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Capacity development training workshop on crop simulation modelling and effects of climate risks on agricultural production systems in Southeast Asia

CBA2018-04MY-Geetha

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UNIVERSITY OF TOYAMA

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1. Summary

Climate change poses a significant threat to the agricultural sector, especially in tropical regions where agriculture is a vital source of livelihood. In Southeast Asia (SEA), climate change is already significantly impacting agricultural production, and the need for sustainable food production systems has become a top priority for researchers, policymakers, and farmers. The effects of climate change on agriculture are complex and multifaceted, making it difficult to predict the exact impact on crop yields. As a result, there is a growing need for tools and methods to evaluate the potential effects of climate change on agricultural production. One such tool is the Decision Support System for Agrotechnology Transfer (DSSAT), a crop modelling system that enables researchers to simulate different crop management scenarios and evaluate the environmental risks associated with these scenarios. The DSSAT crop modelling system has been widely used to study the potential impacts of climate change on crop yields in various regions of the world. The system allows researchers to evaluate the impact of different environmental factors, such as temperature and rainfall, on crop growth and yield. Using this system, researchers can identify potential management strategies to help farmers adapt to changing climatic conditions and maximize sustainable agricultural production. However, to effectively evaluate these impacts, researchers must have the necessary skills and tools to generate new agricultural information that can improve farming practices and guide farmers in mitigating climate risks.

This project's primary objective is to equip researchers from Southeast Asian countries, including Cambodia, Indonesia, Lao PDR, and Vietnam, with skills in using DSSAT cropping system models. To achieve this goal, we conducted a one-week hands-on practical exercise training workshop in Can Tho, Vietnam, in March 2019, Chiang Mai, Thailand, in August 2019, and Bangkok, Thailand, in 2023. The participants, numbering sixty-two, were chosen based on their specialization in crop and soil science and their involvement in crop production or agro-ecosystems-related research, teaching, planning, extension, and outreach, and they were gender-balanced. The significant outcomes of this project, participants learned crop simulation modelling techniques and case study examples that can be utilized to tackle real-world challenges, such as enhancing agricultural practices and providing practical guidance to farmers. The training offers an assessment of integrated assessments, validates farm production inputs, and simulates productivity using crop models. The training workshops served as a platform for future collaboration and knowledge-sharing among SEA participants, including National Agricultural Research Systems (NARS), young researchers, academicians, policymakers, and international organizations. The project also fostered interactions between local agricultural communities and scientists, allowing for exchanging scientific knowledge related to new farm management practices.

Ultimately, our project was fulfilled to contribute to developing sustainable and profitable agricultural production systems in Southeast Asian countries.

2. Objectives

The project aims to contribute to strengthening agricultural adaptation and developing agronomic models that benefit food systems. The SEA region needs to reduce their vulnerability to climate change by supporting building capacity and developing risk management strategies. Strengthening adaptation capacity must acknowledge the farmers stated needs with targeted innovations to create resilience and sustainable agriculture production systems. The proposed training promotes the capacity to increase collaboration with scientists and communities; the crop simulation modelling provides significant strategies and technologies to build cropping systems more resilient against climate change.

The specific objectives to achieve this main goal are identified as follows:

I) To provide a one-week hands-on practical exercise on the proper use and applications of DSSAT and its associated crop simulation models to solve actual problems.

II) Identifying appropriate promising technologies and developing adequate strategies to make agricultural production systems profitable, sustainable and resilient through crop simulation methods.

III) Evaluating integrated assessments and analyzing farm production using DSSAT tools to verify inputs and simulate productivity.

IV) Strengthening technical and scientific abilities by enhancing collaboration between National Agricultural Research System (NARS), policymakers, and local communities with international organizations.

3. Outputs, Outcomes and Impacts

Outputs	**Outcomes**	**Impacts**
- Assists scientists to evaluate the impacts of climate change on crop yields by using experimental data or crop growth simulation models (particularly to improve crop yields, and farm management techniques)	- By utilizing DSSAT tools and crop models, agricultural information can be improved, and efficient guidance can be provided to farmers to mitigate the risks of climate variability and other challenges.	- Strengthening collaboration among multiple institutes in agriculture research promotes knowledge sharing and advances the field. - Integrating crop modelling systems into undergraduate and

- Farmers get an opportunity to learn the lessons from the crop experimental plot (crop varietal changes, shifting planting dates, suitable fertilizer and irrigation techniques).	- Participants from agricultural extension departments successfully conducted simulations to predict future crop yield under various environmental conditions, which can assist in developing effective strategies for crop management and minimizing the impact of climate variability and risks on crop production. - Sixty-two individuals from six countries were trained, including 48 young researchers and 24 female scientists, thereby promoting diversity and inclusivity in agricultural research. - Participants have been formed to encourage future collaboration and data sharing among institutes, facilitating agricultural research and development advancement. - Research partners established experimental plots in the farmers' fields to gather crop management data and identify appropriate technologies that could benefit farmers by improving their agricultural practices.	graduate curricula equips students with essential skills and knowledge for modern agriculture, preparing them for future careers and addressing current challenges. - Encouraging young academics and scientists to pursue more profound research and innovation in agriculture leads to continuous advancements and improvements in the field. - Extending training programs within institutes in local languages by research partners to enhances their effectiveness and empowers more individuals to use crop modelling systems in their work. - Initiating interactions between farmers and scientists promotes collaboration and knowledge sharing, leading to advancements in agricultural practices for the benefit of all.

4. Key facts/figures

- Successfully managed to organize training workshops without translating the DSSAT Cropping model materials into local languages with the support of technical resource persons from the respective case countries.
- An interactive session was organized among five farmers and twenty-three scientists to discuss improving rice crop productivity.
- Forty-eight early career professionals trained.
- Out of sixty-two professionals from (Cambodia (7), Lao PDR (6), Vietnam (21), Ethiopia (1), Singapore (1), Thailand (19), and Indonesia (7)) trained DSSAT cropping system models.
- One inception and three country-wise DSSAT training workshops were organized in Can Tho, Vietnam; Chiang Mai and Bangkok, Thailand.
- Established collaborations among participants and resource persons to share their crop management data and experiences.

5. Publications

Geetha. M., Andi, R.B., Saroj, C., Payus, C., Sudarma, I.M., Kensuke, F. (under submission, May 2023). Assessing farmers` responses to climate change and water management in Bali province, Indonesia. *Climate Services.*

6. Media reports, videos and other digital content

4.1 Project products delivered or completed

1. Inception meeting at Can Tho, Vietnam. http://hatri.org/en/-notification/the-results-of-the-scientific-workshop/n1314.mt24h
2. Five-day hands-on training program on 'Crop Simulation Modelling and Effects of Climate Risks on Agricultural Production Systems in Vietnam' from March 05-09, 2019 at Can Tho, Vietnam. https://sites.google.com/view/hatricsm2019/participants
3. Five-day hands-on training at Can Tho, Vietnam. http://hatri.org/en/activities/transfer-operations/the-results-of-training-workshop/n2137.mt24h
4. Call for Applications: Joint Workshop on DSSAT and MWCropDSS 2019 International Training in Thailand. https://www.apn-gcr.org/2019/06/04/call-for-applications-joint-workshop-on-dssat-and-mwcropdss-2019-international-training-in-thailand/
5. Six-day hands-on training program on 'Efficient and Precision Agricultural Resource Utilization under Changes with Simulation Models and GIS' from

August 19 to 24, 2019, in Chiang Mai, Thailand. https://www.carsr.agri.cmu.ac.th/training/dssat2019/

6. DSSAT Foundation about Vietnam Workshop (In English) https://dssat.net/3268
7. DSSAT Foundation about Thailand Workshop (In English) https://dssat.net/3513
8. Joint training workshop on Crop Simulation Modeling and Effects of Climate Risks on Agricultural Production Systems in Southeast Asia http://www3.u-toyama.ac.jp/cfes/pdf/20230109_14.pdf
9. DSSAT Foundation about Thailand Workshop (In English) https://dssat.net/5239/

4.2 Paper Coverage

1. Soc Trang Provincial Department of Science and Technology (in Vietnamese) https://sokhcn.soctrang.gov.vn/sokhcn/1285/31788/58979/287226/Tin-tuc/Dao-tao-Tin-sinh-hoc-va-phan-mem-quan-ly--nghien-cuu-cay-trong.aspx (Published on March 13, 2019).
2. University of Toyama news about the DSSAT workshop in Bangkok (In English) (https://www.u-toyama.ac.jp/en-news/65088/)

7. Pull quotes

"To ensure the sustainability of agricultural production systems in countries with limited funding for development training, it is crucial to prioritize capacity-building programs, collaboration among institutes, and comprehensive training opportunities that can equip individuals and communities with the necessary skills to mitigate the impact of extreme events and adapt to changing environmental conditions."

-Prof. Geetha Mohan, University of Toyama, Japan

"The project enhances the capacity and collaboration of practitioners and interdisciplinary teams with a systems approach tool called Decision Support System for Agrotechnology Transfer (DSSAT) towards sustainable food production systems under risks from climate change".

-Prof. Attachai Jintrawet, Chiang Mai University, Thailand

"The capacity building and collaboration are key factors for adaptation of the agricultural sector under climate change and the need for food for the world population. The Decision Support System for Agrotechnology Transfer could be used as a tool for precision activity in order to manage efficiency input, reduce cost, increase productivity and a higher standard to meet the market demand."

-Dr. Chitnucha Buddhaboon, Ministry of Agriculture and Cooperatives, Thailand

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