

Theme: Food Security

1. **Course Title:** Crop Journey: Innovation and Food Security

2. **Duration:** 15 days (Total of 45 hours)

Proposed period: fifteen days available during 24 June to 16 July 2021

3. Background and Rationale

Regional economy in recent time had changed from using modern technology for increasing agricultural products and tend to make use of knowledge base and natural resource to create innovation for economic added value, the tendency of economy development in the same style is also the changing direction of world economy. Most of powerful countries are now support the creation of innovation for increasing value of products and country's economy, according to National Economic and Social Development Board No. 11 which set the grouping of countries in Asia policy under Free Trade framework between ASEAN and China, Japan, and India, and becoming ASEAN community in 2005, and No. 12 which emphasized in process that answer the national strategy which is "Thailand, Secure, Prosperous, Sustainable, is developed country by sufficiency Economy Philosophy development", by new economy reformation in Bio Economy and Creative and Cultural Economy reformation which have cross cutting issues such as Intellectual Property System reformation, financial support for creator, researcher, for entrepreneur to use research and intellectual property for developing to products/services to the market, personnel/innovator with creativity preparation, such as Education system reformation to foster the youth to realize the importance of intellectual property, create the specialist about intellectual property management. These changes directly and indirectly affect the investor in the country, both governmental and private, to have development in searching, adjust and develop innovation to conform to the changing of world economy and from the idea of "Thailand 4.0" of Thai government which focus on making the advantage in international economy competition under innovation and creativity.

Economic, social, and cultural effects that came from the fast change of technology which led to creation of innovation. This made innovative knowledge become important thing that must be create in Thailand. Faculty of Sciences, Mahidol University realized the importance of technology and innovation that affect economy, society, and culture, and has the urgent necessity to create student's educational, academic, training programs and research strength for knowledge, ability and becoming important personnel in developing the country. **Faculty of Sciences, Mahidol University (MUSC)** in cooperation with strong institutional partners has been actively established various training programs in

different fields both at national and international levels. This is to support one of our missions in creating the graduate and potential personnel that can bring knowledge in sciences & technology and related areas to increasing their keen professional skills, as well as boosting up the ability to apply and develop sustainable innovation to become new generation entrepreneur and business owner that has ability to create innovation, patent, and develop technology by one's self. MUSC has also the experiences to provide our master programs in science and technology in TICA project on scholarships for Bhutanese's human resource development.

Food security is one of the major challenges many countries including Thailand will have to overcome in the 21st century. Food security could be achieved when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Understanding the value chain of food products is one of the most important components in developing sustainable and secure food value chain. Food value chain consists of different sectors, including upstream (production), midstream (processing), and downstream (marketing, distribution, and waste management). However, different products will have different value chains, and characteristics of value chain of the same product may vary from country to country. Therefore, this short training course will focus on the Thai tropical fruits' value chain starting from upstream to downstream or 'crop journey' from farm to table. For the food value chain to be sustainable and secure, each sector of value chain must achieve these 3 following criteria. First, each sector must be economically profitable and add values to the products. Second, environmental impacts of activities in each sector must be considered. Third, activities in each sector must improve quality of life of people, including making good quality and nutritious food easily accessible and available at affordable price over a stable period of time. This course will cover not only different sectors of the value chain, but also the science, technology, and innovation involved in production, processing, and distribution of Thai tropical fruits, as well as utilization and management of wastes from fruit production and processing to make food value chain more sustainable and secure.

After finishing this training course, the participants will have a perspective of the whole Thai tropical fruits' value chain, starting from the basic science of crops, cultivation, preharvest and postharvest practices, food safety practices, processing and preservation of fruits, packaging technology, distribution of tropical fruits to the market, innovative fruit products, to waste management. Furthermore, the participants will experience the insight of cutting-edge or current technology and innovation in crop production and processing, as well as enjoy unique Thai culture and various fruit products through multiple workshops, practices, and field trips. In addition, the participants will have a chance to present

their project assignment and share their experience about the value chain of food product in their home countries and how they will apply the knowledge and experience acquired during this course in their work or daily life. As a result, the participants will learn about different innovations, technology, value chains, markets, and cultures from different countries.

Faculty of Science of Mahidol University is ready to organize and host this short training course due to the following reasons. First, Faculty of Science is experienced in organizing international short training courses and has been constantly providing short training courses for more than 10 years. Secondly, Faculty of Science of Mahidol University is a pioneer in knowhow for innovative crop production research. Many faculties and researchers have been continuously working on research in areas, such as smart farming, precision agriculture, advance plant breeding, microclimate and environment, indoor farming & plant factory under artificial environments, quality improvement, postharvest and handling, etc. Furthermore, Faculty of Science of Mahidol University has many state-of-the-art facilities that are suitable for this course, such as plant factory at Phayathai Campus, greenhouses at Salaya Campus, and multiple research laboratories at both Campuses. Finally, most of personnel of Faculty of Science of Mahidol University are fluent in English since there are 6 international undergraduate programs and 36 international graduate programs operated under Faculty of Science.

4. Objectives

- 4.1. To introduce upstream, midstream, and downstream sections of value chain of Thai tropical fruits, in both theory and practice
- 4.2. To offer experiences of various activities occurring in value chain of Thai tropical fruits through virtual workshops and site visits
- 4.3. To promote exchanges of knowledge and experiences between participants and other related parties

5. Course Contents

5.1. Course Outline

The program consists of 3 week-long modules, i.e. 'Birth of flavors', 'Flavorful transformation', and 'Serve on your table'. Each module focuses on different sectors, i.e. upstream (production), midstream (processing), and downstream (marketing) of Thai tropical fruits' value chain. The objectives and topics of each module are briefly described below:

Module 1 Birth of Flavors

Objective This module focuses mainly on upstream sector of Thai tropical fruits with some example of vegetables). The content will be emphasized on philosophy and significant roles of tropical crop management; relation of resource demand and supply with human and environment; potential of bioresources, bioproducts and biological wastes; smart technology; creative strategies and integration of innovation for sustainable benefits of mankind, society, and global environment. Principles and process of field professional management of public R&D organizations and private enterprises; invention and quality product development; innovation management of community enterprise and community business; entrepreneurship effect on community, economic and public society; evaluation

Schedule

- Day 1** Quality production of tropical fruits and vegetables (3-h lecture)
- Day 2** Precision farming technology (3-h lecture)
- Day 3** Plant factories for quality production of vegetables (3-h lecture)
- Day 4** Quality control of materials and quality analysis (3-h lecture)
- Day 5** Virtual field trip to plant factory with artificial lighting (PFAL)

Module 2 Flavorful Transformation

Objective This module focuses on midstream sector of Thai tropical fruits' value chain, i.e. the production phase. It provides basic principles and practices of commercial production processes for both SME-level and mass production of fruits and fruit products in Thailand, including receiving and handling of raw materials, important processing and preservation techniques, packaging, and storage of the finished products.

Schedule

- Day 6** Processing and preservation of fruits (3-h lecture)
- Day 7** Flavor of Thai fruits (Sensory evaluation) (3-h lecture)
Virtual workshop: Flavor technology
- Day 8** Packaging technology for fruits and fruit products (3-h lecture)
- Day 9** Virtual workshop: Measurement of fruit and vegetable quality attributes
Virtual workshop: Sensory evaluation
- Day 10** Virtual workshop: Modified Atmosphere Packaging

Module 3 Serve on Your Table

Objective This module focuses on downstream sector of Thai tropical fruits' value chain. It covers important activities that occur after the production phase to the point of sale, for example, storage and distribution and waste management and utilization, as well as marketing of tropical fruits and fruit products.

Schedule

Day 11	Distribution of fruits and fruit products (3-h lecture) Virtual workshop: Fruit damage from transportation
Day 12	Marketing of fruits and fruit products (3-h lecture)
Day 13	Utilization of waste from fruit production and processing (3-h lecture) Virtual workshop: Composite material & edible film preparation
Day 14	Virtual field trip to fruit market
Day 15	- End of program examination - Presentation of project assignment

5.2. Virtual workshops

5.2.1. Quality attributes measurement of fruit and vegetable

Brief lesson and demonstration of how to measure important quality attributes of several fruits and vegetables. In this lesson, the participants will be introduced to principle, equipment, and basic analysis method of many commodity attributes. The lesson also covers the use of test kits in the field.

5.2.2. Flavor technology

Brief lesson and demonstration on flavor technology. In this activity, the participants will learn about natural and artificial flavor related to Thai tropical fruits. The demonstration includes the use of GC-O.

5.2.3. Sensory evaluation

Brief lesson and demonstration on sensory evaluation of Thai tropical fruits will be given. In this activity, participants will be introduced to principle of sensory analysis and important sensory criteria of Thai tropical fruits and fruit products; and practice sensory testing, which is an important tool in raw material selection and product development process.

5.3. Virtual Field Trips

5.3.1. Virtual field trip to plant factory

Location: Both Mahidol University and one of the leading private company in the field of plant factory business in Thailand. Activity includes virtual tour and virtual discussion via Zoom application. The participants will gain experiences and understand principal concepts with business perspectives.

5.3.2. Virtual tour to fruit market and fruit orchard

Virtual visit to both rural- and urban fresh produce markets. This will provide the participants a chance to observe how the final activity in the downstream of value chain of Thai tropical fruits work. The participants will be able to observe commercial produce warehousing and sale managing of these two different produce market businesses, as well as the decision making of the consumers for fruits and fruit products.

5.4. Advance Assignments

5.4.1. Country Report

See attached Country Report Format

5.4.2. Reading Assignment

Participants should read the following documents before attending the training:

- “Novel plant bioresources: applications in food, medicine and cosmetics” by Ameenah Gurib-Fakim (ed.), John Wiley & Sons Inc., 2014.
- “Biorenewable resources: engineering new products from agriculture” by Robert C. Brown and Tristan R. Brown, 2nd edition, Wiley Blackwell, 2014.
- An Introduction to the Basic Concepts of Food Security:
<http://www.fao.org/3/al936e/al936e00.pdf>
- Developing sustainable food value chains: <http://www.fao.org/3/a-i3953e.pdf>
- The food value chain: A challenge for the next century:
https://www2.deloitte.com/content/dam/Deloitte/ie/Documents/ConsumerBusiness/2015-Deloitte-Ireland-Food_Value_Chain.pdf
- Fruit and vegetable processing:
<http://www.fao.org/3/v5030e/v5030E00.htm#Contents>
- Chintakovid W. and Supaibulwatana K. PFAL business and R&D in Asia and North America, Thailand (Chapter 3). *In* Kozai T., Nui G. and Takagaki M. (eds.). *Plant Factory:*

An indoor vertical Farming System or Efficient Quality Food Production (2nd Edition, p. 64-69). *Academic Press. Elsevier Inc.*, 2020; 488 p. ISBN: 978-0-12-816691-8

Topics that participants should have been familiar with before attending the training:

- Sustainable development or sustainability
- Basic chemistry, biology, and physics

5.4.3. Project Assignment

On the first day of this course, an individual project assignment will be given to all participants. The project assignment will be a concept proposal about how each participant will use the knowledge and experience acquired during this course from Biology and classification of tropical fruits, Fruit cultivation, to Utilization of waste from fruit production and processing in his/her work back in his/her home country. Format of the proposal will be provided to participants electronically. The participants will present their project assignments on Day 6 of Module3. The presentation will be 15 minutes long with 10 minutes for proposal presentation and 5 minutes for Q&A, discussion, and recommendation from instructors and fellow participants.

6. Participants Criteria

6.1. Bachelor's degree or higher in the area related to the subject OR

Working or have work experiences in the area related to the subject \geq 3 years

6.2. Fluent in spoken and written English AND

For non-native English-speaking countries, the English language examination score must be submitted, along with 1) the application and 2) the country report.

The minimum English score required for this training course:

TOEFL IBT	70
TOEFL PBT	525
TOEFL CBT	194
IELTS	6.0
TOEIC	635

7. Venue

Via Zoom and/or Facebook live

8. Expected Results

- 8.1. The participants know and understand the basic principles of important aspects/sectors throughout entire value chain of Thai tropical fruits and are able to apply/integrate newly acquired knowledge to/into their current or future work/task, after finishing the training program.
- 8.2. The participants are exposed to real-life experiences of various activities in value chain of Thai tropical fruits, both in small- and mass production scale, and can use these to improve their works or solves problems related to the subject.
- 8.3. The participants gain wider view of the subject through sharing experiences, exchanging ideas, and/or discussing cases with other participants and module instructors, as well as other individuals met throughout the training program.
- 8.4. This training program will initiate collaborations among individuals and their respective organizations.

9. Evaluation

9.1. Program evaluation

Participants will be evaluated their performance according to following activities:

- Class participation
- Project assignment (report and presentation)
- End of program examination

9.2. Program certificate accreditation

Upon completion of the program, participants will be awarded the ‘Assessment-based Certificate’ or ‘Certificate of Participation’. The criteria for both certifications are listed below:

	Assessment-based Certificate	Certificate of Participation
Participation time (%)	> 80%	> 80%
Project assignment	- Submit the report in time - Give presentation on the last day of the program	- Submit the report in time - Give presentation on the last day of the program
Score of end of program examination (%)	≥ 80%	< 80%

10. Institution

10.1. Executing / Implementing Agency

10.1.1. Implementing Agency:

The School of Bioinnovation and Biobased Product Intelligence, Faculty of Science,
Mahidol University

10.1.2. Readiness

10.1.2.1. Staffs

For this course, there will be 3 instructors responsible for lecture, workshop and practice sessions, and field trips, which are:

- 1) Assoc. Prof. Kanyaratt Supaibulwatana, Ph.D., Vice dean of Faculty of Science and Head, School of Bioinnovation and Biobased Product Intelligence

Assoc. Prof. Kanyaratt Supaibulwatana, Ph.D. graduated her doctorate degree in plant biotechnology from Chiba University in Japan and has been working on various research related to plant physiology, plant biotechnology and innovative crop production by genetic manipulation.

- 2) Asst. Prof. Watcharra Chintakovid, Ph.D.

Asst. Prof. Watcharra Chintakovid, Ph.D. graduated his doctorate degree in Environmental Horticulture from Chiba University with specialization in environmental control engineering and simulation of crop physiology. His expertise includes integration of smart device for environmental science, and physiology of fruit crop production under climate change conditions.

- 3) Asst. Prof. Siriyupa Netramai, Ph.D.

Asst. Prof. Siriyupa Netramai, Ph.D. graduated her doctorate degree in packaging from Michigan State University. Her expertise is postharvest technology, food processing, product development and food packaging.

- 4) Thitisilp Kijchavengkul, Ph.D.

Thitisilp Kijchavengkul, Ph.D. graduated his doctorate degree in packaging from Michigan State University with specialization in environmental science and policy. His expertise includes distribution packaging, waste management, and environmental science.

- 5) Wannisa Chuekong, B.Sc.

Ms. Wannisa Chuekong, work as scientist at School of Bioinnovation and Bio-based Product Intelligence, Faculty of Science, Mahidol University. She got her degree in

Agricultural Science at Mahidol University, Kanchanaburi campus and performed her active research specialization in plant micropropagation and plant factory under artificial environments.

During the training, numbers of supporting staffs from Faculty of Science will be assigned to help coordinate and organize this course. Assoc. Prof. Kanyaratt Supaibulwatana was assigned as contact person in the case where participants or prospect participants require any further information regarding the training course or other information. Beside 6 undergraduate programs (Thai regular program), there have 42 international programs which are actively operated under Faculty of Science of Mahidol University, this including 6 undergraduate international programs, 18 Master international programs, and 18 Ph.D. international programs.

10.1.2.2. Training Materials/ Equipment Availability

Faculty of Science of Mahidol University (MUSC) has many state-of-the-art facilities that will be used in this training course, such as plant factory at Phayathai Campus, greenhouses at Salaya Campus, as well as laboratories those are well equipped with appropriate scientific instruments required for this course.

10.1.2.3. Accommodation – (online training with virtual workshop and live)

For on campus training: Generally, Faculty of Science (MUSC) will coordinate for standard accommodation with safety, convenience, and reasonable price.

10.1.3. Implementing Agency Address:

Faculty of Science, Mahidol University,
272 Rama VI Road, Ratchathewi, Bangkok 10400, THAILAND

10.1.4. Contact Person:

- 1) Assoc. Prof. Kanyaratt Supaibulwatana, Ph.D. (Project leader)
E-Mail: kanyaratt.sup@mahidol.ac.th; Tel: +662-201-5303, Fax: +662-354-7160
- 2) Asst. Prof. Siriyupa Netramai, Ph.D.
E-Mail: siriyupa.net@mahidol.ac.th

10.2. Collaborative Organizations

- 10.2.1 Chiba University, Japan
- 10.2.2 Community enterprise
- 10.2.3 Private company

Country Report Format

I. Introduction

1. Name of the Training Course:

2. Name of Applicant:

Home Address:

Phone No. (Home & Office)

Fax:

E-mail:

3. Name of Country:

4. Name of Organization:

5. Main Task of the Organization & Organization Chart:

(Please draw an organization chart, starting from "section" as the lowest level and circling the section to which applicant belongs)

6. Applicants' Position: Roles and Responsibilities

II. General Information of the Participant's Country

(Within 1 pages of A4 size paper)

III. Historical Background and General Information of the Subject Related to the Training Course

(1-2 page of A4 size paper)

(Please include information on the country's local/regional fruits, especially most produced fruits and high-value fruits, if any)

IV. Existing Laws and Regulations Concerning the Subject (if any)

(Please include brief descriptions on significance and area of practice, if any)

V. Existing problems in the Applicants' Section *(1-2 pages of A4 size paper)*

1. Current problems and/or constraints the applicant/the organization are facing

(Please include specific details and/or examples/situations)

2. Obstacles in the process of solving those problems

3. Countermeasures of questions for those problems or idea in which the participant would like to study or solve through this course

VI. Future Program/Project on the Related Subject

1. What is the future policy/program/or project the participant will be participated or involved in concerning the subject?
2. How is this training course related to those future plans?

VII. Expectations for the Training Course *(up to 1 page of A4 size paper)*

1. What are the main area(s) or topics provided in this training course that the participant interested in? Please provide brief reason(s)
2. How does the participant expect to apply the knowledge and skills received from this training course after returning to the home country?
3. Other inquiries/requests the participant is expecting for this course (if any)

(Note that the scope and schedule of this training program is finalized and cannot be changed upon the participant request, but some minor content might be added to improve overall learning experience)