E

联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON TEA

TWENTY-FIFTH SESSION

Guwahati (Assam), India, 31 January–2 February 2024

REPORT OF THE WORKING GROUP ON CLIMATE CHANGE

Progress made since last Intersessional meeting held on 23 February 2022 (virtual mode)

The progress made since the last meeting is presented in this report under each objective/work plan.

India

- In India, data collection and analysis of climatic variables has been further updated and carried out for all the major tea growing regions in North East India, on yearly, monthly, weekly and daily basis. Analysis of data collected from South bank region of Assam, India reveals that the region continues to exhibit declining trends of rainfall. Total rainfall during the year, 2022 was found to be 1869.4 mm which is lower than the long term normal (2003.6 mm) by 134.2 mm. Decadal analysis of the rainfall patterns were also carried out for South Bank region of Assam by calculating the average annual rainfall over last 10 decades. Results of the analysis showed irregular trends for the first five decades, i.e. higher rainfall decade followed by lower rainfall decade alternately but then sixth decade onwards there has been a significant decrease in rainfall. The magnitude of decrease from first decade to last decade amounted to 269.9mm. Analysis of long term temperature data in the South bank region of Assam since 1923 shows that maximum temperature is exhibiting an increasing trend with a steep increase in the last two years viz. 2021 and 2022 as shown in figure 3. In the year 2021, the average maximum temperature was found to be the highest ever recorded average maximum temperature in Tocklai since 1923 while in the year 2022, the temperature that prevailed during the month of March was 31.3^0C which is higher than the long term normal (27.4^0C) by 3.6^0C and also highest ever recorded temperature in the month of March since 1923.Comparison of monthly maximum temperature data for the year 2022 with long term normal shows that in almost every month (except February, April and June) maximum temperature was higher than long term normal as shown in figure 4. The average maximum temperature in the year 2022 was 29.4^0C which is higher than long term normal (28.3^0C) by 1.1^0C .
- To investigate the response of tea cultivars to rising temperature, an experiment has been initiated wherein few heat tolerant cultivars were selected for the study.
- India continued to work on identification of regional specific and socio-economically feasible adaptation strategies:

(a) Rainwater harvesting techniques within tea plantations (e.g. mini-reservoirs)

Development and creation of water bodies is presumed to help in moderation of an estates microclimate. Hence this study was initiated with the motive to study the impact of rainwater harvesting on the microclimate of an area. The study area chosen for this objective is the Borbhetta tea estate located in the South bank region of Assam and a pond of area 27m X 11m X 1.35m ($400m^3$) was developed. The various parameters that are studied regularly includes

Climatic parameters:

- Carbon dioxide (ppm)
- Temperature (℃)
- Humidity (%)

Soil Parameters

- Soil Moisture
- Soil organic carbon

- Soil available nitrogen

Microbial population count

- Bacterial population
- Fungal population

Initial results of the study showed that humid condition is maintained near the pond and it decreases gradually away from the pond.

(b) Irrigation and fertigation

Study on effectiveness of drip irrigation was carried out at Tocklai, South Bank region of Assam, India and in Dooars, North Bengal, India. Results of the study showed reduced water & fertilizer requirement by 25% as well as the cost.

Sri Lanka

Inputs prepared by Dr K Mohotti, Director, Tea Research Institute of Sri Lanka

Climate change in Sri Lanka has shown the potential to significantly impact the tea cultivation through **Temperature Changes, Changes in Precipitation Patterns, Extreme Weather Events, Altitude Shifts and Water Management** requirements etc. Evidences on impacting optimal growth, changes in the flavor profile of tea leaves, traditional regional characteristics of Sri Lankan teas, incidence of pests and diseases, damage tea bushes, disrupt supply chains and lead to production losses and thereby potentially affecting yields are been in investigation through a separate R&D Thrust of the TRISL's Strategic Plan.
In parallel, the tea growers are directed to adopt adaptive measures to mitigate the impacts of climate change; the short, medium and long term strategies include**: developing resilient cultivars and selection of improved seed progenies targeting the climate change vulnerable areas, implementing water conservation practices, strengthening cultural and agronomic practices and crop and vegetation diversification. Besides, TRISL is focusing on additional research and outreach service activities to support the industry.** TRISL highlights the following as outcomes on above and collaboration between government and non-government agencies, research institutions, the tea industry, and local communities are promoted to develop and implement effective adaptation strategies proven as best practices.

Assessment of the impact of global climate change on productivity and profitability of the tea industry
Investigation of rapid interventions to minimize the adverse effects of climate change on tea identified the potential interventions such as exogenous application of chemicals to improve the survival under short term drought conditions and to determine their economic feasibility to minimize the adverse effects of climate change on tea.

Plant hormonal regulation on physiological changes in tea during drought stress
The relationship between exogenously applied plant hormones (abscisic acid - ABA, salicylic acid - SA, and gibberellic acid - GA) and physiological responses in different tea cultivars under drought conditions were established.
Comparison of organically and conventionally grown tea with special emphasis on ambient temperature variation in polytunnels
Increasing ambient temperature under organic and conventional systems increased photosynthesis, stomatal conductance and transpiration, specific leaf area and shoot growth rate

while water use efficiency, leaf total polyphenol content, and yield components measured as dry weight per bud were observed to be decreasing with the increasing temperature, indicating decreasing yield and quality. Further, the specific leaf area increased with the increased temperature, but this increase was significantly lower in the organic system compared to the conventional system indicating better tolerance to the increased temperature under organic tea cultivation and convincing as a climate change mitigation measure.

Climate change and pest incidences

Incidences of different species of insect, mite and nematode pests in the different agro ecological regions were found erratic in the recent past. Also, a few pests were immerging as new and appear as potential pests causing threat to tea in unexpected locations. In contrast, a few pest species lost severity levels in certain recorded locations. The studies on Root-lesion nematode, *Pratylenchus loosi,* most economically important pest in tea in Sri Lanka resulted morphometrically different and molecularly divergent *P. loosi* populations with significantly different virulence and pathogenicity levels triggered by soil temperature variations. This warranted appropriate nematode management and mitigation strategies in different tea growing regions.

Challenges and future direction

R&D focus at the TRISL on Resilient Tea Cultivars, Adaptive Agronomic Practices, Climate-Smart Pest and Disease Management, Precision Agriculture, Community Engagement and Education was well placed and International Collaborations and Policy Support were found as paramount important in the journey of mitigating climate change at medium and long term. TRISL already established tripartite agreements with the University of Bristol and Kew Gardens, UK and University of Peradeniya with funding from the University of Bristol and Ahmed Tea, UK to engage in in depth investigations on water use efficiency in tea cultivars and seed progenies with varying drought tolerance.

Improved irrigation techniques, adoption of sustainable, regeneration and organic farming practices and agroforestry models, monitoring and predicting changes in pest and disease dynamics under different climate scenarios etc. are lined up to improve overall resilience and long-term sustainability of the tea industry.

'Solutions Center for Climate Change Mitigation and Precision Agriculture' for climate smart and carbon neutral tea cultivation

In line with achieving carbon neutrality for the Sri Lankan tea industry as declared by the Colombo Tea Traders Association Road Map (CTTA RM) 2030, appropriate strategies on sustainable and responsible tea cultivation i. e. renewable energy, energy auditing and management, plantation forestry, conservation and social forestry, organic and non-chemical farming, use of bio-fertilizers and bio-pesticides, water and waste footprint management and conservation, sustainable soil development and conservation, eco designing and climate actions of agricultural lands, climate change mitigation measures, recycling of local resources, encouraging natural resource utilization, rational waste management and energy conservation were identified for all communities in the tea sector.

To accomplish the requisites, (i) Satellite mapping through land use and water resource mapping and 3D/4D Landscape models, (ii) Drone mapping covering land use, vegetation cover, vegetation quality through 3D/4D Landscape model and (iii) Automated Weather Stations (AWS) established in selected geographic locations to measure the parameters such as rainfall, humidity, wind speed, soil moisture, soil ammonia, soil carbon dioxide, sunlight lux etc. were implemented and data are being generated.