidus* (26.13%), *Cx. tritaeniorhynchus* (24.12%), *Armigeres spp.* (19.41%), *Cx. vishnui* (12.06%), *Mansonia spp* (8.54%) and *Cx. quinquefasciatus* were categorized as dominant species whereas, *Cx. whitmorei* and *Anopheles spp* (4.52 each) were categorized as sub-dominant species in the study area.

A positive correlation was observed among human JE cases, JEV sero-prevalence in pigs and mosquito density in Sivasagar district and Hajo area of Kamrup (Rural) district of Assam indicating an association existed among them.

Abstract of M. V. Sc. Thesis

Department : Veterinary Public Health

Major Advisor : Dr. R.A. Hazarika

Isolation and molecular characterization of *Escherichia coli* and *Salmonella* species from food animals

Dr. Sabita Debbarma

The present study was carried out for isolation and molecular characterization of *Escherichia coli* and *Salmonella* species from faecal and meat samples of food animals viz. cattle, pigs and poultry.

Among the samples of 3 species of food animals examined, highest recovery of *E. coli* and *Salmonella* was made from faecal and meat samples of pigs. All the 66 *E. coli* and 14 *Salmonella* isolates were confirmed by PCR using genus specific *uidA* and *hisJ* genes, respectively.

On serotyping, out of 66 *E. coli* isolates, 42 (63.64%) were typed into 13 different 'O' serogroups, 13 (19.70%) untypable and remaining 11 (16.67%) were identified as rough. Serogroup O84, O101, O118, O120 and O147 were predominant and serogroup O118 was recorded to be common in the samples of all 3 species of food animals.

Out of the 14 *Salmonella* isolates, 10 (71.43%) were recorded to be *Salmonella* Typhimurium and 2 (14.29% each) *S. Enteritidis* and *S. Miami*. *S. Typhimurium* was the most predominant serovar encountered in food animals and recorded to be the common serovar in pigs and poultry.

Twenty representative *E. coli* isolates from 20 different locations and 10 representative *Salmonella* Typhimurium isolates from 10 different locations were subjected for molecular typing by PCR targeting Repetitive Extragenic Palindromic (REP) sequences. On visual comparison, the multiple DNA fragments of *E. coli*, ranged in sizes between 100 to 1800 bp. Whereas, multiple DNA fragments of *Salmonella* Typhimurium, ranged in sizes between 100 to 1250 bp.

On analysis of dendrogram of *E. coli* isolates, the 17 band profiles were grouped into 2 major clusters viz. cluster A and cluster B at 4.88% similarity. The isolates that belonged to cluster A were specific for cattle and pigs while the cluster B were found to consist of only *E. coli* of poultry and pig origin. Likewise, dendrogram analysis of *Salmonella* Typhimurium isolates depicted 3 band profiles, which were grouped into two major clusters

Abstract of M. V. Sc. Thesis

Department : Veterinary Public Health

Major Advisor : Dr. R. A. Hazarika

viz. cluster A and cluster B. The isolates that belonged to cluster A were specific for pigs and poultry while the cluster B were found to consist of only *Salmonella* Typhimurium of pig origin.

Virulent *stx2* and *est* genes were detected from 5 and 3 *E. coli* isolates, respectively. Out of 5 *stx2* positive *E. coli* isolates, 2 belonged to serotype O2 and O126 and 3 belonged to serotype O84 and untypable (2) which were recovered from cattle and pig faecal samples, respectively. Out of 3 *est* positive *E. coli* isolates, 2 each belonged to serotype O147 and untypable and 1 belonged to serotype O101 which were recovered from cattle faecal and pork samples, respectively.

All the 14 isolates of *Salmonella* showed to bear *invA* gene indicating that all the isolates are invasive in nature.

Antimicrobial sensitivity pattern of all the 66 *E. coli* and 14 *Salmonella* isolates against 7 different antimicrobial agents showed highest sensitivity to chloramphenicol and ciprofloxacin and least sensitivity to ampicillin and cloxacillin

Prevalence of brucellosis in animals and man using conventional and molecular techniques

Dr. Samir Bikash Gogoi

Brucellosis is an infectious, economically ravaging reproductive disease of animal and one of the re-emerging major zoonoses with world-wide distribution. The present work was conducted (i) to screen the animals and human being of different age groups against brucellosis and (ii) to compare the different tests used for diagnosis of the disease. The study was conducted from February, 2015 to May, 2016. A total of 174 milk samples (152 milk sample from cattle and 22 from goat) and 773 serum samples (520, 138 and 115 serum samples from cattle, goat and pig respectively) were collected randomly from animals having history of clinical symptoms suspected to brucellosis as well as from apparently healthy animals of different age groups, from different districts of Assam were screened by MRT, RBPT, STAT and I-ELISA tests.

The prevalence of brucellosis was recorded, 10.53%, 12.69%, 13.08% and 13.84% in cattle by MRT, RBPT, STAT and I-ELISA respectively and 1.45% prevalence rate was recorded in goat by all the three serological tests. All the serum samples from pig found negative by serological tests.

Sex-wise higher prevalence rate was recorded in female cattle (14.06%), Age-wise highest prevalence recorded in the age group of 3-7 year (15.09%), breed-wise higher prevalence in crossbred cattle (20.00%) and cattle from organized farm recorded higher prevalence (15.65%) than unorganized farm by I-ELISA.

In case of goat, sex-wise prevalence rate was recorded in female was 2.15%, age-wise in the age group of 9-18 months of age was 4.76%, breed-wise prevalence found in indigenous breed of goat was 1.56% and prevalence rate recorded from unorganized farm was 1.82% by I-ELISA.

Prevalence rate on the basis of previous history or clinical symptoms recorded highest in case of aborted cattle (64.24%) followed by retention of placenta (47.13%) in cattle. In case of goat, prevalence rate recorded only in aborted goat by I-ELISA was 16.67%.

Abstract of M. V. Sc. Thesis

Department : Veterinary Public Health

Major Advisor : Dr. P. Hussain

The comparative efficacy of the different tests showed that maximum positive reactors was detected by I-ELISA (13.85%) followed by STAT (13.08%), RBPT (12.69%) and MRT (10.53%).

All the serum samples collected from human were showed negative by RBPT and STAT.

Brucella organism has been demonstrated in clinical samples of vaginal swab, uterine discharge and placenta by modified Ziehl Neelsen Stain.

In genus specific PCR, out of 47 clinical samples 6 showed amplification of Brucella bacterial nucleic acid, at 223bp for BCSP31 gene using gene specific primers.

Quality evaluation and detection of adulterants in raw and pasteurized milk marketed in and around Guwahati city

Dr. Smita Kakati

Milk in its natural form is a unique food for the nourishment of human being since time immemorial as it provides immunogenic protection and supplies nutrients in an easily digestible form than any other single food. With growing consumer concern for their daily consumables, there is increased awareness regarding safety and quality issues of milk and dairy products. The presence of adulterants, preservatives and pathogens of zoonotic importance is of primary concern in the effort of achieving a safe milk supply to the consumers. The present investigation was undertaken to study the quality, to determine the presence of different adulterants and preservatives as well as to assess the microbial load of raw and pasteurized milk marketed in and around Guwahati city. A total of 200 pooled milk samples were collected comprising of 8 samples each from 25 different locations in and around Guwahati city. Five different pasteurized packaged milk samples were collected from different dairies viz. Purabi Dairy, Amul Taaza, Central Dairy, Mother Dairy and Nandini. Physical evaluation of raw milk samples revealed mean titratable acidity of 0.14 - 0.20% lactic acid, pH of 5.60 - 6.91, specific gravity of 1.024 - 1.030, fat content of 1.57 - 3.55% and solids-not-fat (SNF) content of 6.634 - 8.350%; the respective values of which in packaged milk samples were 0.14 - 0.19% lactic acid, 6.10 - 6.70, 1.024 - 1.029, 3.00 - 3.05% and 8.515 - 8.580. Both raw and packaged milk samples showed negative result on clot-on-boiling test. Presence of added water, neutralizers, ammonia and salt were recorded in raw milk while the packaged milk samples were found to be properly pasteurized and free from any type of adulterant and preservative. Methylene blue reduction test of raw milk indicated more than 50% of the samples to be of poor and very poor quality in contrast to good quality in all the packaged milk from dairies. The viable bacterial count and coliform count of raw milk were 10.59 - 14.62 and 6.34 - 7.50 log cfu/ml, respectively, while no coliform could be isolated from the packaged milk. Based on physical evaluation, chemical analysis and microbial assessment, the raw milk marketed in and around Guwahati city was found to be of poor quality whereas all the packaged milk samples were found to be properly pasteurized and free from any coliform organism and harmful adulterants and preservatives.

Abstract of M. V. Sc. Thesis

Department : Veterinary Public Health

Major Advisor : Dr. (Mrs) Archana Talukdar

Sero-prevalence, molecular detection and assessment of farm level risk factors of Japanese encephalitis virus infection in pigs of Lakhimpur district of Assam

Dr. Uttam Rajkhowa

An investigation was carried out in the Department of Veterinary Public Health, Faculty of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22, to study the Sero-prevalence, molecular detection and assessment of farm level risk factors of Japanese encephalitis virus infection in pigs of Lakhimpur district of Assam. The samples were collected from 145 pig farms both organized and unorganized in 9 blocks of Lakhimpur district with a total 58 numbers of samples per block of the district, during the year 2015-16

Out of 522 serum samples collected, 20 (3.83%) were found to be sero-positive by Indirect ELISA for Japanese encephalitis virus infection. Among the 9 blocks the highest prevalence was found in Boginadi block (8.62%) followed by North Lakhimpur (6.90%), Nowbachia (6.90%), Dhokuakhana (5.17%), Bihpuria (3.45%), and Karunabari (3.45%). No prevalence was found in Telahi and Narayanpur blocks (0%). Age wise higher prevalence (4.46%) was recorded in the age group above 12 months, sex wise in female (4.41%) pigs and breed wise slightly higher prevalence was observed in local pigs (4.11%). however there was no significant association in sero-prevalence of Japanese encephalitis with respect to age , sex , and breed of pigs.

All the samples subjected for RT-PCR were found to be negative for E gene of JEV by RT-PCR.

Assessment of the farm level risk factors included in the present study *viz.* closeness to rice fields, standing water sources, exposure of wild bird to pig farms, mosquito exposure to pig sheds showed that all the risk factors were significantly associated with sero-positivity of JE in pig farms.

Abstract of M. V. Sc. Thesis
Department : Veterinary Public Health
Major Advisor : Dr. A.G. Barua

Romifidine and its combination with Ketamine in dog

Dr. Anangsha Saikia

Fifteen clinically affected dogs of either sex and different age groups were divided into three groups consisting of five dogs in each. Intramuscular injection of romifidine @ 40 µg/kg b. wt. was injected to group I; romifidine @ 30 µg/kg b. wt. and ketamine @ 5 mg/kg b. wt. to group II and romifidine @ 40 µg/kg b. wt. along with ketamine @ 5mg/kg b. wt. to group III.

The induction time of 12.80 ± 0.80 , 8.40 ± 0.24 and 5.80 ± 0.37 mins; duration of anaesthesia of 50.20 ± 1.11 , 64.40 ± 0.81 and 76.20 ± 0.96 mins and recovery time of 69.40 ± 2.29 , 86.40 ± 0.74 and 94.40 ± 0.67 mins were recorded in group I, II and III. Complete analgesia was present in group III. All the animals exhibited muscle relaxation, cessation of tail movement and salivation. Smooth induction and recovery were recorded in all the groups. In dogs of all the groups heart rate, respiration rate, rectal temperature, tidal volume, minute volume and oxygen saturation decreased significantly ($p < 0.05$). Mean arterial pressure increased significantly ($p < 0.05$) in all three groups.

Haemoglobin and total erythrocyte count decreased significantly ($p < 0.05$) in all the groups. Non-significant ($p > 0.05$) reduction of packed cell volume was recorded in group I while significant ($p < 0.05$) decreased level was recorded in group II and III.

Total protein decreased non-significantly ($p > 0.05$) in group I but significant ($p < 0.05$) decrease of total protein was recorded in other two groups. GGT, blood glucose, alkaline phosphatase, BUN, creatinine and cortisol increased significantly ($p < 0.05$) in all the groups. Based on the observation, romifidine @ 40 g/kg b. wt. and ketamine @ 5 mg/kg b. wt. could be recommended for surgical procedures. Romifidine @ 30 g/kg b. wt. and ketamine @ 5mg/kg b. wt. is suggestive for minor surgical procedure while romifidine @ 40g /kg b. wt. is not recommended for clinical use.

Abstract of M. V. Sc. Thesis

Department : Veterinary Surgery and Radiology

Major Advisor : Dr. Bhupen Sarma

Comparative study between interlocking nailing (iln) and intramedullary pinning for the treatment of fracture of femur in canine

Dr. Chandrashekhar Girish Bapat

The present study was undertaken to compare the use of Interlocking nailing (ILN) and Intramedullary Pinning for the treatment of canine femur fracture cases. A total of 773 cases were presented in the Teaching Veterinary Clinical Complex (Surgery Unit) and Department of Veterinary Surgery and Radiology, College of Veterinary Science, A.A.U., Khanapara during the period of 1st April, 2015 to 31st March, 2016. Out of 265 orthopedic cases 197 (74.34%) were found in canine. According to the distribution of the canine cases with signs of lameness, it was found that fracture incidences were the highest (65.48%) followed by dislocations (18.27%) and neurological disorders (16.24%). Further, fracture distribution in bones was recorded and highest was in femur (44.19%) followed by tibia/fibula (13.18%) and radius/ulna (10.85%).

Ten clinical cases of canine diphyseal fracture of femur irrespective of age and sex were randomly divided into two groups. In Group A and Group B, correction of fracture was done by using intramedullary pinning and interlocking nailing respectively.

Hematological and biochemical analysis were done on 0 day, 5th, 10th and 20th days post-operatively while radiographic evaluation and weight bearing test were done on 0 day, 10th, 20th, 30th and 60th days post-operatively. The cost of surgery and time taken for surgery were compared. Hematological estimation of Hb, TEC, TLC, ESR and PCV were done. Biochemical estimation of Alkaline phosphatase, Creatine kinase, Serum Calcium, Serum Phosphorous and total protein were done. Haematological parameters and Biochemical parameters showed non-significant alterations for both the groups except ALP levels showed significant difference within normal limits. Radiographic evaluation revealed secondary healing with hard callus formation in group A and primary healing with negligible callus formation in group B. Weight Bearing Test revealed 100% recovery in 2 out of 5 cases (40%) and 4 out of 5 cases (80%) in group A and group B respectively. Cost of implants was lesser in group A (Rs. 276/-) than group B (Rs. 1440/-). Time required for surgery was longer in group B (101 minutes) than group A (42 minutes).

Based on the present findings, interlocking nailing was considered better than intramedullary pinning.

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Comparative evaluation of nanosilver, unpasteurized honey and turmeric in the treatment of full thickness contaminated cutaneous wound in rabbits

Dr. Ekta Pradhan

The present study was carried out on experimentally created full-thickness contaminated cutaneous wounds in New Zealand White rabbits with an aim to evaluate the healing efficacy of nanosilver, unpasteurized honey and turmeric.

The experiment was carried out on 15 apparently healthy New Zealand White rabbits of either sex, divided into 3 equal groups. Full-thickness cutaneous wounds of 4x4 cm were created on the thoraco-lumbar region on either sides of the vertebral column under general anaesthesia and were left unattended for 48 hours to render it contaminated. Group A, Group B and Group C were subjected to 'Silverkind Nanofine' (nanosilver), unpasteurized honey and turmeric paste respectively. The rate of wound healing and macroscopic changes were recorded on the 3rd, 7th, 10th, 15th and 20th days of post wound creation. The bacteriological and biochemical investigation were performed on the 3rd, 5th, 7th and 10th days of post-wound creation and the histopathological investigations on the 3rd, 10th and 28th days of experiment.

The rate of wound healing was found to be the fastest in nanosilver treated group, followed by the ones with unpasteurized honey and turmeric till the 28th day of experiment. Various macroscopic changes were observed during the course of treatment viz. peripheral swelling, serous exudation, dry casts over the wound, proliferating pinkish granulation tissue and fast contracting wound edges with re-epithelialization. However, clinically complete wound healing was observed on the 20th day of post-wound creation in Group A. The bacteriological investigation revealed presence of coagulase positive *Staphylococcus spp.*, coagulase negative *Staphylococcus spp.* and *Escherichia coli* at the initial stages and eventually became a sterile wound by the 10th day of post-wound creation in both nanosilver based ointment and unpasteurized honey.

Higher levels of total protein and carbohydrate were observed in Group B and Group C while the enzymatic investigations revealed decreasing levels of creatine kinase and aspartate aminotransferase which was more significant in Group A (P<0.01).

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The histopathological studies on the 28th day of post-wound creation revealed clinically complete healing in Group A with regeneration of all the epidermal layers and associated adnexa and better reorganization of the thick collagen bundles.

From the above findings, it could be drawn that use of nanosilver based ointment was found to more effective in terms of wound healing of contaminated cutaneous wounds compared to the other two treatment regimes.

Surveillance of foot affections in stall fed dairy cattle and their surgico-medical management

Dr. Krishanu Kr. Bhagabati

Bovines are the productive animals. Any sort of disease or discomfort of these sensitive animals may lead to decreased production and corresponding economic losses to the farmers. Healthy feet and legs are of utmost concern for dairy cows' well-being and performance, but the same is intimately related to the management conditions and floor patterns. Foot affections occur when the integrity of climate and structure of floor where animals are kept is rendered defective. Challenges of diseases are also increasing with the increase of the cross bred dairy animal population to meet up the increasing demand and needs of milk augments. Many cases of foot affections in the stall fed dairy cows in and around Khanapara, Guwahati city have been noticed by the practitioners but a systematic study and record of the diseases is still lacking. So the present experiment was undertaken to study incidence of the affections, haematological and biochemical changes in foot affections in relation to clinically healthy animals and to evaluate few prevailing therapeutic measures. Incidence was studied in terms of type of affections, age, season, flooring pattern, lactation number, foot affected and feeding practices. Five animals affected in each summer and winter season with feet affections were considered for investigation.

A total of 1760 (one thousand seven hundred and sixty) dairy cows were surveyed in the present investigation out of which 98 (5.568%) animals were found to be affected with various foot lesions. Different types of foot affections were Hoof overgrowth (59.184%), Scissor Claw (30.612%), Heel Erosion (6.122%) and Interdigital Hyperplasia (4.082%).

Highest incidence of foot affections were found in the age group of 4-6 years (55.102%) and lowest for 0-2 year's age group (1.020%). Out of three different floor patterns observed in the area of survey, highest incidence was found for those animals which were maintained in brick floor (65.307%), second highest for wooden floor (23.469%) and lowest for concrete floor (11.224%). Seasonal variation was also found for the incidence of the affections. Highest for summer (60.204%) followed by winter (39.796%). Out of total affected animals fore foot affections were comparatively high than hind foot (50% and 32.653% respectively). In 17.347 percent animals foot affections could be noted on both

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fore and hind limbs. Highest incidence of the disease was found in animals of 3rd lactation (51.020%). Out of total affected animals foot affections were comparatively high in those that were provided high concentrate ration (67.347%).

Haematological investigation showed that mean values of Hb, Lymphocyte and Monocyte did not differ significantly between normal and affected animals in both summer and winter season. Mean values of RBC, WBC and PMN in affected animals were significant in summer with values being 5.74 ± 0.623 , 5.97 ± 1.692 and 33.6 ± 1.435 compared to the mean values of normal animals. Mean value of TLC in affected animals were significant in winter with value being 9 ± 1.048 . While the mean values of PCV, Neutrophil, Eosinophil and Basophil were significant between normal and affected animals in both the two seasons. Biochemical test revealed that mean values of ALP and Creatinine were significant in winter with values being 211.6 ± 52.384 and 1.0044 ± 0.173 respectively compared to the mean values of normal animals. While the mean values of AST and Creatine Kinase were significant between normal and affected animals in both the two seasons.

Bacteriological investigation revealed both Gram positive and Gram negative organisms from infected hoof lesions. Three samples out of ten showed *Streptococcus* and *Staphylococcus* organisms and rest of the samples showed Gram negative coccobacilli. Sensitivity test of samples showed resistance to Enrofloxacin, Erythromycin, Ampicillin and Amoxicillin but sensitive to Gentamicin and Tetracycline. Four samples out of ten showed sensitivity to ceftiofur but 6 samples were resistance to ceftiofur.

Affected animals were treated according to the type of affections. Secondary bacterial infection as seen in bacterial culture and sensitivity test were treated with specific antibiotics. Meloxicam @ 15ml/375 kg b.w was administered intra muscularly in cases where pain was evidenced. Hoof trimming was done under sedation with Xylazine Hydrochloride @ 0.05-0.22mg/kg b.w in cases of hoof overgrowth and scissor claw. Cases of inter-digital hyperplasia with associated wound were treated with local application of antiseptic and antibiotic powder followed by a course of systemic antibiotic. Animals with heel horn erosion condition were managed by reducing both the heels to the same height.

Surgical affections in pigs with special reference to umbilical hernia

Dr. Y. Bauan Buchem

The survey work on pigs were carried out at AICRP, MSP and 30 Sow Teaching Unit of C.V.Sc. pig farms and places of ambulatory classes viz. Kamalpur Veterinary Dispensary, Hajo Veterinary Hospital and Halogaon Veterinary Dispensary from 1st February 2015 to 31st January 2016 to study the incidence of different surgical problems in pigs.

A total of 2,820 numbers of pigs were surveyed and out of which 77 numbers (2.73 %) of pigs were affected with various surgical affections. Age group between 0-3 months 44 (57.14 %) recorded the highest incidence rate and the lowest 1 year and above 6 (7.80 %), male had higher incidence rate 44 (57.14 %) to female 33 (42.86 %). Breed wise incidence of different surgically affected pigs were found to be non-significant as all the animals surveyed were of only cross breeds. On the basis of different surgical affections, umbilical hernia recorded the highest incidence rate 27 (35.07%), while wound and inguinal hernia were the lowest with 5 (6.49%). Summer season recorded the highest incidence 32 (41.56%) and winter the lowest 8 (10.39%). C.V.Sc pig farms recorded higher incidence rate 36 (46.75 %) in comparison to the other three surveyed places.

From the surveyed animals, 12 numbers of pigs affected with umbilical hernia were selected for the present study and were divided into 2 groups irrespective of the age, sex and breed. Group I animals, where the hernial ring was less than 4 cm (approximately 2 fingers breadth) were rendered herniorrhaphy with prolene suture while Group II animals, where the hernial ring was more than 4 cm (approximately 4 fingers breadth) hernioplasty with prolene mesh was carried out.

The clinical parameters viz. pulse rate, respiration rate and rectal temperature and haematological parameters viz. Hb, PCV, TEC, TLC and DLC were recorded on the day before the surgery and on 3rd, 7th and 14th post-operative days to evaluate the efficacy of the surgical procedure. The recorded parameters did not show any significant changes. There was slight increase or decrease in their values during the recorded days which were within the physiological range.

The rendered surgical procedure of herniorrhaphy with polypropylene suture in group I and hernioplasty with polypropylene mesh in group II to the pigs affected with umbilical hernia were found to be effective without any post-operative complications.

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Evaluation of healing was done on the 3rd, 7th and 14th post-operative days to record the changes. There were peripheral swelling and exudation during the initial stage of wound healing which were followed by scab formation on the 7th day and complete healing was noticed in both the groups by 14th day. These were normal phenomenon characterized in the course of wound healing. The healing process of wound in both the groups were found to be good with no untoward complications.

Ethno-dynamics of mithun rearing practices followed by the tribal communities of Arunachal Pradesh

Dr. Martina Dabi

An investigation was undertaken to study the ethno-dynamics of mithun rearing practices followed by the tribal communities of Arunachal Pradesh. Two mithun rearing districts namely East Siang district and Papum Pare district was purposively selected. Two contiguous clusters of villages from both districts were selected and thirty respondents from each cluster were selected, making the sample size to 120. Only the farmers having at least one Mithun were selected for the study in consultation with the officials of Department of A.H, Veterinary & Dairy, Government of Arunachal Pradesh for the study purpose. Two sets of variable *viz.*, independent and dependent variables were chosen for the study in consultation with available literature, faculties in College of Veterinary Science, AAU, Khanapara, Guwahati, Assam. Data were collected by personally by interviewing the respondents.

Study revealed that majority of the respondents, 45.83 per cent belonged to middle age group, about 87.50 per cent of them were male and married 90.00 per cent. Majority 60.00 per cent had joint family with 44.17 cent medium family size. Almost 43.33 per cent of the respondents had medium education level and majority, 85.54 had agriculture as their main occupation. Overwhelming majority of the respondents 93.33 per cent had medium herd size of livestock other than mithun, 72.5 per cent had medium mithun herd size with 84.17 per cent has inherited the mithun as an ancestral herd. Most of them (89.12%) had medium annual family income (Rs.78500-350000) of which majority of the respondents 89.12 per cent belonged to medium category. Majority 95.83 per cent of the respondents earning (Rs.50000-160000) from mithun. About 48.33 per cent of the respondents had medium extension contact, 44.17 per cent had medium mass media exposure.

As per the preferred means for identification of mithun in order to avoid dispute 100.00 of the respondents responds practiced ear notching, followed by 60.00 per cent by different colour pattern of mithun, 48.33 per cent used birth mark as a means for identification

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of mithun, and 43.33 per cent identified their mithun by horn structure. Majority 66.67 per cent consider rearing of mithun as a status symbol in terms of traditional value. Majority of the respondents 93.33 per cent followed natural system of breeding. 48.33 per cent respondents sell their mithun for the purpose of marriage and 8.33 per cent sell directly to the consumer. Over the time 79.17 per cent said that there was decreased in the herd size of the mithun but there was increase in the price of mithun. The people still follow indigenous practice for the treatment of mithun owing to rich and varied flora and fauna.

Constraints such as conflict with the wild animal & cultivated fields, lack of veterinary support, disease outbreak, searching of mithun and disputes regarding identification of mithun has been identified as severe constraints perceived by the mithun rearer.

Issues around *niang megha* breed of pig rearing in Meghalaya

Dr. Rimiki Suchiang

A research study was undertaken to study the issues regarding *Niang megha* breed of pig in two purposively selected districts of Meghalaya namely, East Khasi Hills and West Khasi Hills district. From each district four villages were purposively selected and from each village 15 *Niang megha* farmers were randomly selected making the total sample size to 120. Two sets of variables *viz.*, independent and dependent were chosen for the study in consultation with available literature and experts of the field. Data were collected by personally interviewing the selected respondents with the reliable and valid interview schedule. The respondents were interviewed personally at their residence/ farm during the month of November 2015 to April 2016. The study revealed that the average age of the respondents was around 43 years. Majority of the respondents read up to primary school (30.84%), had nuclear families (60.83%) with mean family size of about 7 and were married (90.00%). Agriculture was their primary occupation with their mean annual income from pig farming being Rs. 11336 and mean annual income from all sources being Rs. 76,847. Most of them had medium experience of rearing *Niang megha*, with an average of about 34 years with about 4 numbers of pigs and mostly rearing for both breeding and fattening purpose (63.33%). Most of them had medium level of social participation (71.66%) and extension contact (68.33%). Majority of the respondents' attitude towards piggery enterprise was neutral with medium level of liking towards information source. A total of 8 green forages and 10 medicinal herbs were identified which were used for feeding and treatment of *Niang megha* respectively. Most of them reared their pigs in semi-intensive system (55.84%), mostly hiring a boar for breeding purpose (44.17%). Most of them feed their pigs with garbage feeds (84.17%) and most of them had weaned (45.83%) and castrated their pigs (59.17%) and sometimes treated and dewormed them (48.33%). The common marketing channel of pigs was through local trader and the piglets were normally bought through the co-farmers and the common mode of marketing pork was through local trader. A total of fourteen constraints were identified through Rank Based Quotient (RBQ) technique, where high cost of feed was found to occupy the Rank 1 among the constraints in both the districts with a rank correlation coefficient of 0.70** and 0.95** in East Khasi Hills and West Khasi Hills district respectively.

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Progressive poultry rearing ventures in selected districts of Meghalaya

Dr. Riwanki Pyrtuh

The poultry rearing is the most dynamic venture in animal husbandry playing a vital role for socio-economic development of the country. It also plays a significant role in supplementing family income, employment generation, enhances nutrition and alleviates poverty. Thus the study had been conceptualized with the overall objective to study on “Progressive Poultry Rearing Ventures in Selected Districts of Meghalaya”. The study was carried out in two purposively selected districts of Meghalaya viz. East Khasi Hills district and South West Khasi Hills district. Mawphlang block from East Khasi Hills district and Mawkyrwat block from South West Khasi Hills district were purposively selected considering their poultry population. Six villages from each of the two selected blocks were randomly selected and ten poultry farmers were again randomly selected to make the sample size 120. Data on socio-personal and psychological profile of poultry farmers, the factors and areas influencing poultry rearing in the districts, the changes occurred in poultry rearing in recent years, the progressive economic and social contribution of poultry rearing to the family and society respectively and the poultry farmers’ contribution to the local markets were gathered by the researcher through personal interview method.

The study revealed that majority of the respondents were of middle age (64 per cent), married (95 per cent), males (52 per cent) and having a nuclear type (95 per cent) of family. Majority of the respondents had medium sized family with a highly significant difference between the two blocks (t value= 2.019*, $p < 0.05$). A large number of the respondents could read and write (40 per cent), were daily wage earners (56 per cent) in occupation with an average annual income of Rs 80, 483.33 from all sources (82 per cent) and an average of Rs 6883.33 as annual income from poultry (92 per cent). Majority (95 per cent) of the respondents had medium flock size with a highly significant difference between the two blocks ($t = 2.18*$, $p < 0.05$). Majority of the respondents had medium length of experience (69 per cent) in poultry rearing with medium level of training (93 per cent). All the respondents utilized their income from poultry for day-to-day household upkeep. They had also utilized their income from poultry in the fields of education (54.78 per cent), health

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care (49.80 per cent), sustaining of poultry production (34.03 per cent) and in agricultural activities (2.49 per cent) in a mutually exclusive manner. Majority of the respondents had medium level of social participation (92 per cent), extension contact (84 per cent) and mass media exposure (58 per cent). Majority of the respondents had neutral attitude (78 per cent) towards poultry rearing with medium level of economic motivation (68 per cent).

In respect of changes in poultry rearing, there was a reduction in the number of respondents who were found to practice free range system whereas there was an increase in the number of respondents who practiced backyard and intensive system of rearing. In case of floor material, there was an increase in the number of respondents who used concrete. There was an increase in the number of respondents who used GI sheet as roofing material as well as a combination of concrete and wire net as side wall construction. Similarly the number of respondents using plastic-make as feeding trough and commercial feed also increased. The number of respondents who adopted improved variety of chicken also increased. In respect of source of chicks, there was an increase in the number of respondents who procured chicks through private dealers and Government schemes. The number of respondents who vaccinated, de-wormed, provided treatment, buried the dead birds and kept records also showed a markedly upward trend.

Majority of the respondents (64 per cent) fell under the medium category of perception in respect of factors and areas that influenced poultry rearing and agreed that 'finance' (86.00%), 'diseases' (81.00%), 'Government policies of helping farmers' (42.00%), 'knowledge on scientific practices' (38.00%) and 'training on poultry rearing' (59.00%) had 'very much' influenced on poultry rearing. Majority of the respondents (76 per cent) had medium level of perception with respect to the economic and social contribution of poultry rearing to their family and society respectively. There was highly significant difference between the two blocks in economic and social contribution of poultry rearing to their family and society respectively. ('t' value= 3.12**, $p < 0.01$). Further majority of the respondents felt that poultry rearing had 'very much' contributed to their family in terms of 'Increase in family income'. Similarly, majority of the respondents (74 per cent) fell in medium category with respect to their perceived contribution of poultry rearing to the local markets and perceived that the item 'Enhances employment opportunities' (86.00%) had 'very much' contribution to the local markets.

In relational analysis, educational status ($r = 0.20^*$) and extension contact ($r = 0.23^*$) had positive and significant ($p < 0.05$) correlation with the factors and areas affecting poultry rearing. Further, annual income from all sources ($r = 0.35^{**}$), mass media exposure ($r = 0.36^{**}$) and economic motivation ($r = 0.38^{**}$) had positive and highly significant ($p < 0.01$) correlation with the factors and areas affecting poultry rearing. In regression analysis, experience in poultry rearing and economic motivation had a positive and significant ($p < 0.05$) influence on the factors and areas affecting poultry rearing.