



**NATIONAL SEMINAR ON SUSTAINING HILL AGRICULTURE IN  
CHANGING CLIMATE (SHACC), 5-7 DECEMBER, 2015 IN  
PRAGNA BHAWAN, AGARTALA, TRIPURA**



**Organized by  
Indian Association of Hill Farming, Umiam  
In collaboration with  
ICAR Research Complex for NEH Region, Umiam, Meghalaya**

**INAUGURAL SESSION**

**Chief Guest:** Shri Tathagata Roy, Honorable Governor of Tripura

**Rapporteurs:** Dr. R. Laha, Dr. K. P. Mohapatra and Dr. S. S. Roy.

- Dr. J. Chauhan, Scientific advisor to the Union Minister of Agriculture & Farmers Welfare emphasized on promotion of Mithun farming in NE region. He also emphasized upon various means for enhancing farmers' income.
- Dr. S. V. Ngachan highlighted Arsenic problem in Assam and Manipur, emphasized on technological intervention for combating the situation.
- Dr. K. R. Dhiman stressed up on increasing the land use efficiency, rain water harvesting integrated farming system and conservation agriculture in hilly region.
- Dr. P. Das accentuated on devising strategies to achieve 'Zero Carbon – Zero Poverty' goal. He also highlighted the need for concerted effort towards enhancing the agricultural productivity in climate vulnerable districts of NE region.
- Dr. U. C. Sharma stressed upon role of social Scientist in identifying and resolving the socio-economic issues of the farmers, which hinder the agricultural production.
- Dr. A. K. Ghosh emphasized on the popularization of ICT tools for sharing information on soil, climate and market to the farmers in an understandable and tangible way. He also highlighted need for skill upgradation of students on various agricultural technologies.

His Excellency Honorable Governor of Tripura Shri Tathagata Roy stressed upon the processing of fruits and vegetables not only to reduce the post harvest spoilage but also to ensure higher profit. He also emphasized on reducing environmental pollution to combat climate change. Competition for allocation of scarce land resources between agriculture and forestry may be addressed with suitable complementary technologies in order to provide both food security and ecosystem services to the NE region. Honourable chief Guest also conferred various IAHF Awards such as IAHF Fellow, IAHF Young Scientist, IAHF Best extension scientist, IAHF best research papers to the awardees. The Chief Guest also distributed soil health cards and soil health testing kits among the farmers as a part of celebration of World Soil Day and International year of Soil 2015.

### **SPECIAL SESSION**

**Theme: Farmers scientist interaction session**

**Chairman:** Dr. P. Das

**Co-Chairman:** Dr. S. V. Ngachan

**Co-ordinator:** Dr. M. Datta

**Rapporteurs:** Drs. A.K. Mohanty, Mandira Chakraborti, Tridip Bhattacharjee

#### **Proceedings:**

##### **Dr. P. Das , Former DDG (Agril Extension)**

- Excess use of fertilizer degrades the soil quality, hence balanced application of fertilizer should be applied as per soil testing report that will make the production more economic and sustainable
- Farmers should avail the facility of mobile soil testing laboratory extended by the State Government Department.
- Farmers should be imparted training on utility of soil testing, use of soil health card and soil testing kit through KVKs.

##### **Dr. K.R. Dhiman, Former VC, YS Parmer university of Horticulture and Forestry**

- Benchmark survey of the farmer's resources may be conducted for proper utilization of soil health card.
- In pulses crop, nitrogen should be applied as basal dose only not as top dressing as it promote vegetative growth, but in other crops nitrogen can be applied in split doses as per the soil testing report.
- Fruit fly trap should be demonstrated in a cluster area rather than in individual farmer's field.

##### **Dr. S.V. Ngachan, Director, ICAR RC for NEH Region, Umiam**

- Seed production programme may be taken up by the KVKs through farmers' participatory approach under different seed project of the ICAR.
- Agripreneurial opportunities may be explored through quality planting material production in case of fruit plants and seed production of cereals like rice, maize, oilseed like mustard/toria and pulses like field pea and lentil etc..
- As NEH Region is rich in biodiversity hence, there is need to harness the potentiality of NEH region in a comprehensive manner for the growth of agriculture.
- Facility of analyzing different soil micronutrient may be extended to the farmers at the ICAR Centre in the NEH Region.

### Farmer's queries

- Mr. Midot from Meghalaya enquired regarding the intervention of nutmeg (Spices crop) in Meghalaya. It was suggested that the technology can be introduced after the successful evaluation and standardization of the same.
- Mr. Biswajit Reang from Laxmicherra village of South Tripura was advised by the experts to use the fertilizer as per soil health card distributed to get the rice yield to the tune of 6 MT/ha

### Brief Recommendations:

- Fertilizer should be applied as per soil testing report.
- Control of fruit fly through fruit fly trap should be taken up in community scale instead of individual farmers' level to make it effective.
- Participatory seed production programme may be taken through farmers' participation to make the quality seed available to the farmers at cheaper price.

## TECHNICAL SESSION –I

### Theme: Climate Change- Adaptation and Mitigation Strategies for Hills

**Chairman:** Dr. U.C. Sharma

**Co-Chairman:** Dr. R. Bhagawati

**Co-ordinator:** Dr. Anup Das

**Rapporteurs:** Drs. S Ghatak, R. Krishnappa, Vinay Singh

There were five lead lectures covering topics from GHG emission to strategies for hill farming. Moreover, there were seven contributing oral papers.

### Brief Recommendations:

- To mitigate the untoward effects of climate change conservation agriculture will have an important role and needs to be promoted at every facets of agricultural activity.
- Contingency planning for modified cropping sequence and integrated crop and pest management needs to be undertaken on urgent basis.

## TECHNICAL SESSION –II

### Theme: Farming System Approach for Natural Resource Conservation and Food Security (Crop improvement and germplasm management)

**Chairman:** Dr. K. R. Dhiman

**Co-Chairman:** Dr. S. V. Ngachan

**Co-ordinator:** Dr. Basant Singh

**Rapporteurs:** Drs. Raghavendra Singh, Dr. Rshikanta Singh and Samik Chowdhury.

In this session two lead papers on Managing crop Germplasm in North east India-prospects and strategies and Breeding for abiotic stress tolerant crop varieties were presented by Dr. A.K. Mishra and Dr. S.P. Das, respectively. Nine contributory oral papers were presented by different speakers in this session.

### ***Recommendation from lead papers***

- ❖ For managing crop Germplasm, efforts should be made to register farmers and/ or local varieties in collaborating with PPV & FRA.
- ❖ More effort are required for registration of genetic stocks with NBPGR as very less numbers are registered from NEH Region.
- ❖ While breeding for abiotic stress, existing popular crop varieties should be replaced with improved stress tolerant version of the same variety.
- ❖ Stress tolerant variety development program should be included as integrated approach by involving breeders, physiologists, biochemist, soil scientists, agronomists, plant protection scientists and climate scientist to develop not only stress but climate smart crop varieties.
- ❖ Proper phenotyping/screening facility should be followed for developing successful stress tolerant varieties.

### ***Recommendation from oral papers***

- ❖ ICRI Spices Board has conserved 287 large cardamom accessions which should be used for further breeding program in order to find disease tolerant characters.
- ❖ In finger millet, parametric and non parametric stability are highly related and can be used alternatively for identification of stable genotypes. Simultaneous selection for yield and stability was found to be the best measure for identification of finger millet stable genotypes.
- ❖ Alder tree-based intercropping is more productive as compared to Gamhari for Colocasia elephant foot yam and turmeric. Standardization of Colocasia should be undertaken for efficient light interception for future studies.
- ❖ Different tolerance mechanisms against iron toxicity *i.e.*, shoots and root-based mechanisms are found in rice. KD-2-6-3 and Arize was determined to be its root architecture being able to oxidize  $Fe^{+2}$  through air transport in rhizosphere (avoidance), the iron tolerance in Guwahati and Shabsarang was attributed mainly to shoot-based mechanisms (tolerant).
- ❖ MC-34-1-10-6-1-26 was identified to be most promising short duration variety as compared to RCM-8.
- ❖ The total anthocyanin content should be quantified in *Chakhao* parent and the selected progeny lines/
- ❖ Underutilized crop like *Perilla*, which is prevalent in NEH region of India, needs to be propagated and more efforts is required for its improvement.
- ❖ Accession IC 599238 can be recommended for further adaptive trials under AICRN-PC.
- ❖ *Rhizobia* strains LSMR-5 and LSMR-1 were found to be most efficient for improving growth and symbiotic traits in summer mungbean.
- ❖ Gel profiles of the Jhum rice lines of Tripura can be used as fingerprints to identify the varieties. Cluster analysis could bring out the diversity and relatedness among the varieties.

During the presentation, Co-chairman Dr. S. V. Ngachan suggested that impact of different types of ashes should be studied for managing the disease and insect pest on different crops. He urged to NBPGR for retrieval of local landraces of rice from IRRI, which are resistant to different biotic and abiotic stresses collected from NEH region. Chairman of the session, Dr. K. R. Dhiman suggested multidisciplinary approach for development of stress tolerant rice variety.

### **Brief Recommendations:**

- [KVKs from the state governments and ICAR should help in registration of farmers varieties with PPV&FRA for economic benefits to the farmers.](#)

- Proper phenotyping/screening facility should be followed for developing successful stress tolerant varieties.

### **TECHNICAL SESSION –III (06 DEC., 2015, SUNDAY)**

**Theme: Plant Health Management**

**Chairman:** Dr. N. S. Azad Thakur

**Co-Chairman:** Dr. R Bhagwati and Dr. N. Prakash

**Co-ordinator:** Dr. G T Behere

**Rapporteurs:** Dr. Hemavati Ranebennur, Dr. M. A. Ansari and Dr. Chongtham Tania

There were a total of three lead/invited talks and sixteen contributory talks, out of three only one lead/invited talk was given by Dr. N. S. Azad Thakur on Pest Population dynamics in relation to climate change and strategies for their management. Out of sixteen contributory talks, twelve talks were presented.

#### **Recommendations:**

- In changing climatic scenario, pest population dynamics has been changing including hill agriculture in north east India and as result Transboundary invasion of pests is occurring. Therefore research on this aspect should be undertaken on priority basis to protect the hill agriculture.
- Three new species of fruit flies have been reported first time from north east India, hence their damage potential and biology in new habitat should be studied.
- Due to the taxonomic complexity in fruits flies, their genetic divergence limit should be well defined to study the speciation in fruit flies.
- Transplanting of tomato should be strictly restricted to month of November to restrict the spread of Tomato Yellow Leaf Curl Virus (TYLCV), as the incidence of its vector (White flies) is less during the month in Tripura.
- Trichoderma should be multiplied at mass level by using locally available substrates, and training on the same should be given to farmers for management soil born diseases in Tripura.
- Seed treatment with *Pseudomonas fluroscene* (@4g/kg of seed) in combination with soil treatment (@2.5kh/ha mixed in sand) may be recommended for management of damping off disease in off season cabbage cultivation of Tripura.
- Among the pod borers complex, *Marua cavitata*, *Melanagro myzaobtuse* and *Apion claviceps* were found to be pre-dominant pests which are considered to be the limiting factor for successful cultivation of pigeonpea in Tripura. Therefore management strategies should be designed on priority for management of pod borer complex for pigeonpea in Tripura.

- Distribution of soil micro-arthropods are highest in abundance in forest land as compares to agricultural and pasture land, hence the factor limiting their survival in agricultural land may be studied.
- Integrated weed management in upland rice is very essential, as no single strategy will control the weed efficiently in upland rice in Tripura.
- Pendimethalin 1 kga.i./ha in combination with bispyribac sodium 25 kg/ha is the best treatment for management of weed in upland in Tripura conditions and awareness program for farmers on this aspect may be organized in Tripura.
- *Bactrocera tau* is emerging as a major limiting factor for successful cultivation of capsicum in Mizoram, hence eco-friendly management strategies should be designed for Mizoram condition.
- Research on bacterial endophytes may be undertaken for management of fungal and bacterial diseases of agricultural and horticultural crops in north east India.
- Flubendiamide is provide to be a safer insecticide as it appeared to be safer to environment (Soil and ground water), hence this insecticide may be used for management of lepidopteran pests in rice.

#### **Brief Recommendations:**

- Development and demonstration of location specific integrated insect pest management should be done with special emphasis on eco-friendly management solutions for the north east hill agriculture.

#### **TECHNICAL SESSION –IV (06 DEC., 2015, SUNDAY)**

**Theme: Livestock, Poultry and Fisheries in Agriculture**

**Chairman:** Dr. S. M. Deb

**Co-Chairman:** Dr.B.T. Deshmukh

**Co-ordinator:** Dr. I Shakuntala

**Rapporteurs:** Drs. Doni Jini, Rakha Das (C), Vinay Singh

The major recommendations from the session are-

- Impress significance of livestock farming on policy makers.
- Device alternate use of location specific livestock species likes yak & Mithun eg. Pack animal for military.
- Development of low cost feed technologies using locally available ingredients.
- Germplasm upgradation and use of exotic varieties to improve production in piggery.

- Disseminate information on good management practices in animal husbandry.
- Introduction of locally preferred high value alternate species for aquaculture.
- To mitigate population decline of Tibetan sheep, promote remuneration pricing of meat & wool to discourage indiscriminate castration of rams.
- Explore basic research options for capture breeding of difficult to breed aquaculture species.
- Inclusion of livestock in the state development plans, especially in the international border.
- Development and adoption of livestock centric Integrated Farming models suitable for the altitude based on available resources.
- Development of low cost and ecofriendly technologies for feed resources, feed conservation housing and management of pasture.
- Explore the possibility of enhancing economic return from cow dung, draughtability and packability.
- Selective breeding using Open Nucleus Breeding System for improving the livestock.
- Commercial pig farming may be adopted by large farmers/entrepreneurs.

### **Brief Recommendations:**

- Development and adaptation of livestock centric integrated farming model suitable for the altitude based on available resources.
- Development of low cost and ecofriendly technologies for feed resources, feed conversion, housing and management of pastures. Explore the possibility of enhancing economic return from cow dung, draught ability and packaging

### **TECHNICAL SESSION –V (06 DEC., 2015, SUNDAY)**

**Theme: Organic Farming and Natural Farming**

**Chairman:** Dr. P. Battacharya

**Co-Chairman:** Dr. Y.S. Shivay

**Co-ordinator:** Dr. H.Kalita,

**Rapporteurs:** Drs. Subhas Babu, Lembisena

**Brief Recommendations-**

- Laboratory facilities should be strengthened for organic farming practices.
- Package of practices for organic farming should be developed in practice with agronomy practices, integrated nutrient and pest management be given due attention.

**TECHNICAL SESSION –VI****Theme: Improved Shifting Cultivation Practices****Chairman:** Dr. S.V. Ngachan**Co-Chairman:** Dr. Raj Narayan**Co-ordinator:** Dr. R. Bhagawati**Rapporteurs:** Drs. T Samajdar, L Baisya, J Layek

Some salient recommendations for improved Shifting cultivation are-

- Application of 50% RDF and line sowing across the slopes are recommended for successful cultivation of improved rice varieties like Balham-I, IURON-215, RCM-5 in Jhum lands.
- Dr. Raj Narayan: Planning of wild fruit plant should be done in degraded Jhum land for destructing wild animals.
- Organic farming should be promoted in suitable location specific areas and for high value crops. In outer areas INM- approaches should be practiced.
- Multipurpose trees, agro forestry interventions should be practiced in Jhum areas for soil and water conservation and improving soil fertility.

**Brief Recommendations:**

- Multipurpose trees, agroforestry intervention should be practice in theme areas for soil and water conservation and improving soil fertility.
- Application of 50% RDF and line of sowing across slopes are recommended for successful cultivation of improved rice variety.

**TECHNICAL SESSION –VII****Theme: Technology Dissemination****Chairman:** Dr. P. Das**Co-Chairman:** Dr. N Prakash**Co-ordinator:** Dr. A K Mohanty**Rapporteurs:** Drs. Mandira Chakraborty, Gulab Singh Yadav

Some significant recommendations are

- KVKs with the help of ICAR institutes should prepare macro level climate resilience contingency plan for each district for successful adaptation to climate change in agriculture.
- Emphasis should be given on conservation agriculture for better utilization of available soil moisture in rice fallow ecosystem. Besides, the timely intervention of intercultural practices is very important for successful adaptation under climate change.
- Pulses should include in jhum areas either in sequence/intercropping for jhum improvement.
- Public private partnership in milk production and marketing along with skill based training support to dairy farmers will help in strengthening the dairy sector in NEH region.
- Developing village level seed bank and fodder bank should be given priority to face the hazardous consequences of various climatic aberrations.
- Climate resilient agriculture needs a holistic approach integrating different components like timely input support system, ITK based agricultural practices, ICT based weather forecasting, agro advisory service, maintaining India gaps standard in agriculture, conservation of indigenous germplasms, innovate (Innovation for Agriculture and Training), eco-specific demonstration of technologies and imparting knowledge intensive & skill oriented training programme for the stakeholders to make it more sustainable.
- Extension research needs to be refurbished for developing an effective decision making model for successful adoption of innovative climate resilient technology.

### **Brief Recommendations:**

- KVKs with the help of ICAR institutes and should prepare macro level climate resilience contingency plan for each district for successful adaptation to climate change in agriculture. Extension research needs to be refurbished for developing an effective decision making model for successful adoption of innovative climate resilient technology.
- Climate resilient agriculture needs a holistic approach integrating different components like timely input support system, ITK based agricultural practices, ICT based weather forecasting, agro advisory service, maintaining gaps & standard in agriculture, conservation of indigenous germplasms, innovate (Innovation for Agriculture and Training), eco-specific demonstration of technologies and imparting knowledge intensive & skill oriented training programme for the stakeholders to make it more sustainable.

### TECHNICAL SESSION –VIII

**Theme: Potentialities of Horticulture in Hill Farming**

**Chairman:** Dr. B. C. Deka

**Co-Chairman:** Dr. S. K. Sarkar

**Co-ordinator:** Dr. Anjani Kumar Jha

**Rapporteurs:** Drs. Ashish Yadav, M. R. Sahoo and H. Rymbai

- Total 14 presentations were made in the session Potentialities of Horticulture in Hill Farming
- Three lead papers were presented by Dr. S. K. Sarkar, Dr. Raj Narayan and Dr. Biswajit Das and 11 were contributory oral presentations.

**Following were some recommendations**

- Canopy management studies in horticultural crops for optimization of yield and recycling of biomass for beneficial uses need attention.
- Studies on honey bee as a pollinator as well as for honey production should be focused in NEH regions.
- Intensive studies for utilization of indigenous horticultural genetic resources for nutraceutical purposes.
- Cropping systems for potential horticultural crops should be developed for livelihood improvement of native populace.
- ITKs for reduction of intensity of insect pest and disease in horticultural crops need to be documented and validated.

**Brief Recommendations:**

- Canopy management studies in horticultural crops for optimization of yield and recycling of biomass for beneficial uses need attention. Intensive studies for utilization of indigenous horticultural genetic resources for nutraceutical purposes along with ITKs for pest management be documented and validated.
- Studies on honey bee as a pollinator as well as for honey production should be focused in NEH regions.

### TECHNICAL SESSION –IX

**Theme: Animal Health Management**

**Chairman:** Dr. D.K. Sarma

**Co-Chairman:** Dr. R.K. Saha

**Co-ordinator:** Dr. A. Sen

**Rapporters:** Drs. Samir Das, Rajkumari Sanyukta, Brijesh Kumar

**Brief Recommendations:**

- Development of a comprehensive animals and aquatic diseases surveillance system covering the Emerging transboundary, exotic, zoonotic and parasitic diseases including environmental contaminants particularly the heavy metals and its mitigation strategies
- Nanotechnology based herbal research needs to be promoted and strategies pertaining to strengthening the immune system of animal and aquatic animals needs to be build-up.

**TECHNICAL SESSION –X****Theme: Integrated Soil, Water and Nutrient Management****Chairman:** Dr. P.K. Ghosh**Co-Chairman:** Dr. J.K.Bisht**Co-ordinator:** Dr. Debashis Sen**Rapporteurs:** Drs. K K Barman, B K Sethy, Pulak Choudhury**Brief Recommendations:**

- Furrow liming should come in practice in hill agriculture. Continuous monitoring of soil water and soil acidity should be done. Soil health card should be a complete soil health card that should include all physical and biological properties. One farmer should get soil health card only from one institute.
- Studies soil-plant-animal-human continuum should continue.
- Minimum tillage during Kharif followed by Zero tillage in Rabi should be followed for profitable production of green pea in rice pea cropping system in Meghalaya.

**TECHNICAL SESSION –XI****Theme: Farming System Approach for Natural Resource Conservation and Food Security****Chairman:** Dr. U.K. Behera**Co-Chairman:** Dr. A.S. Panwar**Co-ordinator:** Dr. A.K. Mishra**Rapporteurs:** Manoj Kumar (SMS), Gangarani Devi**Brief Recommendations:**

- Utilization of wasteland for fodder production with good quality grass species, tree legumes recommended for this region.
- Intensification of rice based system with improved high yielding rice varieties and integration of pulses, oil seeds, vegetables, poultry, fish, pig etc for food and nutritional security.

## TECHNICAL SESSION –XII

**Theme: Farm Mechanization and Secondary Agriculture**

**Chairman:** Dr. K.R. Dhiman

**Co-Chairman:** Dr. R.K. Thakur

**Co-ordinator:** Dr. RK Singh

**Rapporteurs:** Drs. B.K. Sethy, & Hijen Jiten Singh

No. of lead papers presented –3

No. of research papers presented –8

Recommendations:

- There is a vast scope for farm mechanization in NEH states which not only reduces labour cost but also increases farm income. Hence more efforts may be made for inclusion of more farm Implements in hilly ecosystem.
- ICAR may coordinate with Khadi Gram Udyog Board and AICRP on Honey Bee for establishing one full fledged center in the NE.
- Small scale processing unit for processing of turmeric, ginger and cardamom is the viable option for enhancing farm income for hill farmers. Hence State Govt. may take initiatives for establishment of smaller units in their respective states of the NE region for food and livelihood security of the farming community on subsidy basis.

### **Brief Recommendations:**

- There is a vast scope for farm mechanization in NEH states which not only reduces labour cost but also increases farm income. Hence more efforts may be made for inclusion of more farm Implements in hilly ecosystem.
- ICAR may coordinate with Khadi Gram Udyog Board and AICRP on Honey Bee for establishing one full fledged center in the NE.

The valedictory programme was held on 07 December under the Chairmanship of Dr. KR Dhiman. Dr. UC Sharma, Dr. SV Ngachan, Director, Department of Agriculture, Tripura, Dr. M Datta and other dignitaries gave the concluding remarks. Awards for best oral papers and poster were distributed to the winners by the dignitaries. The seminar ended with vote of thanks by Dr. Anup Das, Secretary, Indian Association of Hill Farming, Umiam.