

In the concluding panel discussion Hem Pande (Ministry of Environment, Forest and Climate Change, Government of India) and Molden referred to the significance of the 2015 Sendai Framework for Disaster Risk Reduction and emphasized its concept of 'build back better'. Despite the existing challenges and inertia in social and political systems, they hoped that the Nepal earthquake will be treated as an opportunity for the whole Himala-

yan region to 'build back better', in preparation for the inevitable future earthquakes. The seminar was a useful step in drawing together various stakeholders and diverse ideas to discuss how effective earthquake preparedness could be achieved. It has made a major beginning in the direction of collaboration between the experts and practitioners of neighbouring countries for improving the knowledge of earthquake science and

the management of the disasters it triggers.

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MEETING REPORT

Sustainable tea production*

Tea is one of the most popular and inexpensive beverages of the world. India is the largest producer of black tea and the largest consumer of this beverage. Tea crop in India is infested by various insect and mite species that cause substantial damage to this foliage-crop. The use of pesticides has often been considered as the only way to manage pest infestation on tea. Indiscriminate application of pesticides poses various risks to environment, human health and also the plant itself in the long run. There is a need to relook into the usage pattern of synthetic pesticides on this crop and development of non-chemical-based strategies for pest management. Various research groups work on or practice non-chemical pesticide approach for pest management in tea. A need was felt to have a forum to share the different initiatives and findings with the scientific community, industry and planters. This will enable development of a roadmap for non-chemical pest management. Hence a workshop on sustainable tea production was organized, that was attended by more than 200 planters along with members of Tea Research Association (TRA), Tea Board, Unilever and other MNCs, and the relevant experts from CABI and Tocklai Tea Research Institute (TTRI), Jorhat and other institutes.

The workshop clearly highlighted the efforts being made by the tea industry to reduce use of chemicals. CABI and TTRI are conducting a scientific study to evaluate the environmental and economic feasibility of applying non-chemical pest management methods for plant protection on three commercial tea estates in Assam. The ultimate aim of this project is to develop a toolkit of best practices for the ecological production of tea, which will lay down a template for industry-wide application.

The workshop started with the welcoming of the delegates by N. Muraliedharan (TRA). Ravi Khetarpal (CABI South Asia) described the purpose of the workshop. The message on behalf of Chairman, Tea Board was read by Joydeep Phukan (TRA). The workshop was structured into two technical sessions followed by a panel discussion.

The first session was on 'Non-chemical pest management – strategies and challenges' chaired by Muraliedharan and S. K. Pathak. B. V. David (Chennai) gave an introduction to sustainable pest management and an overview of pest management strategies in different crop ecosystems. Kavya Dashora (CABI) and Somnath Roy (TTRI) presented the activities under the pilot field studies in Assam for non-chemical pest management of tea, funded by Unilever. They emphasized the systems approach for enhancing soil health, pest–predator ratio, and increasing the biodiversity and systems health to manage pest attack. Radhakrishnan (UPASI-TRF) presented a success story on non-chemical pest management of tea in South India with

special reference to the use of sex pheromone traps in the management of tea mosquito bug. It was noted that the sex pheromone traps for *Helopeltis* should be field-tested in the experimental gardens, where tea mosquito is a major problem under this project. Pravir Murari (Phoolbari Tea Estate, McLeod Russell) a partner garden in the project, gave an overview of the challenges faced by the tea gardens, the experiments being performed and the deliverables so far in the project. He laid special emphasis on field and drainage sanitation to avoid the building of inoculum in the field. He described the various strategies being adopted in the garden under the project. There was active involvement from the participants during the presentations; a large number of questions were posed to the presenters and satisfactory clarifications were provided by the speakers.

The second session was on 'Strategic approaches in translation of research to practice' chaired by Ravi Khetarpal (CABI) and A. Babu (Tocklai Tea Research Institute). Abid Rahman (Goodricke Group Ltd.) on behalf of Kapil Sinha presented the experiences related to integrated pest management practices for tea at Sessa tea estate, a partner garden in the project. B Rajkhowa (Hooloongure T.E.), Andrew Yule and Co. Tea Estate and partner in the project, presented the field experiences related to the Integrated Crop Management (ICM) and Ecological Pest Management (EPM) strategies being implemented and the challenges to it. He talked about practitioner's skill building for integrated and ecological pest management. Raj Barooah (Aideobari T.E. Pvt Ltd)

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explained practicality and economics of the use of yellow sticky polythene sheet in the tea gardens to control early instars of loopers and sucking pests like thrips and white flies. Boney Kuriakose (SciGenom) explained the use of entomopathogenic viruses for pest control. Nuclear polyhedrosis viruses are known to be effective against caterpillar pests. It was noted that in the project, attempts may be made to use the crude viral suspensions for looper (*Hyposidra talaca*) control. The viral suspensions may be field-tested against the early instars of the looper. The key points discussed during the session were on jointly developing bio-pesticides and conducting multi-locational trials of the products before commercialization and involvement of community to practice it. In an active discussion, the planters recalled the initial system of ecosystem management, where each garden had multiple small areas earmarked for diverse micro-ecological zones like seed-bari, bamboo-bari, etc. which later was used for planting more tea; this has led to increased pest problems.

A panel discussion was held where the industry, policy-makers and academia gave their opinions on the topic. Everyone agreed upon the need of a consortium that would include all the stakeholders and would help in capacity building. The problem of pest management needs an understanding of the whole ecosystem, including soil health, planting material, predator life cycle, etc. and more emphasis should be laid on conducting systematic improvement in soil and bush health. The need of regular communications among stakeholders (planters, researchers, donors and policy makers), and feedback from industry to research institutions was amply highlighted. The Central Insecticide Board and Registration Committee procedures

to register the Nuclear Polyhedrosis Virus for use in pest management in tea were discussed. Another point was the better efficacy of the local strains of beneficial microbes in pest and disease management. It would be useful to apply local strains of microbial agents for more effective control of pests and pathogens. However, registration of microbial strains/formulations also needs to be considered as an official biopesticide of tea. Another key point highlighted was the need for good seed-bearing plants rather than depending solely on clonal varieties; TRA may write to the gardens for their interest in planting seed-bari and more interactive approach between scientists and planters. Clonal susceptibility is an important factor in pest attack. Information on susceptibility of clones to different pests may be obtained from the literature and also through survey by different advisory officers. Another major point of discussion was soil health, as it plays a vital role on plant health. In the project, attempts should be made to improve soil health in the experimental plots, especially ICM and EPM plots, so that apart from augmenting soil nutrient availability, the plants will be more tolerant to pest infestation.

The response from the audience was overwhelming and encouraging. The opinions of the policy-makers and research experts as well as the rich, field-based practical experience of the planters were helpful in giving direction to the present study. The ultimate aim of this work is to develop a tool kit of best practices for the ecological production of tea which will lay down a template for industry-wide application. It was noted that the toolkit should contain practices that would fit in the dynamic conditions of pests and climate change.

The key outcomes from the workshop are: (a) Systematic scientific studies on

specific ecological approaches have shown positive results. (b) Use of sticky trap works best for sucking pests and also helps in tapping the population of thrips, jassids and adults of tea mosquito bug. They are environment-friendly and cost-effective. (c) Considering the systems approach in ensuring the health of soil, ecosystem and bush in the same regard, soil-enhancing ingredients like development and use of microbial pesticides, compost, vermiwash, etc. were extensively used which showed an increase in soil health parameters. Planting of various flowering plants was done to encourage ecological diversity, population of pollinators, natural enemies, etc.

These encouraging results have motivated many planters to cut down on the use of hard chemicals and take due consideration of ecological health, pH, population of natural enemies, etc. for a healthy and sustainable tea plantations.

According to Michael Gude (Unilever) a new enthusiasm is being witnessed due to change in approach from chemicals to more sustainable tea production. He expressed hope that the outcomes of the workshop will support a roadmap for non-chemical approach in the tea industry for pest management.

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