

Proceedings of the 2nd NICRA-ICARNEH Review Workshop held at ICAR Research Complex for NEH Region, Umiam, on 30-31 January, 2013

The 2nd Review Workshop of the NICRA-ICARNEH project was held on 30-31st January, 2013 at ICAR Research complex for NEH region, Umiam. Dr. Anil Kumar Singh, Hon'ble Vice Chancellor, Rajmata Vijaye Raje Scindhia Krishi Vishwa Vidyalaya, Gwalior graced the occasion as chief guest and the function was presided over by the Dr S.V. Ngachan, Director, ICAR Research Complex for NEH Region, Umiam, Dr A.K. Pathak, former Director of Research, AAU, Jorhat, Dr R.J. Rabindra, Dean, CPGS, Umiam and Dr. M. Maheswari, PI of the NICRA project, CRIDA, other experts from different parts of the country also attended the review workshop.

In his welcome speech, Dr. S.V. Ngachan highlighted the achievements of the institute, particularly in the direction of achieving climate resilience in hill agricultural system. He mentioned about IURON-514, an upland rice line, which has been found to be multiple stress tolerant especially under moisture stress. About 64,000 farmers were benefited in terms of improved seeds, seedlings, piglets, and technology demonstration etc facilitated under different programmes of the institute such as NICRA, NAIP and TSP. District contingency plans for North East, to cope with aberrant weather/climatic conditions, have also been finalized recently. With provisioning of water resources from small irrigation facilities, large acreage in Nagaland has been brought under high yielding varieties of toria. He also highlighted the institutes renewed priorities on *Jhum* improvement programme and temperate horticulture in the states of Arunachal Pradesh and Sikkim.

Dr A.K. Pathak emphasized the need to take the emerging challenges of flash floods in Assam and Arunachal Pradesh. He also suggested developing climate resilient technology and contingency for partial and complete submerged conditions as well as intermittent drought conditions for *Kharif* rice. He also emphatically opined not to generalize climate change but address location specific issues and develop mitigation and adaptation strategies as the region is characterized by highly spatially variable agro-ecosystems. As the small and marginal farmers are most vulnerable to the impacts of climate change, the mitigation and adaptation strategy should critically focus on them, Dr. Pathak opined.

Dr R.J. Rabindra, Dean, CPGS, Umiam stressed the need to focus on biotic stress management such as insect pest and disease dynamics in the fluctuating temperature and rainfall conditions. He also suggested to study the shift in balance in the emergence of pest and their natural enemies in the changing climatic scenario. The change in microbial diversity and their activity for maintaining soil health would also be a good area to work on.

The chief guest, Dr Anil Kumar Singh, congratulated the institute for the progress made in NICRA activities during last two years. He stressed on few emerging issues in climate change and indicated that the numbers of high and medium intensity rainfall events are likely to increase and number of rainy days may reduce substantially. Apart from warming, prolonged low temperature

and very low temperature in short spells are also going to pose challenges in Agriculture. As the ICAR NEH has many regional stations in different climatic conditions, the climatic analogues can be prepared by analysing the long term data and climate resilient research trials can be conducted at field scale, which would provide more reliable information. He emphasized the need of precise crop-weather modelling and multiply the efforts on weather predictions which can help the other groups like the crop and animal scientists to better formulate their research programmes. North east is rich in biomass, hence strategy and technology may be developed to convert it into nutrients to be released over long term and the foot prints on water, nutrient and carbon may be estimated at. The region is rich in biodiversity and the local varieties are tolerant to multiple stress. Therefore, bio prospecting, allele mining, genomics etc may be used to tag those genes and use them in high yielding crops. This would be helpful in combating climate originated multiple stresses in the entire North Eastern India.

Theme 1: Identification of temperature tolerant rice and maize varieties for North Eastern hill ecosystem

Chairman: Dr. M. Maheshwari, Principal Scientist, CRIDA, Hyderabad

Co-chairman: Dr. G. N. Hazarika, Director of Research, AAU, Jorhat

- A project on “Identification of major QTLs for grain yield under drought stress in rice varieties for use in marker assisted selection” is current going on at **Tripura** Centre. Some promising rice lines like RCPL 1-128, Bhalum-3, Berain-2, Full Badam and Kataktara have been identified. Several Jhum paddy lines were also screened. Different crosses (more than 12) were made for developing mapping population. A work plan (2012-17) was presented with an idea to transfer major QTLs for grain yield under drought conditions in the background of Swarna and Naveen.

Comments: It was pointed out that making so many crosses for developing mapping population is needless and so the researcher should stick to two or three crosses only. Submergence tolerance can be achieved using Swarna Sub1 variety.

- In **Manipur** basic strategy was to screen indigenous maize genotypes for cold tolerance and submerge tolerance in rice. Two cold tolerant maize lines viz., Khamathei white and Chechata have been identified.

In other project “Impact of climate change on tomato production” the major objective was to develop tolerance to frost and drought tolerance in tomato. Ten tomato genotypes were evaluated for frost, heat and low light intensity conditions. Selection 9A was found to be tolerant to drought and high temperature.

Comments: It was pointed out that checks were either not included in the experiment or not described. While planning for experiments checks needs to be included. Also clarification regarding half submergence condition is required. Dr. O.N. Singh, CRRRI has pointed out that CRRRI may supply materials/donors for submergence tolerance. Dr. Maheshwari stressed on the need of tanks for experiments regarding submergence tolerance. Collect water stress tolerant cultivars from AAU and distribute among the centres for experimentation in their specific conditions.

- In **Mizoram** activities on “Identification of drought and high temperature tolerant rice varieties for NEH region” is going on.

Comments: It was pointed out that only three varieties like RCM 9, RCM 10 and RCM 11 were grown both in upland and lowland conditions. There is a need to include more varieties from next year onwards. Specific ecology requires specific set of varieties suited well for those conditions. Lowland varieties shouldn't be grown in upland conditions. Further, IURON 514 and Bhalum series of cultivars may be tested for upland condition and Ranjit variety from Assam may be tested for lowland condition. As indicated by photographs in the presentation crop area was full of water. In this case researchers should ensure that drought conditions in the experiment by deploying some means.

Another activity on ‘collection of germplasm of rice and maize’ from various parts of Mizoram is also going on. A project regarding “Identification of water deficit stress tolerant French bean genotypes in Mizoram” was proposed. As French bean is not a major crop so,

this activity can't be taken up under NICRA. Another project "Cold setting traits evaluation in tomato" was approved with a suggestion that we should concentrated on few crops and come out with solid output.

- In **Sikkim** one activity on 'evaluation of chow chow' was proposed but not approved. Work on evaluation of paddy lines for water stress tolerance is going on. Bhalum-2 was found to be earliest in maturity where as highest grain per plant was observed for Bhalum 3 followed by RCPL 1-412.
- In **Umiam**, work has been conducted on "Identification of heat tolerant rice and maize genotypes at reproductive stage". Nine rice and sixteen maize genotypes were identified which were able to grow over 45 °C. Pollen grain germination characteristics, at different temperature exposure levels, of tolerant genotypes were also studied. **Comment:** Screening of genotypes should be restricted to ambient temperature with plus or minus 3°C. The ambient temperature should be based on long term average of maximum and minimum temperature. In another way, different lines from relatively hotter regions should be tested here for their performance. Stress should be given on choosing right kind of donor for hybridization programme using high yielding variety adapted for North East Region. Effort should be made on developing right kind of variety and not on "screen and stop".

Technical session 2 (30-1-2013)

Theme 2: Assessment of mitigation potential through SWM practices for enhancing climate resilience

Chairman: Dr A K Singh, Hon'ble VC, RVRSKVV, Gwalior

Co-chairman: Dr. S V Ngachan, Director, ICAR RC NEH Region, Umiam, Meghalaya

- Dr. AVM Subba Rao (CRIDA Hyderabad) emphasized the need of collection and generation of sufficient and spatially distributed meteorological data for accurately estimating the climatic impacts and to evolve appropriate mitigation and adaptation strategies. He also stressed upon the need of climatic characterisation and crop calendar based on agro climatic analysis.
- Drastic changes in climatic parameter in NEH region have been reported. Decline in precipitation in all the states were observed with maximum reduction being recorded in Arunachal Pradesh and Nagaland. On an average, 5% reduction in rainy days was recorded. Mizoram being the greatest loser in this aspect. Weather variables like flood, drought, rainy days and their trends etc. were analysed for various NE states.
- Preliminary crop-weather modelling study suggests possible increase of rice productivity in Meghalaya and Manipur if maximum temperature rise by +2 °C and CO₂ conc. enhanced up to 450 ppm. Modelling should be carried out through ensembling of various models and come out with one specific conclusion.
- Resource conservation technology for improving crop yield was tested. Guinea grass, groundnut, maize-groundnut intercropping under reduced tillage or zero tillage performed well. Pulses were found to lessen soil loss, and promote carbon sequestration. 'Maize+ Rice

bean' system performed best in this aspect. SOC stock under different systems viz., pine forest, fodder crop etc. were estimated.

- Tillage and residue management effects in combination with nutrient management options on rice productivity and carbon sequestration was also studied. 'Compost+ fertilizer' along with proper residue management performed best. Rate of water loss was considerably lesser under zero tillage than conventional tillage. However, maize yield was not found to increase under zero tillage, rather, in one of the studies, SOC content was found to reduce, and the weed density was also found higher in zero tillage than in conventional tillage. Spatial mapping of SOC stock in all the NE states were done. Tripura was found to have the lowest SOC stock.
- **Suggestion:** Biochar experiments needs to be done with different proportions of soil and biochar mixing to choose the best possible combination. Water quality analysis studies should be included in the project.
- Variation in yearly total rainfall in 16 places of Tripura was studied. All 4 districts recorded deficits in rainfall receipts over time. Deficit in rainfall was also recorded in different seasons during 2012. Detailed soil moisture analysis from soils of different land use systems was done to finalize the crop calendar. Low cost drip irrigation systems in banana was also studied in the severely water stressed areas of the state. Under resource conservation study, conventional tillage was found better than zero tillage in terms of rice yield. Residue management also had pronounced effect in this aspect. Tripura has lowest SOC and it is attributed to high temperature leading to greater decomposition/ mineralization of organic matter. Director stressed upon proper soil sampling based on land use systems. Area coverage for soil sampling should be enhanced for more accuracy and to detect greater variation in SOM content.
- In **Manipur** experiment was initiated for development of sustainable land use model in hill slopes for increasing water and nutrient use efficiency. One important finding was that there was no increase in SOC content in lands kept as fallow up to 10 years. Another experiment on influence of micronutrients on crop productivity and soil fertility was also initiated.
- **Suggestion:** Characterize soils from jhum land, fallow cycle or cropping cycle. Generalization of data based on small scale sample analysis should be avoided.
- In **Nagaland** some evidences of changing climate in terms of changing temperature and rain fall have been noticed. Study was initiated on soil properties under elevated temperature in different soil types.
- **Suggestion:** Consider modest variations in temperature while experimenting on changes in soil properties.
- In **Arunachal** studies were initiated on strategies for soil and water management for climate resilient agriculture. Residue retention contributed more crop yield over residue removal. Germination of crops like mustard was higher under zero tillage in comparison to minimum and conventional tillage. This has been attributed to relatively greater soil moisture content under zero tillage system.
- **Suggestion:** Take up quantification studies on soil, moisture and nutrient loss under different practices. Exploration of scopes for paddy cum fish culture in areas/spots where water is ponded under these indigenous conservation practices was also suggested. Large scale dissemination and popularization of rice variety RCM- 11 is needed, which is performing very well under trial.

- In **Mizoram** studies included the utility of Jalkund for harvesting rain water to be used in drier months to provide life saving irrigations to crop. Promising results were reported. Fish rearing in jalkund was also tried successfully.
- **Suggestion:** taking up studies for quantifying water loss from Jalkund, potential area coverage with the stored water and delineating the extent of yield improvement that could be achieved by using the stored water. Director also suggested establishment of integrated farming system models in combination with jalkund technology. Studies on crop performance under different tillage practices were also taken up. Under zero tillage, toria was reported to perform well.
- **Suggestion:** Change Toria cultivars for experimentation.
- **Suggestion:** Determine area that can be irrigated from an average sized jalkund.
- **Suggestion:** Try linseed under zero tillage system.

Technical session 3 (31-1-2013)

Theme 3: Understanding the unique traits of indigenous pig and poultry which make them resilient to climate change and development of data-base.

Chairman: Dr RN Chatterjee, Director, Project Directorate on Poultry, Hyderabad

Co-chairman: Dr S Banerjee , Senior Scientist, Eastern Regional Station, IVRI, Kolkata

- The session began with presentation on documenting climate resilient traits among indigenous breeds of pigs. Deep litter system in rearing pigs in NE region is advantageous though the system was found to be difficult to be integrated with other farming systems.
- Performance of Vanaraja, Gramapriya and indigenous breeds were presented. The Co-Chair of the session suggested that the relation between weather parameters and performance indicators may be looked into.
- The Chairman elaborately outlined the poultry scenario of India and the impact of climate change on the poultry industry.
- Experiments of cold water fisheries are to be taken up under institute project and also with the help of NABARD funding.
- Various physiological responses that are observed in animal due to climatic stress were highlighted.
- Data on GI parasites and meteorological parameters were presented. Studies on larval pasture concentration are to be taken up.
- In animal health sector surveillance and preparedness are crucial to mitigation and management. Such kind of studies are being taken up at Umiam and should be carried out for longer duration.
- Phenotypic and molecular characterization of Chittagong breed of poultry and Mali breed of sheep should be taken up at Tripura centre.
- Dr K. Puro, Scientist, Animal Health Division, ICAR RC for NEHR presented a new sub-project on 'Effects of climate change on disease resistant marker genes in pigs and poultry in the

north eastern region with special reference to Meghalaya'. The deliberated on the projects proposal and finally recommended for funding under NICRA with the advice that she should work on FUT1 gene of pigs of NE Region in collaboration with IIT Guwahati.

Technical session 4 (31-1-2013)

Theme 4: Technology demonstration

Chairman: Dr. O. N. Singh, Principal Scientist, CRRI, Cuttack

Co-chairman: Dr. DBV Ramanna, Sr. Scientist, CRIDA, Hyderabad

Under technology demonstration component ICAR NEH (Umiam) along with 6 other centres and 8 KVKs undertaken demonstration on different modules viz., natural resource management, crop production & protection, livestock & fisheries and capacity building in identified villages. Some of the major observations/recommendations for HQ/ centers / KVKs under Technology demonstration are as follows:

Tripura:

1. Before promoting any technology, the feasibility of adoption considering available local and socio-economic condition should be thoroughly studied.
2. Only the viable and proven technologies should be demonstrated. Only few identified technology/ variety/ breed should be promoted.
3. Jack-fruit may be introduced in agro-forestry system considering its multiple use and climate resilient nature.

Umiam:

1. The full package of practices for SRI on Rice cultivation including nursery management, use of cono- weeder should be followed for higher productivity.
2. Water delivery mechanism from jalkund should be standardized for efficient water recycling.

Arunachal Pradesh:

1. The crop selected for poly house should be a high value and off season crop for higher income.
2. Under zero tillage cultivation of toria in rice fallow the residues should be managed efficiently. Retention of standing stubbles (20-40 cm) is an economically feasible option.
3. For showing impact of interventions on citrus decline, it is better to show a good photograph of the field bearing fruits.

Mizoram:

1. The data on egg production should not be extrapolated based on one or two months record. Egg production should be reported on yearly basis considering actual dry and productive period.
2. Costly intervention such as terracing, pacca livestock houses should be restricted by all the centres.
3. Low cost live stock sheds using locally available materials and deep-litter pig housing should be promoted.

4. Jalkund should be constructed in the upper hill sides for use of water through gravitational force.
5. Mulching in pineapple may be practiced to conserve soil moisture.
6. Appropriate soil conservation measures such as growing of hedge row species, fodders on contours at an interval of 10 metres or so should be incorporated in farming system model in sloppy land condition.
7. While depicting the photographs of any integrated interventions, it is better to give a complete view of the system along with actual background and all other component for better impact and understanding of the model.

Nagaland:

1. Considering good performance of vanaraja in the backyard rural poultry farming, it may be promoted for commercial rural poultry farming also.

Sikkim:

1. Good quality silage has lot of potential during dry season under Sikkim condition.
2. Pig housing should be improved and deep litter housing system should be promoted.

General comments:

1. All the centres, KVKs should indentify stress tolerance crop/livestock species for respective locations.
2. The model village concept should be strengthened for showcasing climate resilient technologies to farmers and other stakeholders.

Recommendations /suggestions

Session-1 (Breeding strategies)

1. In Tripura, the no of crosses may be restricted to a reasonable size. Two or three crosses may be taken for the development of mapping population to identify major QTLs for rice productivity under drought conditions.
2. For Manipur centre it was advised to include checks for comparison of cold and submergence tolerance. Donors for submergence tolerance can be obtained from other institutes like CRRI.
3. There is a need to screen more rice varieties in Mizoram. Specific varieties for specific locations (upland/ lowland) should be used. Same rice varieties can't be used both in upland and lowland conditions.
4. For Centre for Biotechnology, screening of varieties should be done at ambient temperature plus or minus 3°C. Different varieties or donors from regions of high/ low temperature should be tested to identify the suitable ones in the HQ, Umiam.

Session-2 (Natural Resource Management)

1. Climate characterization and crop calendar based on agro climatic analysis to be prepared.
2. Biochar needs to satisfy (i) enhancement of soil organic matter and (ii) improve nitrogen economy. Accordingly, constituents for preparing biochar should be selected.
3. While characterizing soil from *jhum* land, fallow cycle or cropping cycle should be considered and data reported separately. Generalization of soil data is to be discouraged.
4. It was suggested that too much increases in experimental temperature was irrational as under climate change scenario increase in temperature is hardly 2-3°C. Soil temperature rise is even lesser predicted. Hence, only modest variations in temperature were suggested while experimenting on changes in soil properties.
5. Paddy cum fish culture may be considered for resource conservation. Large scale dissemination and popularization of rice variety RCM- 11 may be initiated.
6. Quantification of water loss from Jalkund, potential area coverage with the stored water and delineating the extent of yield improvement should be raised measured.
7. Linseed can be included under zero tillage condition. Promising *toria* varieties may be obtained from AAU, Jorhat.

Session-3 (Livestock)

1. Deep litter system of rearing pigs in NE region is suitable for resource conservation, though the system was found to be difficult to be integrate with other farming systems.
2. The relationship between weather parameters and performance indicators for poultry birds to be considered.
3. Larval pasture concentration in poultry can be studied.
4. Surveillance and preparedness are crucial for mitigation and management. Hence, long term experimentation on this aspect should be continued.

5. Phenotypic and molecular characterization of Chittagong breed of poultry and Mali breed of sheep from Tripura can be studied.
6. A new sub-project on 'Effect of climate change on disease resistant marker genes in pigs and poultry in the north eastern region with special reference to Meghalaya' was presented by Dr. K. Puro and suggested to restrict to pig only and with respect to climate vulnerability.

Session-4 (Technology Demonstration)

1. Before promoting any technology, the feasibility of adoption considering prevailing local and socio-economic condition should be thoroughly studied and only the viable and proven technologies should be demonstrated. Jack-fruit tree may be introduced in agro-forestry system considering its multiple use and climate resilient nature in Tripura.
2. The full package of practices for SRI on Rice cultivation including nursery management, use of cono-weeder should be demonstrated for higher productivity in Meghalaya.
3. Jalkund should be constructed in the upper hill sides for use of water through gravitational force.
4. Water delivery mechanism from jalkund should be standardized for efficient water recycling.
5. The crop selected for poly house should be a high value and off season crop for higher income.
6. Under zero tillage cultivation of toria in rice fallow the residue should be managed efficiently. Retention of standing stubbles (20-40 cm) is a economically feasible option.
7. Expensive interventions viz, terracing, pucca livestock houses etc., should be restricted by all the centers. Low cost live stock sheds using locally available materials and deep-litter pig housing should be promoted.
8. Mulching in pineapple may be practiced to conserve soil moisture in moisture form.
9. Appropriate soil conservation measures such as hedge row species, fodders on contours at an interval of 10 meters should be incorporated in the farming system model in sloppy land condition.
10. Considering good performance of vanaraja in the backyard rural poultry farming, it may be promoted for commercial rural poultry farming also under Nagaland condition.
11. KVKs of all the centers should identify location specific stress tolerance crop/livestock species for further dissemination.
12. The model village concept should be strengthened for showcasing climate resilient technologies to farmers and other stakeholders.

SD/-
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