The 20th International Students Summit
on Food, Agriculture and Environment

Linking Actions, Research and Education in Agriculture Value Chains to Achieve Environmental, Social and Economic Sustainability

September 14 - 17, 2021

ONLINE

2021 TOKYO

Organized by
Tokyo University of Agriculture（Tokyo NODAI）

The 20th International Students Summit (ISS) on Food, Agriculture and Environment

Linking Actions, Research and Education in Agriculture Value Chains to Achieve Environmental, Social and Economic Sustainability

September 14 - 17, 2021, Online

Statement

The rapid global spread of the unprecedented COVID-19 pandemic since 2020 has affected millions of people already made vulnerable by food insecurity and malnutrition, furthering the sustainability crisis the world had been facing before 2020. This global situation makes it a clearly urgent need to draw together the wisdom and vitality of youth, the torchbearers of the future of mankind. There are especially wide-ranging missions for agricultural students, as agricultural science plays a key role in the solution of fundamental problems in food production and safety, environmental conservation, energy, and human health. The system of food production and consumption is without a doubt closely related to the condition of the natural environment, the stage of economic development, and food culture of each country, and their patterns and problems reflect the regional characteristics. It is thus important to understand how agriculture and food systems should be organized and maintained in each society.

Tokyo University of Agriculture (Tokyo NODAI) has been organizing the "International Students Summit (ISS) on Food, Agriculture and Environment" since 2001 to provide students from our global partner universities with an opportunity to gather and exchange views and ideas on global food, agricultural, and environmental issues, and also to discuss their own roles in sustainable development.

This year, the 20th ISS has been decided to take place on September 14-17, 2021 with the theme of "Linking Actions, Research and Education in Agriculture Value Chains to Achieve Environmental, Social and Economic Sustainability," which was adopted at the 19th ISS in 2019. Due to the pandemic situation, the event will be exclusively held online. We expect the participating students to share the activities they have undertaken at their universities during their presentations and discussions. The framework of student activities as to the rationale, methods, implications (economic, social and cultural), and constraints should be clarified in order to link their contributions to the solution of global problems for the sustainability of this world.

- Two(*) presenters were nominated by each participating university. Each presentation must be aligned with one of the following **sub-themes**:
  - Session 1: Students' Actions in the field of **Agriculture**
  - Session 2: Students' Actions in the field of **Environment**
  - Session 3: Students' Actions in the field of **Food**
  - Session 4: Students' Actions in the field of **Education**
  - Session 5: Students' Actions in the field of **Nutrition**

(*) Upon the support from MEXT for our ongoing "Inter-University Exchange Project", our partner universities in Africa were entitled to nominate 6 presenters.

- All participating universities are required to appoint a faculty advisor for each presenter to provide support during preparation and ensure the quality of the abstract and presentation.

Organizing Committee& Students Committee
International Students Forum,
Tokyo University of Agriculture

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To the audience of the 20th International Students Summit
The ULR links for the Live Discussion are available on the ISS portal site: https://www.isstokyonodai.net/
The presentations will be in on-demand format and only the discussion part will be conducted in live format. The presentation videos of all presenters are available on ISS portal site.
It is highly recommend watching the presentation videos before assisting the Live Discussion.

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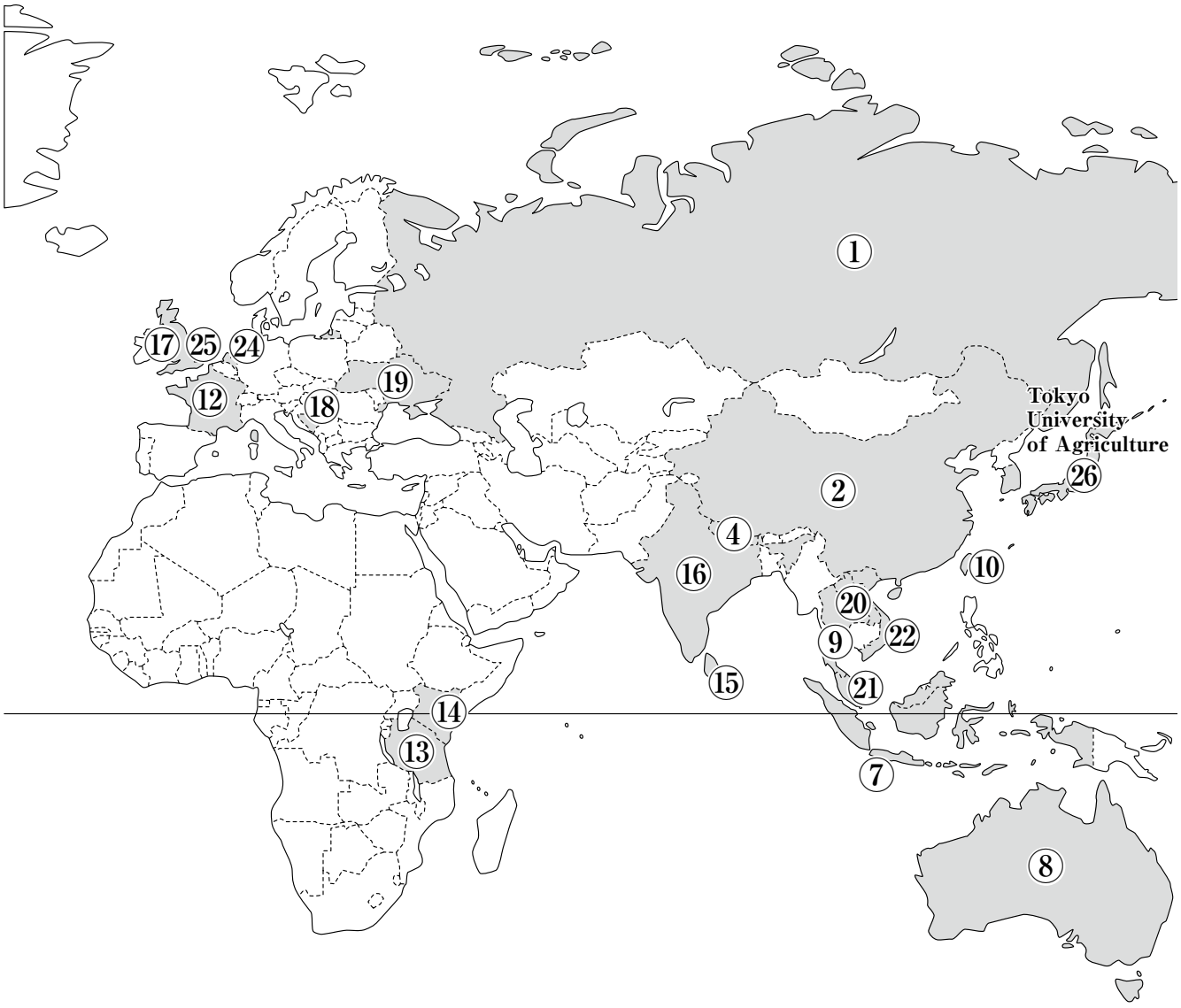
All the chairpersons are students representing Tokyo University of Agriculture

The 20th ISS Participating Universities



① Far Eastern Federal University
② Beijing Forestry University
③ Universidad Nacional Agraria La Molina
④ Agriculture and Forestry University
⑤ Michigan State University
⑥ University of São Paulo
⑦ IPB University
⑧ Western Sydney University
⑨ Kasetsart University
⑩ National Chung Hsing University
⑪ The University of British Columbia
⑫ UniLaSalle
⑬ Sokoine University of Agriculture
⑭ Jomo Kenyatta University of Agriculture and Technology
⑮ University of Peradeniya

⑯ Chaudhary Charan Singh Haryana Agricultural University
⑰ University of the Highlands and Islands
⑱ University of East Sarajevo
⑲ National University of Life and Environmental Sciences of Ukraine
⑳ National University of Laos
㉑ Universiti Putra Malaysia
㉒ Vietnam National University of Agriculture
㉓ Rural Federal University of Amazon
㉔ Wageningen University & Research
㉕ University of Reading
㉖ Tokyo University of Agriculture

Program

*Please note that there may be many sessions occurring simultaneously

Wednesday, September 15th

9：00 AM（Japan time）　Group A: Students' Actions in the Field of "Agriculture"

https://youtu.be/tqiQe4VP38U

【Biochar and physical properties in Luvic Anthrosols】

Alena Ivanovna, *Far Eastern Federal University*

https://youtu.be/tP5a5cMPLtI

【Strategies of Rural Agriculture Development from Landscape Perspective: A Case Study of Linxian, Shanxi Province】

Yuxin Hao, *Beijing Forestry University*

https://youtu.be/4Q6dApHVsIM

【The sustainability of peat use in plant nurseries in Peru】

Santiago Rosell, *Universidad Nacional Agraria La Molina*

https://youtu.be/JNsfzMcWQto

【Productivity and Profitability of Mandarin Orange Production in Nepal】

Ritesh Kumar Jha, *Agriculture and Forestry University*

https://youtu.be/hb53ASs--eM

9：00 AM（Japan time）　Group B: Students' Actions in the Field of "Education"

https://youtu.be/J_b91z6h6K8

【Empowering Youth Through Community Food Security Efforts】

Addy Stuever Battel, *Michigan State University College of Agriculture and Natural Resources*

https://youtu.be/NHGomij2x_0

【Environmental education with children about the water usage】

Isabela Butturi Gevartoski, *University of São Paulo*

https://youtu.be/wPX-_ecSkps

【Localite: Empowering Youth through Community-Based Local Development in Supporting Indigenous and Local Food System to Achieve Food Security and Sustainable Development】

Yasmin Kamila, *IPB University*

https://youtu.be/2Tbr7oT5tes

10：40 AM（Japan time）　Group C: Students' Actions in the Field of "Nutrition"

https://youtu.be/-3Zg-Bs16bo

【Vegetable protected cropping in warm climates】

Terry Lin, Western Sydney *University, Sydney*

https://youtu.be/nMk70UsLGNE

【Thriving food innovation in Thailand by the BCG model】

Onnalin Wiriyasumon, *Kasetsart University*

https://youtu.be/y7uJe2vzl6U

【Precision Agriculture as a Solution for Current Problems】

Mayara Sartori, *University of São Paulo*

https://youtu.be/pUQxYGXzo4o

【An alternative to animal testing on food: Using a skin equivalent to test the anti-aging effect of functional food for responsible production and sustainable life on land】

Nguyen Hanh Nhung, *Tokyo University of Agriculture*

https://youtu.be/tEw9bXi1SY0

10：40 AM（Japan time）　Group D: Students' Actions in the Field of "Food"

https://youtu.be/Pyb2lEmzEHk

【Moving toward sustainable circular economy through insect biotreatment】

Achitphon Teeraruangchaisri, *National Chung-Hsing University*

https://youtu.be/jr8PD4O_Prk

【Creating a Culturally Appropriate Pantry Purchasing Guide for Students During the COVID-19 Pandemic】

Salma Ghanem, *University of British Columbia*

https://youtu.be/55vEKR1LYJ0

【Prevalence of NTS Salmonella, Antimicrobial Resistance Pattern and Risk Factors on Commercial Poultry Value Chain in Chitwan, Nepal】

Sumit Sharma, *Veterinary Sciences and Fisheries, Agriculture and Forestry University*

https://youtu.be/4lrdY4--PLo

16：00 PM（Japan time）　Group E: Students' Actions in the Field of "Agriculture"

https://youtu.be/SsavodjY48w

【Thinking about access to healthy and sustainable food as a common good for all to achieve Environmental, Social and Economic Sustainability】

Karen Coria Chagoya, *UniLaSalle*

https://youtu.be/IhNNNwzxJEg

【Storage Stability Assessment of the Meat Tenderizer Blend with Pawpaw-Ginger to Determine Its Shelf Life】

KILEMILE WARREN HENRY, *Sokoine University of Agriculture*

https://youtu.be/mU5xRo4RZMc

【Socio-economic Factors Influencing Select African Indigenous Vegetables' Productivity amongst Smallholder Farmers. A case study of Kabete Sub-County, Kiambu County, Kenya】

Joan Murugi Macharia, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/5X1HoSGcIjQ

【Knowledge Dissemination by Linking Actions and Research: Solutions for the Problems Faced by the Farmers in Sri Lanka】

Sahitha Lochana Karapitiya, *University of Peradeniya*

https://youtu.be/Ska-tlaZnG4

【Promotion of Organic Farming in Kampong Cham Province, Cambodia】

Oum somara, *Tokyo University of Agriculture*

https://youtu.be/U34ZTjjRnkw

16：00 PM（Japan time）　Group F: Students' Actions in the Field of "Education"

https://youtu.be/6hFTNtYMtBY

【Application of Image Classification Model in agricultural insect's management】

Patcharawit Wilaikaew, *Kasetsart University*

https://youtu.be/EKcU-HiBO9A

【Engaging Youth in Indian Agriculture Education for Ensuring Food and Environmental Security】

Sakshi Chugh, *Chaudhary Charan Singh Haryana Agricultural University*

https://youtu.be/IKsVb9InICM

【Personal factors affecting consumer purchasing decisions towards women skin care products(A case study at Saba Saba ward in Morogoro Municipality)】

Mercey M Laban, *Sokoine University of Agriculture*

https://youtu.be/4A5LvbbesoU

【Development and assessment of the physiochemical characteristics of cookies made using a flour blend of wheat, sesame seeds and Bambara groundnut.】

Wachira Joy Njeri, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/9zkL0yNfYsc

【Farmer Ranger: A New Paradigm Shift of Youth Agriculture Development in Indonesia by Optimizing Local Institution and Ag Big Data】

R Imam Nuryaman K, *IPB University*

https://youtu.be/knK_l8mBXFA

17：40 PM（Japan time）　Group G: Students' Actions in the Field of "Environment"

https://youtu.be/61C7q9hk6Hk

【Deer Management Practices in European Forestry and their Potential Future Applications in Scottish Forestry】

Euan Tomes, *University of the Highlands and Islands*

https://youtu.be/k2X53B9-m5k

【Geographic Information System in environmental protection】

Igor Cemercic, *University of East Sarajevo*

https://youtu.be/stv65fxiPL0

【Environmental education in National university of Life and Environmental Sciences of Ukraine and youth initiatives in Ukraine】

Sofiia Salnyk, *National University of Life and Environmental Sciences of Ukraine*

https://youtu.be/vg54pGg5-d4

【Eco-tourism For Sustainable Environmental Conservation】

Julius Mwangi Kamita, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/JkrRwiP-hcQ

17：40 PM（Japan time）　Group H: Students' Actions in the Field of "Nutrition"

https://youtu.be/qGHK4uBV0SQ

【Bakery product development using stevioside】

Galstyan Mariam Vardanovna, *Far Eastern Federal University*

https://youtu.be/4_G3Hs9n1QA

【Contributing Sustainable Development goal for Food System in Lao PDR.】

Oulaiphone Ouankhamchanh, *National University of Laos*

https://youtu.be/DrCq1XmF9dg

【Food and Dietary Related Non-Communicable Diseases in Tanzania】

Jenipha B. Mayenga, *Sokoine University of Agriculture*

https://youtu.be/_x91cjWUCUw

【Solar Dehydration Characteristics of Papaya（*Carica papaya*）】

Maryiano Keziah Anyango Awino, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/XCoEatnIdjA

Thursday, September 16th

9：00 AM（Japan time）　Group I: Students' Actions in the Field of "Agriculture"

https://youtu.be/DLonNgMQ7FA

【What do we lose when unfettered capitalism meets under-utilized species?】

Rachel Drobnak, *Michigan State University*

https://youtu.be/VvU1gbfy8Lc

【Raise the awareness of agricultural water shortage issue among new generation in Taiwan】

Yong-Sin Lo, *National Chung-Hsing University*

https://youtu.be/gZMveBsYVpU

【Agriculture for youth】

Vatsal Arora, *Chaudhary Charan Singh Haryana Agricultural University*

https://youtu.be/ORAr0id7s5U

【Freezing Method on Minimally Processed Durian for Long Term Storage】

Intan Afiqah Ahmad Fadzil, *Universiti Putra Malaysia*

https://youtu.be/EK-Pt9stND4

9：00 AM（Japan time）　Group J: Students' Actions in the Field of "Environment"

https://youtu.be/C9Wxg2UuBJ4

【The changes on the consuming habits of Vietnamese youth to deal with microplastic pollution】

Nguyen Duc Canh, Cao Thi Thu Thuy, *Vietnam National University of Agriculture*

https://youtu.be/LSk41T-lM2U

【Using agro-industrial by-products to achieve sustainable livestock production in Brazilian Amazon】

Érica Coutinho David, *Federal Rural University of Amazon*

https://youtu.be/N2A1vQGLW-Y

【Incentivizing Reuse Culture in Metro Vancouver through a Mobile App Program】

Angelica Tso, *The University of British Columbia*

https://youtu.be/5LCKBjHRzxM

【Soil Organic Carbon（SOC）Importance and its influence on Climate Change: an approach new mitigation method】

Arostegui, Keiji, *Tokyo University of Agriculture*

https://youtu.be/nVxqrue2l6w

16：00 PM（Japan time）　Group K: Students' Actions in the Field of "Agriculture"

https://youtu.be/CTZL0H-C8rs

【Protected Cropping in Australia Emerging Technologies in Novel Environments】

Bethanie Haase, *Western Sydney University*

https://youtu.be/oaYFSKHk0ec

【INCREASE OF DROUGHT TOLERANCE IN MAIZE THROUGH THE USE OF GENETIC MODIFICATION USING SbABI5 FROM SORGHUM】

KIM KUFAZVINEYI, *UniLaSalle*

https://youtu.be/q_OYDqPHi9k

【Quality Improvement of Cocopeat as a Propagation Media through Composting as a Desalinization Procedure】

Irene Akinyi, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/UpZnkBb8a4Y

【Changing the Existing Social Identity of a Farming Community to Sustain Their Lives】

Dematagolle Wedaralalage Ovin Jetha Amaratunga, *University of Peradeniya*

https://youtu.be/9-7Gbkrrkfw

16：00 PM（Japan time）　Group L: Students' Actions in the Field of "Food"

https://youtu.be/uJqUL2i1r7s

【Competitiveness of Ukrainian agricultural products】

Alona Lebedko, *National University of Life and Environmental Sciences of Ukraine*

https://youtu.be/IvAyccOiykI

【Use of Bio-Fungicidal Extracts in Managing Seed-Borne Fungi for Improved Maize Seed Germination in Morogoro, Tanzania】

Rehema Erasto, *Sokoine University of Agriculture*

https://youtu.be/WrWpO528xzs

【Effect of Different Processing Techniques on the Biochemical Composition of Purple Tea（*Camellia sinensis* var. kitamura）】

Joyline Cheptoo, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/1lFBuDCRAfk

【The Effect of Retail Promotions on the Price Elasticity of Demand of Conventional and Organic Food Products】

Martijn Wals, *Wageningen University*

https://youtu.be/XfbColvQ8xE

【Tackling Food Waste for a More Sustainable Food System】

Iqra Amin, *University of Reading*

https://youtu.be/GQ388rjTqMk

17：40 PM（Japan time）　Group M: Students' Actions in the Field of "Agriculture"

https://youtu.be/wF-eDdQwZEU

【Breaking Down Barriers Between Forestry and Agriculture within Scotland】

James Jacek, *University of the Highlands and Islands*

https://youtu.be/BiRxegvQTW4

【Organic Animal husbandry】

Verica Prodanovic, *University of East Sarajevo*

https://youtu.be/Wf1TwDXr9Bg

【Characterization of selected rice landraces tolerance to flooding in Tanzania】

Mwakyusa Lupakisyo, *Sokoine University of Agriculture*

https://youtu.be/3JcZRwEst6g

【Application of Plant Growth-Promoting Rhizobacteria（PGPR）on *Cucumis melo* to Enhance Plant Growth and Fruit Quality】

Melissa Lok Mei Teng, *Universiti Putra Malaysia*

https://youtu.be/p0k_wyWh9H8

【The CHINAMPAS ～ Aztec technology will help developing Agriculture ～】

Yuzu Nakano, *Tokyo University of Agriculture*

https://youtu.be/bmd_A8EvqCs

Voices from Next Generation

High School Students' Presentations

1 **【An Effective Use of Blueberry Leaves: Utilization of Agricultural Waste】**
Mana Iizuka
Senior High School at Sakado, University of Tsukuba
https://youtu.be/lSSoMpz5vrY

2 **【Utilization of Coppice Woodlands through Cultivation of Japanese Yams】**
Ikumi Kanaya
Senior High School at Sakado, University of Tsukuba
https://youtu.be/kuXYy5g7VF4

3 **【Conservation Oriented Agriculture: What we consumers can do】**
Aisa Amano, Tamaki Hoshino, Tohei Doi
The First High School, Tokyo University of Agriculture
https://youtu.be/h26il9EBm2U

4 **【How to make the world of endangered animals better】**
Hina Samata, Yuka Teshima, Yuka Otomo, Shogo Sekiguchi, Miyu Higuchi, Soshu Ikeda, Kenshi Sorimachi, Toi Sato
The Second High School, Tokyo University of Agriculture
https://youtu.be/WlCOKeDhTaw

5 **【Gender Gap】**
Miru Fukuda, Rin Nakanishi, Kurumi Horie, Chiseri Matsumoto, Karen Miyata
The Second High School, Tokyo University of Agriculture
https://youtu.be/0ov9meXhcrE

6 **【Investing in Children through Foodbank】**
Sena Kazama, Katsuhiro Teraya, Shogo Shimada
The Third High School, Tokyo University of Agriculture
https://youtu.be/-xl9GTiAoZk

7 **【The Inquiry-Based Study of Sustainable Development Goals】**
Ami Kimura, Yuka Matsumoto, Hirotsugu Nakamura
The Third High School, Tokyo University of Agriculture
https://youtu.be/bPk3-jvzihk

Message from Elementary School Students

Toka Elementary School, Tokyo University of Agriculture
https://youtu.be/iHmPmTJ4OvA

Group A

Group theme

Agriculture

Presenters:

Alena Ivanovna, Far Eastern Federal University
Yuxin Hao, Beijing Forestry University
Santiago Rosell, Universidad Nacional Agraria La Molina
Ritesh Kumar Jha, Agriculture and Forestry University

Chairpersons:

Rival Valcin, Tokyo University of Agriculture
Mozelle Millenas Ramos, Tokyo University of Agriculture

Biochar and physical properties in Luvic Anthrosols

Alena Ivanovna

Advisor: Brikmans Anastasia Vladimirovna

Far Eastern Federal University, Soil Science department

Safe and sustainable food production on healthy soils is one of the main goal for the modern society in the face of limited resources of the planet. Among the main properties of the soil, density settings occupy a special place. On the base of the density of soil provides the calculations and quantitative assessment, such information is necessary for understanding soil processes of water movement in the soil, growth of the roots, air exchange, redox reaction and other important factors. Use of green technologies for agriculture are modern trend in soil science. These methods include the application of biochar as a meliorant of agricultural soils. Biochar is a biomass of black carbon produced by low temperature pyrolysis (e.g. manure, organic waste, bioenergy crops, plant residues) in an oxygen-free or low oxygen environment.

Biochar, as a soil builder, significantly improves many of the physical properties of the soil and can positively influence the growth of roots or mycorrhiza in the soil, increasing the ability of plants to absorb water or nutrients. The field experiment was in 2018 - 2020 on the territory of the Primorskaya Vegetable Experimental Station of the All-Russian Scientific Research Institute of Vegetables (Surazhevka village, Primorsky Territory, Russian Federation), Luvic Anthrosols (FAO&IUSS, 2015; Popova, 2019) were selected as the objects of research. Biochar produced from wood residues of *Betula alba* was used as an meliorant to improve soil porosity (Bovsun, 2020). Doses of biochar application on the experimental sites were 1 and 3kg /m^2. The determination of soil density was carried out in samples with undisturbed composition, taken into metal cylinders. The density of the solid phase of soils was determined by the pycnometric method (Kachinsky, 1965).

The experimental site was divided into 3 parts: without of biochar (control), with biochar 1 kg of (1 kg/m^2) and 3 kg of biochar (3 kg/m^2). Crop rotation shows in table 1. Soil porosity measurements were carried out before the growing season (May) and after it (October) from 2018 to 2020.

Table 1. Field experiment during 2018-2020

Year	Experimental plots		
	0 kg/m^2	1 kg/m^2	3 kg/m^2
2018	Cabbage		
2019	Soybean		
2020	Green grass		

Density and porosity of the soil. Studies have shown that the values of the field density (Table 2) are in the range of 0.89-1.24 g/cm^3, the density of the solid phase is 2.41-2.8 g/cm^3. Based on the data on soil density and solid phase density, the porosity of the studied Luvic Anthrosols was calculated.

At the beginning of the growing season in 2018, the porosity of agricultural soils was characterized as satisfactory. At the end of the 2018 growing season, an improvement in porosity was found in the control sample, which corresponded to the transition of the soil to an

excellent indicator for arable horizons. At a dose of biochar of 1 kg/m^2, by October 2018, an increase in the porosity index of agricultural soils, an excessively porous estimate. The application of a biochar dose of 3 kg/m^2 also leads to a significant increase in porosity and its transition from a satisfactory to an excessively porous state. A year after the application of biochar (2019), at the beginning of the growing season, porosity indicators in the control plot deteriorated. Biochar dose at 1 kg/m^2 excessively porous structure turned into an excellent one, also biochar at dose at 3 kg/m^2. At the end of the growing season of 2019, the number of pores decreased in all observed samples; in the control, and was assessed as satisfactory, turning into unsatisfactory for the arable horizons. Biochar dose at 1 and 3 kg/m^2 there was a transition from excellent porosity to satisfactory.

Table 2. Physical parameters of soils during 2018-2020

Object	May 2018			October 2018		
	Porosity	Granulometric composition [3]	Antierosion resistance	Porosity	Granulometric composition [3]	Antierosion resistance
Control	53	Light clay	average	62	Light clay	low
1 kg/m^2	-			68		low
3 kg/m^2				64		average
	May 2019			October 2019		
Control	60	Heavy loam	average	50	Heavy loam	average
1 kg/m^2	57		average	51		low
3 kg/m^2	58		low	54		low
	May 2020			October 2020		
Control	56	Heavy loam	average	-		
1 kg/m^2	53		average			
3 kg/m^2	57		low			

Granulometric composition of soils. Agrosoils in May 2018 (before the introduction of biochar) were light clay in terms of granulometric composition (table 2). In October 2018 the granulometric composition did not change (light clay).

In May 2019, a year after the start of the experiment, the particle size distribution changed from light clay to heavy loam, which could have been triggered by appropriate pre-sowing treatment. In October 2019 and May 2020, the granulometric composition did not change and is a heavy loam. When comparing the granulometric composition of October 2019 and May 2020, only a slight change in the ratio of particles in the fraction of physical clay was revealed, without changing the name.

Biochar in long-term dynamics improves the granulometric composition of Luvic Anthrosols. During the year of the experiment, the soils gradually changed from light clay to heavy loam, which corresponds to a lighter granulometric composition and an improvement in the quality of surface horizons for their use in agriculture.

Anti-erosion resistance of soils. The anti-erosion resistance of soils characterizes the ability of soils to withstand the washing away effect of a water flow or the mutual effect of water flow and rain drops, the value is expressed by the erosion flow rate, determined by the size of the water-resistant aggregates and their adhesion to each other. Biochar affects the

physical properties of agricultural soils, assessing their changes, it is possible to identify the effect of biochar on the anti-erosion resistance of soils.

In October 2018, the anti-erosion resistance is mainly low, however, in the variant with the use of biochar at a dose of 3 kg/m^2, it is average, despite the 4-time inter-row cultivation. At the beginning of the growing season (May) 2019, the indicators of anti-erosion resistance are average, except for the option at a dose of 3 kg, where the indicator decreases and becomes low. In the end of the growing season (October 2019), the anti-erosion resistance is predominantly low. It should be noted that this year was characterized by a significant amount of rainfall throughout the growing season.

In May 2020, the test plots were left fallow and therefore were not actively machined. In the control variant, it is average, but in the variant with the use of biochar at a dose of 3 kg/m^2, this indicator is low. It should be noted once again that these soils were not processed during the entire growing season, however, an indicator that, in general, the anti-erosion resistance is higher than in the same areas after steam at the beginning of 2018 before the introduction of biochar and planting of cabbage.

Biomass. During the growing season of 2018, white cabbage was grown in the studied areas, the plant biomass increases (table 3). For example, in the area without biochar the lowest value was both the total biomass of cabbage from the site and the average biomass of one unit. At the site with a dose of 3 kg/m^2 of biochar – the highest value of the cabbage biomass.

According to the data for the growing season of 2019, there was no significant difference in the soybean biomass when applying different doses of biochar. Probably, the lack of correlations is associated with abnormally wet conditions during this growing season.

Table 3. Plant biomass of agricultural crops, 2018-2019

Plot	Biomass of cabbage		Biomass of soybean	
	Total biomass, kg/number of units from plot	Average biomass, kg/unit	Total biomass, kg/plot	Average biomass, kg/m^2
Control	23.420/45	0.520	52.704	2.440
1 kg/m^2	49.480/45	1.110	45.446	2.104
3 kg/m^2	71.382/48	1.487	50.328	2.330

Conclusion. In general, over the three years of the experiment, biochar as a structure of soils had a positive effect on the granulometric composition of Luvic Anthrosols, making it easier. As a result of the biomass study, it was concluded that the introduction of biochar in heavy soils by granulometric composition has a positive effect on the crop productivity. There was also a correlation between the dose of biochar application and the biomass of white cabbage. With an increase in the dose of biochar application, the biomass of cabbage increased.

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Strategies of Rural Agriculture Development from Landscape Perspective: A Case Study of Linxian, Shanxi Province

Yuxin Hao

Advisor: Shiyang Zhang

Beijing Forestry University

School of Landscape Architecture

Landscape Architecture

China has been an agricultural country since ancient times, with a long history of farming. People settled in rich land and lived here for generations, and then they have a special feeling of dependence and belonging to the land. Gradually, a human settlement environment centered on agriculture was formed.

The geology and landforms in China are varied, so in order to adapt to the local natural conditions, people use different ways to rebuild environment. So that farming methods, territorial landscape and vernacular settlements are different from place to place. Terrain of China is high in the west and low in the east, and can be divided into three terraces. Historically, the large-scale development of China's land originated in river valley basin in the second terrace (Wang, 2018), where the land is conducive to crop growth. Therefore, villages and cities gathered around here.

The rich geomorphic features gave birth to the rich man-land relationship. People select a suitable place to settle down. In order to carry out agricultural activities better, people build water conservancy facilities and transform the texture of the land. This unique way of land arrangement and utilization has led to the traditional landscape of China, including both artificial and natural elements, which formed the landscape system integrating mountain, water, field and city. (Wang, 2018)

But nowadays, with the acceleration of urbanization, the land problem also springs up. First of all, the rapid development of land resources has caused serious damage to the environment and the featured regional landscape. For example, the pesticide pollution on the land surface, soil salinization, desertification, soil erosion, decrease of arable area (Kong, 2019) and the homogenization of villages and cities. Secondly, traditional farming patterns are no longer suitable, land use needs to be innovated and transformed. These are all environmental problems and challenges that we face today.

At the beginning of last year, the sudden outbreak of COVID-19 changed the world dramatically. While I was quarantined at my grandmother's home in countryside, I start to think about how rural agriculture like here adapt to the modern society from the perspective of landscape.

My grandmother's home is located in Linxian, Shanxi Province, which belongs to the loess plateau of the second terrace, where the gullies are deep and steep, and the terrain is broken. The rivers in Linxian belong to the Yellow River system, and the utilization rate of surface

water is only 27.7%, so the irrigation water cannot be guaranteed. (Xue, 2020)

Linxian is also a traditional agricultural county with 1073 square kilometer of cultivated land, including 30 square kilometer of high-yield first-grade land and 51 square kilometer of second-grade land. Other cultivated land is sloping land with low soil nutrient content or shallow beach land (Wu, 2016), which has serious soil erosion and low land productivity problems.

Linxian is located in the mountains. People reserved the relatively flat land for farmland, built caves along the contour of the hillside nearby rivers (Li, 2016), forming settlement layout closely related to landscape.

Through interviews, I learned from some elderly residents in Linxian that the planting of Linxian used to be dominated by dates and walnuts. About two decades ago, agricultural products were sold all over the country, and residents took this as their main source of income. But in recent years, as every family rushed to grow better-selling industrial crops, there was an excessive output and value reduction. Meanwhile, with the acceleration of urbanization, all the young people in rural areas go out to work, leaving only the elderly to farm, and agricultural products lose their competitive advantage. Now the agricultural products are not even self-sufficient. So, we can see that agriculture has not formed a complete industrial chain in Linxian, and the role of agriculture has not been fully played. Linxian has even become one of the key counties for poverty alleviation and development in China.

From the above research and analysis comes the conclusions. Firstly, agriculture has always been an important system to support human settlements. The living system is a whole, and agriculture is closely related to other parts, which is indispensable in the urban and rural development in future China. So, we must solve the problem from the perspective of how to adapt agriculture to modern development.

Secondly, agricultural industry in Linxian is not a system, which can not support the development of Linxian. From the perspective of my major under the holistic view, this is a problem of rural agriculture being impacted while fitting in the modern society. On the one hand, it is an economic problem. For example, as each family decides its own agricultural crops, Linxian's agriculture cannot form a well-functioning agricultural value chain, and the current agricultural industry cannot support Linxian's economic development at all. On the other hand, rural construction does not pay attention to the protection of regional landscape features. The urbanization in rural areas makes all villages the same. Many distinctive cultural landscapes cease to exist, and villages become unrecognizable and uncompetitive, which in turn affects the regional economy.

Based on the problems and conclusions above, I consider and discuss from my professional perspective that agriculture in Linxian should be developed in combination with scenery and tourism, for agriculture alone is not enough to support its development.The key lies in the protection and utilization of rural cultural landscape. Perhaps we can put forward some possible solutions from the perspective of the combination of agricultural value chain and territorial landscape.

1.Protection. Protect the ecologically fragile natural areas and the distinctive landscape

features.

2.Restoration. Restore the areas where the natural environment has been damaged. Make full use of modern ecological restoration technology.

3.Renewal. With the purpose of building a characteristic brand for Linxian, we should adjust the agricultural planting strategy, update the agricultural value chain, fully excavate the regional advantages, and combine local agricultural products with local culture. We should plan the county's agricultural system under the holistic view, and enhance the regional uniqueness comprehensively.

4.Intervention. On the basis of the protection strategy and on the premise of not affecting the lives of local people and not damaging the local cultural landscape, appropriate modern means should be introduced to create an agricultural value chain combining culture and tourism. For example, renovate some of the cave dwellings and turn them into modern museums and homestays. Build agricultural experience parks that combines science popularization. Develope jointly with surrounding towns, and comprehensively promote the agricultural, ecology and economic of Linxian.

These four strategies are put forward from the perspective of human, nature and city, take the protection and restoration of natural environment and cultural landscape as the basis, take the renewal and intervention as the main means to improve the economy. These strategies coordinate with each other, develop together, and reconstruct the agricultural value chain, so as to achieve the ideal rural agricultural development.

There are many similar rural areas in China. I put forward some development strategy possibilities from my professional perspective here, hoping that one day we can get rid of poverty in these rural areas and retain China's territorial landscape at the same time.

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The sustainability of peat use in plant nurseries in Peru

Santiago Rosell
Advisor: Roberto Ugas
Universidad Nacional Agraria La Molina, Peru
Department of Horticulture

The use of peat in plant nurseries has increased over the years in Peru. With agricultural exports rising up, new markets have opened as well as multiple opportunities for service businesses, one of these being the value chains of plant nurseries, which are in charge of the initial process of sowing seed and maintaining seedlings, reducing the costs and logistics of crop establishment. Peru is now a leading exporter of fruits and vegetables in Latin America and if growth continues the need for specialized nurseries will also grow, including the demand for peat or similar inputs. Peat has several benefits for nurseries when used as plant substrate: it increases the water holding capacity, has a good cation exchange capacity, does not contain phytotoxic substances, and has a low bulk density (Pascual, 2018). This product is also used a lot for home gardening and ornamental plants in urban settings.

This product is normally extracted from Andean wetlands (peatlands) at high altitudes (over 3000 masl), which are generally managed by peasant communities. This peat is extracted by the farmers and sold to private companies or to middlemen, who generally take care of primary processing (cleaning, homogenization of particles) and exported or sold to other value chain actors locally. But Andean wetlands have a key role in the regulation of water in the watershed and provide ecosystem services (Fonkén, 2014), so there are various institutions or projects collaborating with the rural communities in the management of their wetlands and the negotiations with several stakeholders (Zarabia, 2014). But the exploitation of wetlands to obtain peat can be highly unsustainable, contributing to ecosystem degradation and weakening social organization linked to it (Zaller, 2007). Peatlands specifically are very important because they capture large quantities of carbon dioxide (CO_2) and convert it to organically bound forms, so they have the potential to mitigate climate change (Lilleskov, 2019). With this we can also imply that if we do not maintain the peatlands correctly we can contribute to climate change.

Peru is the country with the largest area (50 000 km^2, 11% of total) and volume (88 Gm^3, 5% of total) of peatlands in South America and fourth in the world (Page et al, 2011), although a lot of peat is imported, there has been an increase in peat harvesters, some legal and others illegal (who are also called "champeros"). One problem with this is the lack of regulations in these activities and that the difference between wetlands and peatlands is not clear, as the Ministry of the Environment has stated: "*The general law recognizes the importance of wetlands, but there is no mention of peatlands*", and that there are several public institutions with a say in this situation, increasing bureaucracy and the need for multiple coordination (Gutierrez, 2019). Other factors are affecting peatlands as well: extraction activities like mining, the construction of roads, illegal change of land use, logging, overgrazing, drainage works, lack

of data regarding extraction, among others (Gonzales, 2020).

There are some ways by which markets try to regulate the use of peat. For example, it is accepted in substrates of certified organic operations if it is less than 80% of the mixture, since it is the most common substrate in plant nurseries over the world (EGTOP, 2013). Even though this maximum is supposed to decline, it has not changed substantially over the years; nevertheless, having organic certifications or other general certifications rules about the use of peat would help a lot to minimize its extraction. New alternatives for peat have appeared in the Peruvian market, like coconut coir that I am investigating for my graduation research.

A very promising development in Peru is the payment for ecosystem services and in 2021 SEDAPAL, Lima's public water company, started a project with peasant communities in the highlands of the Rimac watershed, where Lima is located, investing in training and support for the conservation of peatlands that help regulate the water available for the city (Forest Trends, 2021). At the same time, public opinion is getting more information about the ecological and social dangers of the unsustainable extraction of peat in the Andean highlands (Zieger, 2020).

I think there should be more activities coming from university students about the importance of maintaining peatlands, especially the Peruvian ones as it is especially important for South America. Plenty of consumers are not aware of the damages that comes from using this substrate and prefer to buy the local peat because of its lower prices not knowing the implications of choosing it. Just like recycling and other activities, it is important to create conscience on the consumer mind, and this can be done in universities.

When it comes to replacing peat, the government should conduct more research about substrates or agronomical practices for replacement, because right now peat is too important in the industry and the government should help, not only to maintain it but to look for alternatives and solutions for its replacement or illegal markets will rise when peat is forbidden. In the research I am doing about coconut coir as a replacement for peat has shown until now that coconut coir alone is not going to replace peat but mixing coconut coir with other renewable substrates as compost and other agronomic practices might do.

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Productivity and Profitability of Mandarin Orange Production in Nepal

Ritesh Kumar Jha
Advisor: Dr. Arjun Kumar Shrestha
Agriculture and Forestry University, Nepal

Citrus is a major cultivated fruit in Nepal and mandarin ranks first in terms of area, coverage and production among other citrus species (AITC, 2020). Area and production of citrus fruits have increased in the last five years while productivity has decreased. An increase in total production of citrus in Nepal is primarily attributed to an increase in the area under cultivation (ARSD, 2006; Paudyal *et al*., 2002; Subedi & Jacobsen, 2000; Subedi & Acharya, 2008). In this context, this study was conducted to assess cost, return and profitability; resource use efficiency, adoption of orchard management practices and their determinants. The study was conducted in Salyan district of Karnali Province taking data primarily from field survey conducted in Chhatreshwori and Baghchaur municipalities of the districts. A total of 150 mandarin orange producers were selected randomly and surveyed to collect primary information required for the study using local enumerators/students studying at Agriculture and Forestry University, Rampur, Chitwan, Nepal. Collected data were entered in MS-Excel and were analyzed using Stata software. Primary data were analyzed using appropriate analytical techniques like mean, frequency, percentage, range, Cobb-Douglas production function, Logistic, regression analysis, marginal fixed effect analysis and correlation analysis. The study showed that the total fixed cost shared only 16.65% of the total cost and the cost of human labor shared highest among the variable cost. Profitability in terms of gross and net margin from the study area showed mandarin-based farming system a viable and attractive commercial enterprise with average gross and net margin of NRs. 108820 and NRs. 92790.75 respectively. Similarly, average BC ratio over variable cost was 2.36 while average BC ratio over total cost was 1.97 respectively which showed mandarin farming as one of the profitable enterprise in mid-hills of Nepal. Similar to the finding of present study, Pokhrel (2011) has found BC ratio greater than one i.e. 2.1 for Udipur and 2.6 for Chitti VDC of Lamjung district respectively. This evidence was further supported by Gautam et al. (2020) and Regmi *et al.* (2020) who have found mandarin production as one of the viable enterprise with the BC ratio greater than one in Gulmi and Dailekh districts of Nepal respectively. The results further revealed that the labor factor of production was over-utilized by about 136 percent and need to be reduced with the use of mechanical tools and other factors of production like manure, fertilizers, micronutrients, irrigation and pesticides were underutilized. These resources are to be increased in their use by about 69, 92, 99, 94 and 99 percent respectively for realizing optimum revenue. It was also found that the return to scale was decreasing (0.733) which suggests that production occurred among mandarin farmers in the study were in stage 2, a rational stage of production. Study also revealed that the major factors which are responsible for positive contribution in the adoption of different management practices were gender and education of household head, land holding,

economically active members in the family, primary occupation being agriculture, attachment of mandarin producers in farmers' group, training and percent of total household income from mandarin crop sub-sector. The different management practices like use of lime in orchard for soil reclamation, irrigation, north facing of orchard, use of less sloppy area for mandarin orchard establishment, planting trees in terrace, spacing of more than 4X4 square meter, intercropping in winter season, intercropping of mandarin with legume, uses of Bordeaux paste, mulching and weeding showed negative correlation between all these management practices and citrus decline. This means increase in the level of use of all these resources and practices help to reduce the level of citrus decline in mandarin orchard and contribute toward higher productivity. The result is in line with the finding of Srivastava and Singh (2009) who have stated that the proper management practices as an important remedial solution for citrus decline in mandarin orchard. Arriving to the concluding remarks, the study justified that there is enormous scope of increasing productivity and profitability of mandarin orange, and a mandarin-based farming system could be one of the possible options for mid-hills of Nepal for commercialization which can be achieved by increasing the use of underutilized resources and addressing the factors contributing the adoption of recommended management practices as assessed in this study.

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Group B

Group theme

Education

Presenters:

Addy Stuever Battel, Michigan State University
Isabela Butturi, University of Sao Paulo
Yasmin Kamila, IPB University

Chairpersons:

Sophavina Bunthan, Tokyo University of Agriculture
Ognen Onchevski, Tokyo University of Agriculture

Empowering Youth Through Community Food Security Efforts

Addy Stuever Battel
Advisor: Rhonda Crackel
Michigan State University College of Agriculture and Natural Resources

In 2014, my hometown (Cass City, Michigan, USA) became a food desert when our only grocery store closed its doors. As defined by the United States Department of Agriculture, "Low-income census tracts with a substantial number or share of residents with low levels of access to retail outlets selling healthy and affordable foods are defined as food deserts." (Ver Ploeg *et al*., 2011). Residents would now have to rely on the limited food options provided by the nearby dollar stores or travel to the nearest supermarket 20 miles away, a drive not attainable for everyone in Cass City.

Shortly after the grocery store closed, 17% of our community was food insecure according to the Robert Wood Johnson Foundation County Health Rankings. ("County Health Rankings & Roadmaps" n.d.) As defined by the United States Department of Agriculture, food insecurity "is a household-level economic and social condition of limited or uncertain access to adequate food." (Coleman-Jensen *et al*., 2020) This is significant because the community was already lacking in income, then lost access to the only source of healthy affordable food, and so more people rely on places like food pantries. Cass City is served by one food pantry, a volunteer-led resource where low-income members of the community can get food at no cost to them, usually once a month. Approximately 60-80 families visit Cass City's food pantry each month.

When I volunteered at this local food pantry, I packed food boxes with small amounts of unappealing sources of protein. A can of beans, a can of tuna and a jar of peanut butter were meant to supply a family's need for protein for all three meals over three days. Further, food pantry goods are often chosen to maximize calories and shelf-stability, not to maximize nutrition. This was far different from my dinner table with plentiful homegrown beef, pork, and chicken. I recognized there was a need for high-quality sources of protein at the food pantry and that I was uniquely qualified to meet this need in my community.

I grew up on a farm and as a 4-H member, as did many of my friends, where raising the animals to feed our families or to sell was common. I saw an opportunity for us to share our skills in raising farm animals to provide quality protein to local food pantries. At twelve years old, I recruited three of my friends and we began making regular donations of beef, pork, and chicken from our own farm animals. With some help from our parents, our 4-H leaders, and local Michigan State University Extension staff, we founded an organization called Meating the Need for Our Village.

Our work with Meating the Need for Our Village empowers young people to donate sources of quality protein to local food pantries by equipping them with skills necessary to finance and raise animals to feed their community. I also use the organization as a platform to train other youth outside the project to become hunger fighters, teaching them about the root

causes of hunger and inequality and equipping them with the tools to fight them.

After six years, regular contributions from Meating the Need for Our Village and other community actors were able to meet seven local food pantries' needs for meat, and we wanted to continue providing quality protein in a way that remained relevant to pantry needs. When local dairy farmers expressed concern about the market for their products, I approached them with a local solution. I asked them for money to buy milk from local grocery stores to contribute to the pantry. This request was met with overwhelming support. The milk not only provided protein to our community, but it filled another important nutritional gap. Milk is an important source of calcium and vitamin D for growing children and is similarly important for older adults in our community. In an area with an aging population and poor access to dental hygiene that leaves some seniors unable to properly chew meat, milk is important for supporting muscle mass and slowing osteoporosis. Similarly, we eventually began making regular donations of cheese and eggs.

Over the past six years, Meating the Need for Our Village has had a $62,611 impact through 11,238 pounds of meat, 3,908 gallons of milk, 680 pounds of cheese, 620 pounds of butter, 350 pounds of produce and 329 dozen eggs as well as $1,300 worth of nutrition education resources donated to seven food pantries. The project has involved more than 500 youth in rising animals and securing donations. Before COVID-19, food insecurity in the community was reduced from 17% to 12%according to the Robert Wood Johnson Foundation County Health Rankings. (Since the pandemic the rate has risen again slightly to 14%, due to the compounding economic and public health crises.)

As I neared my final year of high school, I realized I wouldn't always be around to manage Meating the Need for Our Village. Although there was a solid core group of volunteers who would help raise animals, collect and wash eggs, and make milk and cheese pick-ups and deliveries, there was concern that a "big picture" management structure for the organization was not in place. I reached out to Michigan State University Extension educators and together we brainstormed ideas for building a larger body of engagement around Meating the Need for Our Village and broader food security issues in my hometown.

This resulted in the Cass City Hunger Summit. It took weeks of door-to-door outreach and other promotion, and we brought together 50 people from Cass City — impressive considering our population is around 2,000 people. At the summit, we organized community members to take collective action against food insecurity: we created action groups to work on bringing a grocery store to Cass City, created a community garden, and helped Meating the Need for Our Village gain 501 (c) (3) nonprofit NGO status, which is pending. The accomplishments of the garden action group are noteworthy, as it was completely youth-led and resulted in four raised bed gardens growing vegetables for the local food pantry.

The next step was building longevity for Meating the Need for Our Village specifically. The Cass City Hunger Summit helped us identify adult supporters including local 4-H leaders who would be valuable in maintaining our status as a registered nonprofit, and it rekindled excitement from core youth volunteers. We developed an organizational structure including a mission, vision, and bylaws. Today there is a Leadership Team of 16 committed youth and

adults complete with a youth President, Vice President, Secretary and Treasurer and a youth-adult legal Board of Directors.

Meating the Need for Our Village has proven to be an effective model for addressing community food insecurity. Our organization values youth empowerment, human dignity, nutrition, and local agriculture. The multifaceted approach empowers young people with leadership skills and provides them with a platform to improve their communities and engages other community actors all while taking advantage of university extension resources.

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Environmental education with children about the water usage

Isabela Butturi

Advisor: Prof. Dr. Plínio Barbosa de Camargo

Center of Nuclear Energy in Agriculture, University of Sao Paulo (CENA – USP)

Water is the most important resource on earth, but only around 3% of it is consumable, while the other 97% is salty and demands a considerably complicated and expensive process of desalination to become suitable for human consumption. From an economical and environmental point of vital, it is far better to maintain the health and quality of existing freshwater bodies. Although it is considered a renewable resource, this resource is becoming more and more scarce and that is a huge problem for the human race's very existence. Conserving freshwater bodies is crucial for ensuring our species' future. Water can be related directly to two Sustainable Development Goals (SDG), namely Clean Water and Sanitation (SDGs#6) and Life Below Water (SDGs#14) and can be related indirectly to the other 15 goals (THE 17 GOALS, 2021). These justify the importance of water for humanity and for the economy in general.

This topic is on the daily life of citizens, as it is in the news, in different social media segmentation and it is present in curriculum documents, legislation, textbooks and objects of pedagogical proposals. However, potable water is increasingly deteriorating due to human activities, revealing the urgency of actions to recover, conserve and preserve water resources. Thus, initiatives related to conscious water usage and applicability of these actions must always be encouraged.

In the Brazilian context, the country has 12% of the whole Earth's fresh water, so it is important to take care of all these resources. Despite owning a great water potential, bad distribution and water pollution greatly affect the country's environment. Therefore, education about preservation is essential for the future of this source. This implies dealing with issues of educational, cultural, historical, and socioeconomic aspects that make it possible to learn about the effective field of environmental history, cultural heritage, environmental education, and community environmental management (Hoffman et. al. 2011).

Student Initiative and Environmental Education

It can be understood that environmental education is a means by which the child begins to obtain knowledge about environmental issues, in which one starts to have a new vision about the environment, acting as a transforming agent in relation to environmental conservation (Medeiros et. al. 2019).

The reason to have children as a target is that critical sense is being formed at this age, and it makes it easier to consolidate the knowledge in their minds. The act of questioning (with children), by the way, is one of the stages of creative and critical thinking (Ayrton Senna Institute, 2021). If they grow up with these values about taking care of the environment, a lot

of resources can be saved.

My work includes the development of ludic educational activities regarding the water subject with children to connect the university environment and students to the community, judging consumption values for the preservation and sustainable management of water resources. With these activities, the student's critical sense and thinking are stimulated by understanding how water is related to different aspects of society and nature, based not only on the reduction of water usage in daily basis, but also understanding that water is involved in production of food, clothes, and many other products.

Children are able to learn about these facts and interactions by playing games like puzzles, memory-game, hide and seek objects and other ludic activities with a 'water theme' behind it. They can have fun while learning and it will help consolidate the knowledge without losing the attention or getting bored about the content.

The role of the environmental educator (the university students involved with the project) is to start a dialogue among the children while the game is being played, asking them questions, and proposing reflections about the discussed topic. The educator needs to hear the children and make questions to nourish the conversations, and at the end of their discussion, make some points, and answer questions that may arise during the process. In other words, the child is actually the protagonist of the project: the one who's going to ask, think, criticize and act, while the educator is only an intermediate, who is going to guide the participants during the learning dynamics.

This project started in 2019 and is still in progress nowadays. It has reached around 100 students (5-9 years) among private, public and rural schools in Piracicaba's region (Sao Paulo - Brazil). The challenge that this program has encountered is the lack of opening in the community to the knowledge that is different from the usual ones or already wrongly consolidated for part of the population, especially for traditional rural communities. It is expected that this target audience can be reached through the children, so that they can pass on the knowledge acquired in the dynamics to their family circles and neighbors.

The youth inside and outside the university can participate in this program by being involved and applying the activities with their children in families, their neighborhood, and in scientific papers as a way of formalizing the methodology. The project can be molded to fit specific issues depending on the local community needs, allowing that more people can participate in different areas. Thus, environmental education must be prioritized within a context that works with local environmental problems that are found in daily life and that directly affects their communities.

In general, it is possible to educate children about water usage and its importance to human beings by giving young people and adults a critical sense about the subject, and knowledge about how to preserve this resource. Children are the future of the world and if they grow up with a sense of respect for the environment, subsequently, it will be possible to create a sustainable future and existence.

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Localite: Empowering Youth through Community-Based Local Development in Supporting Indigenous and Local Food System to Achieve Food Security and Sustainable Development

Yasmin Kamila

Advisor: Dr. Berry Juliandi S. Si., M.Si.

Department of Biology

Faculty of Mathematics and Natural Sciences

IPB University

The COVID-19 pandemic has resulted in a significant loss of human life worldwide and poses a challenge to public health, world of work, and our food systems. It is also expected to increase a significant number of individuals experiencing extreme food insecurity. The number of undernourished people, which is presently projected to be almost 69 million, might rise to 132 million by the end of 2020 (WHO, 2020). Even before the COVID-19 pandemic, our country, Indonesia, has been highly reliant on unsustainable modern food and farming systems. Modern agriculture contributes significantly to global carbon emissions from various sources, including product and machinery manufacturing, material transportation, global biodiversity loss, and direct and indirect soil greenhouse gas emissions. They degrade the natural resources needed to sustain agricultural output, such as water, soils, and genetic resources. Power and income are also concentrated in the hands of a few businesses in modern food systems, making them highly inequitable.

Food systems of the world's 476 million people, including ~60 million indigenous Indonesians (Kuhnlein *et al*., 2013), are frequently labelled as "backward" or "unproductive," however evidence reveals that they are very productive, sustainable, and equitable. Modern food system mostly uses high-tech systems for storing, transporting, processing, and selling that are usually high in carbon footprints within the entire processes (Béné *et al*., 2019). In contrast, the indigenous or local food system refers to all available food from local natural resources and is culturally recognized within a given community. These ecosystems protect biodiversity, produce nutrient-dense food, and are both climate-resilient and low-carbon.

An alternative approach to food security should be advocated by NGOs, small-farmers organizations, and researchers and is grounded in local knowledge, traditional farming, and locally sovereign systems of production, distribution, and consumption. In fact, specific ethnic communities relocated to megacities such as Jakarta have switched their cultural and nutritional preferences to western diets (Wibisono *et al*., 2020). There is also limited knowledge distribution to address this critical issue to Indonesian citizens, which lowers the exposure of indigenous or local food system rate consumption.

The transformation of food systems thus needs to become an urgent national priority. To support such urgency, Localite presents as youth national solidarity to overcome the intertwined impacts of the pandemic, especially in our food system by building and also

maintaining community-based local development support. Localite is a youth-driven community that focuses on advancing healthy local food production and consumption by reinforcing local actors considering the long-term potential of their region.

In this research, the methodology is based on a qualitative method adapted from European Commission (2011), a community-led local development (CLLD) 'bottom-up' approach. It focuses on specific sub-regional areas, is community-led, by local action groups (composed of representatives of the local public such as youth, minorities, women/men, socio-economic interests, etc), is carried out through integrated and multi-sectoral area-based local development strategies. The methodology will allow for the integrated use of the funds from public-private local partnerships to deliver local development strategies. Localite would engage all the youths all over Indonesia to spread knowledge and awareness in a scientific framework to support the local food system in the form of planned and customized local development strategies in protecting indigenous lands and healthy food systems.

During the pandemic, Localite will be operating both on an online and offline platform. In online platforms such as social media, Localite will work in digitizing information to spread awareness for people in Indonesia or worldwide about the importance of local food production and consumption and the environmental impacts it will be giving in the long term. While on an offline platform, the other teams will try to reach and establish the local action group we have mentioned before which represent different kinds of interest. Students can firstly reach some remote areas in Indonesia by making sure our communication is integrated with society, especially in the mountains and small islands. If possible, the communication could be done through mobile phone or even postal mail. If these attempts are still not applicable to certain areas, we could do another plan to bring some human resources to research and do direct investigation to the location. When the local action group has been established, a target area and population will be defined. We then perform an analysis identifying the area's customized development needs and potential to draft the strategies. It will be the basis of our action plan to make a change on a local level. The action plan could be an innovation such as new programs, collaboration with logistic start-ups, and community empowerment especially in the agriculture sector. To do so, we have to invest in which the capital is needed. Hence, integrative collaboration with public-private local partnership or national government funds is necessary. Students should encourage the inhabitants to be involved with the plans and come up with their own initiatives. Together, we can reach our primary goal of spreading awareness and increasing engagement as well as thriving through immediate action to support indigenous food systems.

Localite's core visions on this subject are ensuring an equal understanding of local foods that are beneficial to all societies. Indigenous or local food system knowledge is incorporated in both cultivated and wild foods, as well as synergies with the natural environment and biodiversity, adaptation to local conditions, and understanding of how these factors are changing. Therefore, we could increase the awareness of local foods' value and importance for health. We also believe that introducing environmentally friendly technology could help societies to grow or utilize local foods better. Last but not least, spreading education to both rural and urban areas' society is very critical to increase diet quality by shifting from poor

quality of westernised and export diets to local foods. These steps help prevent both undernutrition, overweight, and obesity and promote direct consumption of local foods and promote sustainable food systems within the unique local cultures.

Nowadays, Localite is still run online by students' small team creating an educational platform on social media in the form of Instagram posts that focuses on scientific and rational-minded humanity. We usually discuss natural or social phenomena and humanity's irrational behaviours, especially those that directly affect environmental disruptions. Localite's initiatives have also presented earlier with Indigenous Peoples' Alliance of the Archipelago or Aliansi Masyarakat Adat Nusantara (AMAN) by Local Harvest which could strengthen our missions together through collaboration. In the next future, Localite is expected to implement its plan to expand its project in supporting local products through our community-based local development and programs we have discussed.

Creating this community with well-organized programs gives several social, economic, and environmental impacts. Together, we could help to improve access to fresh local foods which lead to advanced dietary habits and a lower risk of health-related diseases. Indigenous food system knowledge may synergize with the natural environment and biodiversity. It is adapted to local conditions and gives low carbon footprints due to minimum transportation and decreasing external inputs such as fuel and ecologically sensitive technologies. We also initiate participatory partnerships or stakeholders to invite local solutions to local challenges and allow for the inhabitants to directly influence their own living environment which keeps their nature and local identity.

Various processes still need to be taken in the development of Localite to become a community that can be beneficial to others by implementing our values. Different actions need to be carried out, primarily related to spreading knowledge and strategic awareness. Stakeholders (community, governments, universities, research centres, and other agencies) must take local food systems as their priority focus. It is necessary to document these resources' scientific and cultural benefits and promote more sustainable food systems to develop more sustainable global healthy diets in this current pandemic COVID-19.

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Group C

Group theme

Nutrition

Presenters:

Terry Lin, Western Sydney University
Onnalin Wiriyasumon, Kasetsart University
Mayara Sartori, University of São Paulo
Nguyen Hanh Nhung, Tokyo University of Agriculture

Chairpersons:

Claudia Fiorella Ortega Morales, Tokyo University of Agriculture
Yuka Nakamura, Tokyo University of Agriculture

Vegetable protected cropping in warm climates

Terry Lin

Advisor: Professor Zhonghua Chen

School of Science, Western Sydney University, Sydney, NSW.

The 21st century is faced with an impending crisis in global food security. Climate change is reducing the hospitability of environments across the globe - creating droughts, expanding deserts, and increasing climate variability. Simultaneously, the world is observing a reduction in arable land together with increasing population density in habitable regions; global food demand has been predicted to eventually outstrip supply, with new projections forecasting the need for a 25 - 70% increase in food production levels by the middle of the century (Hunter *et al*., 2017). Greenhouses are a means of improving food security and maintaining a low ecological footprint while taking advantage of uncultivated land. In warm climates, they employ physical barriers against pests, wind, and disease vectors; shading and Heating, Ventilation, and Air Conditioning (HVAC) for temperature control; and hydroponics and diffuse glass to improve water, nutrient, and light usage.

High-tech greenhouses allow for automated control of many aspects of the greenhouse environment, such as CO_2 concentration, relative humidity, solar radiation, irrigation, lighting, airflow, and temperature. The resulting data is also used to further understand and improve crop performance. Despite these benefits, high-tech greenhouses are capital-intensive, and labour and electricity typically account for over 50% of operating costs in smaller units – so the economic benefit of these greenhouses is currently unclear (Jadhav & Rosentrater, 2017; Peet & Welles, 2005).

The Australian protected cropping industry is the fastest growing food producing sector, with an annual expansion of 5% per annum in recent years. However, protected cropping in Australia is primarily confined to temperate climatic zones, while high potential exists for expansion of this industry for tropical and subtropical climate zones. Greenhouse energy and water use efficiency is one of the key components to the success of Australian protected cropping industry in warmer climates. With rising energy prices, producers need an energy efficient, cost effective climate control solution for greenhouses. Australian greenhouse cooling technologies largely originate from heating-dominant, wet-weather European countries, and therefore require further optimisation to overcome the specific challenges of high-intensity light and large diurnal and seasonal temperature variations present in Australian climates.

Currently, there are no tools available to estimate if the increased yield due to high-tech, fully-controlled greenhouses can offset the high initial cost of these systems. My work will utilise phenological and physiological data collected from climate-controlled greenhouses and correlate these to energy use to derive a stronger understanding of the interaction between common cooling technologies and common greenhouse crops within the Australian climate. The project aims to improve economic viability of protected cropping due to reduction in the initial

cost of the greenhouses (with locally available technology) and reduction in operating cost (energy and water use efficiency). This process will involve collaboration with Commonwealth Scientific and Industrial Research Organisation (CSIRO) energy researchers with expertise in built-environment climate control, and with Western Sydney University agriculture researchers with expertise in plant physiology and crop yield. This will also involve the development of a high-fidelity greenhouse energy model integrating crop growth and greenhouse climate sub-models to optimize energy savings and crop productivity. The model will be designed in the building simulation software TRNSYS, and will be used to predict the performance of other crops and cooling technologies, including an innovative solar desiccant-based cooling solution by CSIRO, to serve as a decision support tool for activities in protected cropping in warm climates.

An initial statistical investigation was conducted into the operation of a photoselective optical thin film, or 'smartglass', in a high-tech greenhouse fitted with mechanical coolers (cooling water pipe system), fogging compartments, curtains and vents. The crop employed for these experiments was eggplant. This investigation identified seasonal and diurnal variations in smartglass energy-saving performance under different ambient light, air temperatures, and air relative humidity. The results indicated that the smartglass decreased cooling energy usage by 11% in cooler, less sunny cropping periods, but by only 4% in warmer, sunnier cropping periods. This difference was largely due to greenhouse temperatures being influenced by direct heating through insolation, and indirect heating by conduction and convection.

The decrease in cooling energy usage in cooler periods was potentially underestimated owing to the greenhouse venting control algorithm, which saw increased venting in smartglass rooms owing to increased relative humidity. Humidity was driven by fogging and by crop evapotranspiration, in which case specific future investigations will include correlation of crop physiology and phenology to greenhouse climate and cooling energy usage. The findings will be used to support the design and selection of crop models for evapotranspiration and growth of capsicum, lettuce, and eggplant, and the coupling of greenhouse climate, crop nutritional content, and crop yield.

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Thriving food innovation in Thailand by the BCG model

Onnalin Wiriyasumon

Advisor: Asst. Prof. Suvimol Charoensiddhi, PhD

Department of Food Science and Technology, Faculty of Agro-Industry,

Kasetsart University

Food industry significantly contributed to industrial GDP of Thailand with a strong backward linkage to the agricultural sector, the foundation of Thai economy (Ajchara Kessuvan and Arisara Thongpech, 2020). However, the pandemic of the COVID-19 virus has underscored Thailand's competitiveness as a major global exporter of food and processed food products as international shipments of these products have held up during the health crisis. The Thai government has earmarked a budget of US$ 213 million for the Ministry of Industry to implement action plans to further enhance global competitiveness and value added of the Thai food products over the next seven years, given to the industry's sizeable employment and significance in the local industrial supply chains (Bangkok post group, 2020).

Bio-Circular-Green Economic Model or BCG has been introduced by the research community and promoted by the Thai government as a new economic model for inclusive and sustainable growth. The BCG model capitalizes the country's strengths in biological diversity and cultural richness and employs technology and innovation to transform Thailand to a value-based and innovation-driven economy. The model consists of 3 submodels; (1) the Bioeconomy which involves the production of renewable biological resources and the conversion of these resources into value added products, (2) the Circular economy that aims at reusing and recycling materials to maximize the value of limited resources and (3) the Green economy which determines to keep economy, society and the environment in balance, leading to sustainable development. (Office of National Higher Education Science Research and Innovation Policy Council, 2021). It also conforms with the UN Sustainable Development Goals (SDGs) and aligns with the Sufficiency Economy Philosophy (SEP) which is also the key principle of Thailand's social and economic development (Office of National Higher Education Science Research and Innovation Policy Council, 2021).

Regarding to Thailand's strengths in robust agricultural activities, rich natural resources, and diversity in terms of both biological resources and physical geography, the BCG model is applied to focus on promoting four industries – namely agriculture and food; medical and wellness; bioenergy, biomaterial and biochemical; as well as tourism and creative economy. Science, technology and innovation will be employed to enhance the capacity and competitiveness of players in the value chain, both upstream and downstream, in all four industries, coupling with innovative policy and supportive legal and financial measures. The value of the Food and Agriculture sector can be multiplied with product diversification, product differentiation, high-value and premium-quality products and services, waste reduction, resource- and land-use efficiency improvement. This strategy can be enabled by R&D and

technologies such as customer behavior analytics, optimized waste production, smart farming technologies, traceability, food and product safety, as well as the development of high-value and novel food products such as food for special groups of people (patients and the elderly, for example) and functional ingredients (Bangkok post group, 2020; Office of National Higher Education Science Research and Innovation Policy Council, 2021).

Nowadays, a demand for future food turns to "New Normal" lifestyle. The crisis, however, affected many consumers to change their behaviors and their new experiences as shift to fundamental health and caring economy. It is essential to consider key behaviors going through the prolonged recovery period; health conscious, digitalization, sanitization, balancing of home and duty and personalized food supply that would become the "New Normal" for Thais affecting food consumptions (Ajchara Kessuvan and Arisara Thongpech, 2020). Therefore, people's health and environmental consciousness grows. Thailand has a proliferation of a new breed of entrepreneurs for production of healthy diets, and aims to enhance diversification and differentiation of food products toward higher value products such as future healthy food and functional ingredients (Bangkok post group, 2020).

Since last year I was a third year student of the Department of Food science and Technology, Faculty of Agro-Industry, Kasetsart University. I have been participating in the Food Innopolis Innovation Contest from November 2020 to August 2021 as a leader of a four-member team selected to join the national food innovation contest held by Food Innopolis together with National Science and Technology Development Agency under the topic of "Future Lifestyle Food Innovation". Thailand Food Innopolis is a global food innovation hub focusing on research, development and innovation for food industry (FoodInnopolis, 2021). The Food Innopolis Innovation Contest has offered an opportunity for high school students, undergraduates, academics and researchers to put their ideas of food products to use by encouraging to brainstorm current problems and pain points, plan the new product development and to finally come up with the prototypes. Participants are upskilled all the necessary knowledge i.e. basic food technology, value proposition design, and marketing skills. In order to develop ideas of new innovative product which is potential to launch in the market. On the presentation day, they would set up a food exhibition stands showing prototypes as well as give a pitch presentation about their products and business models. The motivation of participating in this program is that the winning teams of each levels are rewarded differently including prototype budget, oversea trip support and also a demonstration of the product at ThaiFex Exhibition.

"Vegete", the innovative product of my team, is high-nutrient and colorful vegetable strips. Different-colored strips are well designed for different target consumers including working people and seniors who have different nutritional requirements and health concerns. Moreover, this product can also be consumed in two different ways as a snack or instant pasta. My product development is consistent with the BCG model in term of food security and sustainability which reveals that local vegetables are converted to value-added and premium-quality products, maximizes the value of our rich agricultural resources and reduces wastes for sustainable environment. Vegetables, highly perishable food, from local farmers are extended

their shelf life through a production process and prevented spoilage from long term storage after harvesting. Advantages to the society are local Thai farmers can overcome the current situation. Their quality of life will be continuously improved to eradicate extreme poverty. The economy, environment and society will be balanced along with the long-term economic growth in the country. Also, the developed product of my team can be one of innovative food products provided additional nutrients for consumers with personal health concerns. "Vegete" is a high-quality healthy functional food product that can be easily consumed by those target customers with affordable prices as the ingredients and raw materials are locally produced. In addition, it provides essential nutrients from fresh vegetables without adding artificial colors or flavors to promote Thai health and prevent them from non-communicable diseases (NCDs) in the future.

The vision of our food product is to create high-value functional future food for consumers with health concerns and to use local produce wisely in order to increase food security and food sustainability in the country. The product development trainings and all the activities held by this contest has been a part of an effective effort applying concept of food innovation, to the BCG model in accordance with "New Normal" lifestyle in Thailand.

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Precision Agriculture as a Solution for Current Problems

Mayara Sartori

Advisor: Dr. José Paulo Molin

College of Agriculture "Luiz de Queiroz" - University of São Paulo

Brazil was previously considered to be a import country with low agricultural development. However, with the increase of the urban population, food security has become a concern. The government has instituted policies to increase production as well as agricultural productivity, including public investments in research and development (Chaddad, 2016).

According to recent surveys, approximately 800 million people are fed by Brazilian agricultural production, considering the production of grains and oilseeds, basic foods and inputs for the manufacture of animal protein (Contin *et al*., 2020). In addition, Brazil is currently one of the few countries in the world with great potential for increasing its agricultural production, especially due to expansion of planted area and increase in productivity.

In 1977 the grain production was 47 million tons and in 2017 this production had been increased in 237 million, wich represent an increase of more than five times in 40 years. On the other hand, the planted area increased by only 60% (Conab, 2018) and this difference is mainly explained by the increased productivity provided by innovations and scientific gains. According to a study carried out by the Brazilian Agricultural Research Corporation - Embrapa, between 1975 and 2015 the technology was responsible for 59% of the growth in the gross value of production.

Currently, one of the biggest challenges in food production is increasing productivity along the lines of sustainable production capable of feeding the growing population without further impacting natural resources (Rodrigues, 2016). Thus, technologies for agricultural development become essential for increasing efficiency in the production chain.

One of the most studied management methods for improving production systems is the so-called precision agriculture. According to The International Society of Precision Agriculture, Precision Agriculture is "a management strategy that gathers, processes and analyzes temporal, spatial and individual data and combines it with other information to support management decisions according to estimated variability for improved resource use efficiency, productivity, quality, profitability and sustainability of agricultural production."

Precision Agriculture technologies identify, monitor and guide rural producers in property management to improve productivity, environmental preservation, and income (Molin *et al*., 2015). Through information based on the spatial variability of a crop, it is possible to carry out more rational planning regarding the management of pests, diseases, soil nutrients and weeds, which facilitates decision-making.

For the application of this management system, advanced technologies and the use of complex monitoring systems are necessary to monitor agronomic activities, with one of the main tools for monitoring crops being the use of sensor systems. Therefore, currently I am

conducting scientific research that aims to comparatively evaluate the performance in predicting biomass of some sensors available on the market, carrying out continuous monitoring of an experimental crop in cover crops and grain production.

By collecting data with these sensors, it is possible to increase the power of the information obtained, as well as share the results scientific society. In this way, the research can be easily applied in the daily life of Brazilian rural producers, and through the identification of the sensors that proved to be more efficient, it is possible to provide producers with more relevant information about which equipment to use according to their crop. Consequently, with the information provided, it is possible to optimize the use of inputs applied in the production system and thus provide a more sustainable chain.

In the extension group I participate my colleagues and I are constantly encouraged to produce scientific research, in addition to having direct contact with academic studies and researchers who promote innovation and technology, the group has twenty years old since have been founded, wich means that a lot of research have been made since that. The group today has 40 undergraduate and graduate students responsible for various research in precision agriculture.

Currently, students who are part of the group have their individual researches that are guided by postgraduate students. Every month at least one of each student's research is done in the laboratory with the help of the members. The next step in the expansion of precision agriculture technologies is to make contact between private companies and the university ever greater, aiming at scientific evolution in general so that new technologies reach producers. In this case, students can help increase contact with these other companies through networking.

In short, one of the greatest difficulties faced for the development of scientific research, as well as the application of precision agriculture, is the lack of a standard for the information obtained by sensors and interpretation software. This makes it difficult to carry out fast and efficient processing of the data obtained, since it is necessary to understand the functioning of each tool as well as knowing how to integrate them.

Therefore, scientific research for the development of precision agriculture is fundamental for the agricultural production models of the future. More and more studies capable of showing in a representative way the advantages of this system are needed, mainly so that precision agriculture is increasingly practiced and consequently helps in increasing sustainable production efficiency.

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An alternative to animal testing on food: Using a skin equivalent to test the anti-aging effect of functional food for responsible production and sustainable life on land

Nguyen Hanh Nhung

Advisor: Prof. Katsuhiro Miyajima and Prof. Masumi Iijima

Tokyo University of Agriculture

Department of Nutritional Science and Food Safety, 4th-year

Background

All living beings on the Earth share the same environment and resources such as air, forests, oceans, and rivers. In fact, human and animals share deadly pathogens responsible for diseases. Many pathogens can easily jump from species to species which makes a disease risk anywhere can easily become a risk everywhere especially in a world more globalized and interconnected than ever before. It is estimated that 60% of human infectious diseases and 3 out of 5 new human diseases that appear every year have an animal origin, for example Ebola and probably COVID-19 [World Organisation of Animal Health, 2013]. Therefore, animal health and animal welfare in general become an international issue.

Animal experimentation is one of animal welfare issues. In biomedical research, animal testing is used as surrogates in the investigation of human diseases. Despite the necessary use of animals in this kind of research, the public is also concerned about the care and treatment of laboratory animals. The 3Rs (replacement, reduction, and refinement), first mentioned by Russell and Burch (1959), have since then been adopted in most regulation and guidelines related to animals used for scientific purposes all over the world (EUROPEAN MEDICINES AGENCY, 2016).

Functional food which is believed to be able to prevent diseases and strengthen human's health were first mentioned in 1993 in the Nature news magazine (C J Henry, 2010) To find and test the function of those products, animal experiments are widely used. Moreover, baker's yeast, which is familiar with every family as one ingredient of bread, has been known with immunoregulatory effect and intestinal regulatory effect. As to find a new method to replace animal testing on functional food, we conduct a cell experiment to test anti-aging function of tea catechin and baker's yeast. Tea catechin which has been known to be a strong antioxidant (Japan Tea Central Public Interest Incorporated Association, 2015) is used as a positive control to establish the testing system in this experiment. After that, the system is used to test the anti-aging effect of the candidate yeast.

Methods

HaCaT keratinocytes (Cell Lines Service Co.) – a type of cell extracted from human adult skin were used for assessment. The cell damage was caused by hydrogen peroxide

(H_2O_2) – a powerful oxidizer. Epicatechin gallate (ECg, a type of tea catechin) is used as positive control for establishing the testing system. Many conditions were tried to determine the optimal testing conditions. For example, time for yeast treatment, epicatechin gallate treatment and hydrogen peroxide treatment was optimized. Then, the testing course which can show the anti-aging effect of epicatechin gallate was selected to continue testing on yeast. The parameter for assessment were cell viability (apoptosis) and gene expression (RT-PCR).

Results

After trying many different conditions, the testing system was decided to last in 96 hours with 24-hour yeast treatment, one-hour epicatechin gallate treatment before hydrogen peroxide treatment.

In apoptosis, the percent of damage cells with hydrogen peroxide treatments was higher than those with epicatechin gallate-treatment (Figure 1). The group treated with baker's yeast has not shown any reduction in apoptosis cells compared to hydrogen peroxide -treated group. The gene expression showed the same results because the inflammatory-related gene did not clearly change between yeast-treated and hydrogen peroxide-treated groups.

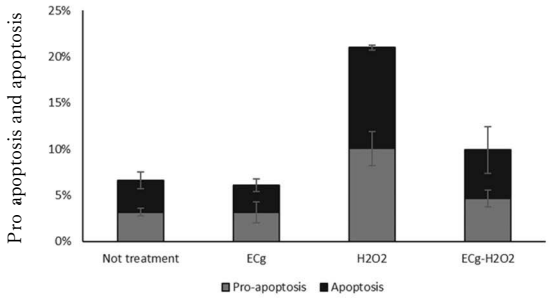

Figure 1. Percentage of pro-apoptosis and apoptosis in each group treated with ECg and H_2O_2

Conclusions

The results showed that HaCaT keratinocytes was a good choice for the anti-aging function testing experiment. This kind of cell can be used for other anti-aging related experiments.

The testing system has been established using epicatechin gallate. For baker's yeast, the anti-aging function has not been clear but other function can be taken into consideration.

The testing method using extracted cells has contributed to the reduction and replacement of animal use for biomedical purposes. This method is also time and cost effective, and more environmental-friendlier than that of animal-testing method. The yeast candidate with anti-aging function has not been found yet but the experiment is going to continue with other candidates. Once a good candidate is found, it will open the door for developing new product.

This research is one action to practise the 3Rs in biomedical research. By linking this research and actions, a new product can be developed with environmental, social and economic sustainability. This is also the connection between my project and this year's ISS theme.

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Group D

Group theme

Food

Presenters:

Achitphon Teeraruangchaisri, National Chung-Hsing University
Salma Ghanem, The University of British Columbia
Sumit Sharma, Agriculture and Forestry University

Chairpersons:

Ramadhina Putri Indraswari, Tokyo University of Agriculture
Daiki Nakai, Tokyo University of Agriculture

Moving toward sustainable circular economy through insect biotreatment

Achitphon Teeraruangchaisri
Advisor: Dr. Hwang Shaw-Yhi
National Chung-Hsing University, College of Agriculture and Natural Resources,
Department of International Master Program of Agriculture

For more than a decade, the world has changed by our hands, increasing temperature, rising sea level, vanishing jungle, all of these problems result from the demand of humans. In the past to sustain our life, humans discover cultivation and we start growing crops for consumption. Now day agriculture has become one of the most important industries in the world. With increasing population, we clearing fields to make way for more cultivable land, farmstead, ranch, and orchard have been built upon the ground where it uses to be forest, nevertheless, no matter how many areas we clear or crops we grow, it still not enough to satisfy the demand for human consumption. Even though world food production is as high as 10 billion metric tons in 2018 (FAO *et al*., 2020) however from the estimation about one-third of total food production is lost as waste every year (Gustavsson *et al*., 2011), this is equal to more than 3 billion metric tons per year, enough to fill 15,000 football field.

Recently insect biotreatment has been proposed as a novel solution for treating solid food waste. Insect is a small animal with amazing capability, it can consume a wide variety of organic matter, grow very quickly, and have a high reproduction rate. Insect can reduce more than 70% of food waste by weight within 30 days (Lim *et al*., 2019) In contrast conventional composting methods may take from 3 to 6 months to fully degrade material (Kadir *et al*., 2016). One of the high potential species for waste treatment is "Black soldier fly (BSF)" it is a non-pest insect that didn't transmit any animal or plant diseases. Black soldier fly larvae (BSFL) have ability to convert organic material into high-quality fertilizer. BSFL have a high content of lipid (16-58% dw) and protein (32-50% dw) (Ewald *et al*., 2020) which can be utilized in variety of product, for example livestock feed, biodiesel, cosmetic, or food ingredient (Delicato *et al*., 2020).

This research aims to addressing how can we effectively integrate insect biotreatment in our waste management system, possible use of insect byproducts, and acceptability of consumer toward these byproducts.

Food waste mainly soybean dregs, and carrot pulp were received from breakfast shops selling soymilk and chaimeei juice factory respectively. The collected wastes are mixed together and use to rear the BSF from the colony maintained at National Chung Hsing University. The BSFL development, waste converted efficiency, waste reducing ability are recorded. For crude fat content (CF) BSFL fat is extracted from harvested dried larvae using Hexane Soxhlet extraction. BSFL Crude protein content (CP) is determined using kjeldahl analysis with nitrogen to protein multiplying factor of 6.25. To test the consumer acceptability

of insect food, BSF larvae (BSFL) are mixed as ingredient in bakery product. BSFL cookies is prepared by replacing 10% of wheat flour with BSFL powder (BC) 100% wheat cookies (WC) are use as control sample. 20 participants are recruited from around Chung Hsing university. the sensory test is conducted using 9-point hedonic score to evaluate participants acceptability of appearance, aroma, taste, texture, and overall parameter in sample. Participants are asked to describe the difference between two sample for descriptive analysis. From experiment the feed contains higher ratio of soybean was found to positively increase BSFL weight and development more than carrot waste however. The participants hedonic score of BC isn't significantly difference from WC but descriptive analysis suggests grounded BSFL powder can alter smell, texture and after taste of cookie. For future study we also cooperated with BSFL farm and local businesses to find an alternative use for BSF byproduct. Currently, the BSF oil is being experimented for it potential as raw material for soap and detergent production.

With BSF treatment organic waste can be circulating back into agriculture industry as fertilizer while the harvested larvae can be process into new product. Insect biotreatment using BSF have very high potential as alternative more sustainable waste management method compare to traditional landfill system. Insect biotreatment could help us pave way toward more circular green economy with how we manage our resources.

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Creating a Culturally Appropriate Pantry Purchasing Guide for Students During the COVID-19 Pandemic

Salma Ghanem
Advisor: Leslie Lavkulich
The University of British Columbia

In the summer of 2020, I and three colleagues created an emergency pantry purchasing guide for students in response to the COVID-19 pandemic. The need arose from noticing the so-called "panic buying" that occurred in the early months of the pandemic. We believed this was a potential sign of a lack of food literacy/preparedness that students felt, and an emergency guide would be one way to support student well-being during the difficulties. We recognized that this would be a challenge as Vancouver and UBC is a culturally diverse community. The guide was aimed to be nutritious, culturally appropriate, and affordable. Our research consisted of surveying students to understand what their current level of food literacy and emergency preparedness was, how to measure and evaluate cultural appropriateness, and how to create a guide that took students' needs and understanding into consideration. My major contribution to the research was ensuring our team made culturally appropriate food recommendations to students. To accomplish this, I conducted a literature review on cultural appropriateness, and we surveyed UBC students about what their cultural identity was and whether their food preferences aligned with their identities, with which we determined what foods to recommend.

The results indicated that students felt a general lack of confidence in emergency preparedness and felt less able to react and adapt to the shock of the emergency. In terms of cultural appropriateness, the literature review showed that the lack of culturally appropriate foods can lead to feelings "of depression, loneliness, isolation, homesickness and identity loss" amongst students (Bates et al. 2014). Additionally, there was a lack of literature discussing what culturally appropriate food means or what kinds of foods are culturally appropriate, which made the recommendations harder to implement. One previous UBC study defined culturally appropriate food as "*food that is important for the health, identity, religious beliefs, practices, or overall well being of specific cultural groups.*" (Bates *et al.* 2014) This definition emphasized the need to ask students what cultural foods are important for *their* overall wellbeing, which was one major reason that our research was centered around asking students what their culture is and what they consider culturally appropriate food. Our survey results showed that the students' cultural identities were highly complex and not necessarily correlated with their nationalities. Additionally, the survey revealed that 82% of UBC students felt that their cultural identity aligned with their food habits.

Our next step was to show students nine generic pantry items and ask whether they thought these were culturally appropriate. These items were: soup/stews, canned fruits, canned vegetables, protein/granola bars, peanut butter, instant oatmeal, nuts & dried fruits, pasta, and

rice. Eighty-four percent of students said these items were appropriate, listing reasons such as "fairly general and can be diversified". While these items were generic, the students felt that they could be combined into cultural meals with which they were familiar. The students' input helped us in creating our guide based on these items. However, our team found these results a surprise as we expected these items were not culturally appropriate. This research emphasized that for culturally appropriate food systems to exist, institutions, researchers, and project managers should be asking their demographics what food they consider culturally appropriate when creating guides, projects, menus etc. For example, if a university wants to include Chinese cuisine in their cafeteria, they can send out the prospective menus to culturally Chinese students and survey them on whether or not these are appropriate. We also found that cultural appropriateness, as a concept, has much room for more academic exploration if institutions truly want to implement it as a value in their food systems.

Overall, our project resulted in the creation of a pantry purchasing guide that consisted of around 17 items that are nutritious, affordable, and culturally appropriate according to the students we surveyed. To ensure that this guide could be used in an emergency, all foods recommended are non-perishable. This guide contributes to easing the lack of food literacy and emergency preparedness that students experience. They can now access a guide that aids them in their purchasing habits, as well as one that is tailored to their cultural needs. One difficulty in the promotion of this guide is its format. In response to the question whether students would seek out the pantry purchasing guide, the response was largely no. This suggests that students, like most people, prefer more direct access, such as that offered by social media. This indicates that there can be more effective ways to share this information, potentially through social media.

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Prevalence of NTS *Salmonella*, Antimicrobial Resistance Pattern and Risk Factors on Commercial Poultry Value Chain in Chitwan, Nepal

Sumit Sharma

Advisor: Dr. Subir Singh

Faculty of Animal Sciences, Veterinary Sciences and Fisheries,

Agriculture and Forestry University (AFU)

Nontyphoidal *Salmonella enterica* (NTS) infections are estimated to cause more than 150 million cases of gastroenteritis and around 60,000 deaths globally each year, making it one of the leading causes of bacterial diarrhea worldwide (Healy & Bruce, 2020). Infections of humans with NTS are frequently associated with the consumption of contaminated food and is considered the second largest cause of food-borne illnesses after *Campylobacter* species (Ejo *et al.*, 2016; Bakeri *et al.*, 2003). Due to the economic importance of this sector and the increasing reliance on poultry as a source of nutrition, foodborne pathogens such as *Salmonella* are of increasing concern as they pose a potential threat to both livestock production and human health (Bae *et al.*, 2015). The few studies that have been conducted to date have shown a high rate of NTS contamination among Nepal's poultry farms and slaughter houses (Bae *et al.*, 2013; Shrestha *et al.*, 2013; Laxman *et al.*, 2016). This study seeks to establish baseline data about the farm-level prevalence of NTS species in general specifically on broiler and layer operations along with characterization of the antimicrobial resistance patterns and serotypes of the NTS isolates collected from poultry farms and slaughterhouses in the Chitwan district of Nepal in the Chitwan district of Nepal.

A mixture of purposive and judgment sampling of 18 poultry farms and 20 slaughterhouses representing a broad geographic distribution across multiple municipalities in Chitwan was conducted. Environmental samples taken from poultry farms included: Water, litter, feces, feed, farm swabs, and eggshell swabs. Biological samples taken from nearby slaughterhouses included: Muscle, heart, liver, skin, cecum, crop, and spleen. Samples were cultured and tested for the presence of NTS. Positive isolates were serotyped and tested for antimicrobial susceptibility to seven antibiotics known to be important to both human and animal health regionally. Farm practices were also characterized through a survey.

Chitwan district has emerged as a major income-generating enterprise in the agricultural sector over the past 35 years, contributing 39.5% of Nepal's poultry population, 21.8% of poultry meat production, and 36.5% overall egg production (MOALD, 2017, 2020). NTS is highly prevalent among Chitwan's growing poultry industry. This data can immediately help guide policies to improve antibiotic stewardship among farmers in the along with groundwork necessary to assess resistance patterns of AMR NTS in poultry, the serotypes present and the potential impact on human health in the region. To ensure the success of this industry and the continued health of the population, it is important to understand the risks posed by foodborne

pathogens such as NTS along with establishing good antibiotic stewardship.

Out of 708 samples (288 environmental and 420 biological), 103 (15%) tested positive for NTS (9% of environmental; n=26, 18% of biological; n=77). Farm management variables/risk factors are summarized and categorized as non-modifiable and modifiable for analysis. Broiler operations were more likely to be positive than layer operations as were poultry houses with two or less open sides. All-in/all-out management style was found to be protective. Due to the small sample size (18 farms), no associations reached statistical significance. The percentage of positive environmental and biological samples varied by source. Environmental sample positive rates were water (27.5%), feces (10.6%), litter (8.6%), farm swabs (5%), feed (1.8%), and eggshells (0%). Biological sample positive rates were skin (28%), heart (23%), crop (20%), muscle (15%), liver (15%), spleen (15%), and cecum (12%). Out of 103 positive S. enterica isolates, 48.5% were identified as Salmonella Typhimurium, 35% Salmonella Enteritidis, 7.8% Salmonella Gallinarum, 4.9% Salmonella Virchow, and 3.9% were Salmonella Agona. Of the 103 positive isolates, 80 (78%) were resistant to at least one antibiotic, and 21 (20%) were multidrug-resistant (MDR).

NTS is highly prevalent among Chitwan's growing poultry industry with higher rates of positivity found in slaughterhouse samples compared with environmental samples from farms. Additionally, a high rate of antimicrobial resistance (78%) was revealed, and an extremely concerning number of those were shown to be MDR (20%). Certain risk factors are associated with finding NTS on farms.

As an internee student my role was to actively work on the sample collection, questionnaire design and initial sample processing, and draft writing along with another student. After being supervised from my supervisors (national and international), We, students, worked in sample handling and completed the process of identification and isolation of *Salmonella* strains. Our supervisors participated actively in study design and data analysis, while I contributed in part to the study design, draft writing, data interpretation and revisions. The thing that provided motivation to us was the idea that our work will be a good foundation for further researches and also will help for linking the findings to human health. Our team further wanted to perform the Gene Sequencing of the resistant *Salmonella* species after checking the Antibiotic resistant gene through PCR, but we couldn't due to lack of further funding. We also are looking for opportunities to conduct similar researches in humans, hospital waste water etc. nearby around this area to find a proper epidemiological and zoonotic connection within poultry and human.

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Group E

Group theme

Agriculture

Presenters:

Karen Coria Chagoya, Unilasalle
Kilemile Warren Henry, Sokoine University of Agriculture
Joan Murugi Macharia, Jomo Kenyatta University of Agriculture and Technology
Sahitha Lochana Karapitiya, University of Peradeniya
Oum Somara, Tokyo University of Agriculture

Chairpersons:

Muy Leang Kim, Tokyo University of Agriculture
Parminder, Tokyo University of Agriculture

Thinking about access to healthy and sustainable food as a common good for all to achieve Environmental, Social and Economic Sustainability

Karen Coria Chagoya
Advisor: Pauline Anton-Gay
UniLaSalle Beauvais - Health

This abstract aims to outline the work of a group of students from UniLaSalle who worked on developing several ideas for a system that could help provide and guarantee access to healthy and sustainable food production, if implemented. Although these ideas still need to be further developed, this model aims to think of food as a Human basic right.

Facing the many flaws that the current food system production and consumption practices have, those being: inequity of access to healthy food at a global scale meaning that not all population from around the world have access to a variety of healthy food, sometimes they don't even have access to food; climate change, increasing population growth rate, which would require more reactive, resilient and productive food production systems; loss of biodiversity related to actual agricultural practices; the exorbitant hospital expenses related to the consequences that under and over nutrition provokes within societies (IPES Food, 2016). Therefore, one system including several action axes and parallel vias seemed adequate to us.

We identified the need to work on a solution that covered these stated food production system flaws, that allows financial accessibility to healthy and sustainable food products that respect and promote good agricultural practices. A universal allocation is proposed to be able to supply these food products to country members that decide to participate in order to become a part of this solution.

This allocation, hopefully gathered thanks to the contribution of various stakeholders, this would concede everyone to have access to food products that meet the criteria stablished by the system.

Boundaries, definitions and ground rules have to be described, and implemented as a certification. This certification would be conditioned by abiding certain principles inspired by agroecology food system production.

Recent research studies prove that this agricultural model would bring, among other benefits, a 40% reduction in greenhouse gas emissions linked to the agricultural sector, as well as a reduction of up to 97% in direct and indirect costs linked to health (FAO, 2020; Poux & Aubert, 2016). Agroecology can also be seen as a social way of understanding relationship between farmers and crops because it creates a link between nature and food; respecting their traditions (Toledo, 2011). This is the reason why it may also bring benefits on the social spectrum through increased employment opportunity to local productors.

Health impacts could be related to an increase in agroecological farmers health, through more nutritious and balanced diets. Agroecology can improve nutrient adequacy through higher production diversity and dietary diversity, and therefore, contribute to achieving SDG 2 (zero hunger) (Deaconu et al., 2021; Kansanga et al., 2020)

This approach regarding funding, would be ground based on the profits and savings that the agroeconomic food system production model promotes through health prevention, crops quality and resilience and fair work circumstances.

Hence, the positive result of the system would provide a positive outcome on 4 dimensions: environmental, social, economic and health, should it be approved and implemented as defined in the specifications. These same specifications will be measured by indicators (to collect data and evaluate results) such as the rate of carbon stored in the soil, the quantity of water used to obtain the product (regeneration index), evolution of food access, work opportunities as well as tools to support the stakeholders of the food system in this transition.

The participation of the afore mentioned member territories involved and participating in this system would contribute to the construction a virtuous circle, because of their commitment (and therefore contribution, investment) and its links to research; research leads to data and these data, once processed, will serve as an incentive to inspire other countries and hence, accelerate the transition. Data collection allows for information production and continuous improvement.

This outline cannot oversee one important dimension, democracy. Indeed, one of the stakes of this project is to give power back to the actors and citizens. Even if this system will initially be implemented in different pilot territories, they will progressively be adapted to other territories by creating democratic councils, guaranteeing the participation of every stakeholder in this transition.

The main challenge is to empower the world population to be protectors of their own health. Through this approach, many aspects are addressed as inducers of co-benefits: Protein autonomy, food resilience (as more diversity facilitates adaptation), decrease of externalities and so for.

The main obstacle lies in its financing, resulting from another problem, its feasibility on a global scale. This choice is totally assumed and is in line with the latest UNICEF reports indicating that national climate plans were leading to a dead end with an estimated reduction of 0.5% against the 45% announced (FAO, 2020). Faced with this observation, one solution that comes to our mind might be: ambitious international cooperation. Even if one country is harmless environmentally speaking, if its neighbors continue to produce large quantities of greenhouse gas emissions, everyone will suffer the consequences. The ecological consequences remain globalized. Thus, an international contribution system will only be possible in a second step where a percentage of investment of the countries based on the savings obtained, will be established.

The success of this system could be estimated through a financing prototype that contemplates world disparities, considers its specific needs to be able to respond to these urgent necessities. Moreover, main obstacle could be convincing territories to engage in this transition. Indeed, this transition, even if it improves food resilience, will require work, time and attempts to adapt it to each territory. As previously mentioned, hopefully, if the investment is made, many jobs would be created to work through this transition, and therefore we could balance this obstacle, which by then, could become an opportunity.

To address these challenges, we want to be involved in projects that can help us to start on a small scale, to then participate in bigger scale projects that would allow us grow. We would like the implementation of the pilot projects to involve many actors, mainly young local

people. However, there is a lot of work to do. We hope that after the implementation of the first pilot system, we will be able to observe an improvement on several levels:

Social impact: the local scale implementation would allow privileged contacts between producers and their clients; consumers of all age groups, especially adults, would be involved thanks to the promotion of the project; citizens would be more involved in the system through their responsible consumption, promoting local, responsible, and healthy food consumption. Food democracy would lead to a decrease in food insecurity; it would also promote equity and gender equality, safety at work.

Economic impact: the allocation allows for a better remuneration of producers and the establishment of "fair price" policies and new economic circuits favored.

Environmental impact: the project would lead to a reduction of greenhouse gas emissions thanks to the application of agro-ecological models (improved practices) and to the reduction of transport (local production) and also, to a reduction of water pollution, an increase in biodiversity and the resilience of territories.

Health impact: agroecological practices would allow for a reduction of diseases and health risks.

The success of the implementation of these systems will allow the implementation of our model on other territories with different characteristics. These effects and impacts would be measured and evaluated on pilot systems in three different countries on a regional scale (France, Lebanon and Brazil) for 3 years.

In summary, this idea aims to ensure access to safe and nutritious food for all; but also to enable a shift to sustainable consumption patterns: a shift to healthier, safer and more climate and nature friendly diets. The seriousness of the current situation requires very ambitious and high impact solutions, embodied by this idea. Thinking about such a big project makes us face a major problem, its feasibility. The ISS is a place that can help to make it happen, by allowing all the stakeholders to step up and help us to further develop this idea and create synergy around the project.

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STORAGE STABILITY ASSESSMENT OF THE MEAT TENDERIZER BLEND WITH PAWPAW-GINGER TO DETERMINE ITS SHELF LIFE

KILEMILE WARREN HENRY

Advisor: Dr. KILIMA B. M.

SOKOINE UNIVERSITY OF AGRICULTURE

DEPARTMENT OF FOOD TECHNOLOGY, NUTRITION AND CONSUMER SCIENCES

Meat tenderness is the most important organoleptic properties influencing acceptability and eating satisfaction of meat products for consumers, as well as impacting the future decision to repeat purchase. Different chemical meat tenderizers are used to treat meat. However, most of these treatments have negative effects such as abnormal flavour and bitter taste due to calcium chloride. Moreover, other treatments are claimed to contain many undesirable food additives like salts and monosodium glutamate with suspected possible health hazards.

Considering the mentioned health effects of available tenderizing methods, according to Malu *et al.,* (2009) ginger increases the motility of the gastrointestinal tract and has antimicrobial properties. Also ginger stimulates the production of saliva. Papaya acts a pain reliever (Tewari, 2014), also promotes wound healing and may aid in the treatment of allergy, diarrhea and indigestion. Based on the mentioned significance of ginger and papaya there is a need to develop cheap, natural tenderizer from natural products such as different spices and fruits which contain naturally occurring proteolytic enzymes.

The study aimed to develop a cheap, natural tenderizer from natural products. These include spices such as ginger and fruits such as papaya which contain naturally occurring proteolytic enzymes. The study was conducted at Sokoine University of Agriculture (SUA) for six months from January to June 2021 in order to determine the shelf life of the meat tenderizer formulated after mixing papaya, and ginger in ratio one to one or (1:1) and stored under room temperature for all six months. Each month the physiochemical properties including pH and titratable acidity were determined according to AOAC, 2000 method 981.12 and AOAC, 2000 method 942.15 respectively, color and the microbial quality of the tenderizer were determined according to AOAC 988.13 method and ISO 7218:2007 (E) respectively. Data were entered in Microsoft excel and then transported to SPSS version 16.0 for statistical analysis.

The pH ranged from 3.81-6.02; with titratable acidity (TA) ranging between 0.0375% and 0.2325% whereas color ranged between 0.3005-0.339AU, and between 0.297-0.341AU for yellow and red color respectively during six months of storage; Total microbial count ranged between 1.8×10^{2}CFU/ml and 42×10^{3}CFU/ml. There was also significant decrease in pH from 6.115 to 3.81 and TA value from 0.2325% to 0.0325%, total microbial count ranged between 1.8×10^{2}CFU/ml and 42×10^{3}CFU/ml with time while the value for color ranged between 0.3005-0.339AU, and between 0.297-0.341AU for yellow and red color respectively and coliforms remain

constant with time.

Therefore, meat tenderizer is suitable for human consumption and the shelf life of the product is six months.

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Socio-economic Factors Influencing Select African Indigenous Vegetables' Productivity amongst Smallholder Farmers. A case study of Kabete Sub-County, Kiambu County, Kenya

Joan Murugi Macharia

Advisor: Dr. Kaibui Mwikamba

Jomo Kenyatta University of Agriculture and Technology

College of Agricultural and Natural Resources

School of Agriculture and Environmental Sciences

Department of Agriculture and Resource Economics

African Indigenous Vegetables (AIVs), most of which are leafy vegetables cooked prior to consumption, have been grown and consumed in East Africa for decades, based on their economic and nutritional potential. Amaranth (Amaranthus spp.), cowpea (Vigna unguiculata), African nightshade (Solanum spp.) and spider plant (Cleome gynandra) are the top four AIVs grown in Kenya, Tanzania and Uganda (Abukutsa, 2010). Those four varieties are the most cultivated AIVs by small-scale vegetable producers in eastern and central Kenya (Mbugua et al., 2011).

In Kenya AIVs are mostly produced and supplied by smallholder farmers because the production of these crops is beneficial to these farmers as they can obtain higher prices compared to those obtained for exotic vegetables (Ndenga et al. 2013; Weinberger & Pichop, 2009). Another thing worthy noting is that high returns from their sale have motivated commercialization of AIVs by small-scale farmers, who produce and supply them either individually or collectively in groups (Ngugi et al. 2007; Muhanji et al. 2011; Weinberger et al. 2011). In addition, while AIVs have long been slighted as "poor people's food" or "famine food" (Mbhenyane et al. 2016; Weinberger & Msuya, 2004), the presence of AIVs in Kenya's urban markets has significantly increased since the 2000s. The main reason for this is growing consumer demand due to the nutritional benefits of these crops (Irungu et al. 2007). AIVs are now even served in some expensive restaurants in Nairobi (Cernansky, 2015), and end customers show a significant willingness to pay higher prices for high quality AIVs (Croft et al. 2014). Hence increasing numbers of producers have responded to this trend in the last decade and engaged in AIV production and marketing (Gotor & Irungu, 2010).

Another reason for the increased number of AIVs smallholder farmers in Kenya is that due to their high levels of micronutrients, AIVs are a very suitable tool to fight so-called "hidden hunger" (Msuya et al., 2009). "Hidden hunger" describes a state in which people consume enough calories but do not have enough nutrients available, and it is a very common problem in Kenya (Muthayya et al., 2013). Dark green, leafy vegetables can substantially contribute to the intake of calcium, iron, vitamin A and riboflavin, especially in young children (Faber et al., 2009).

However, despite the increased number of AIVs producers in Kenya, due to low productivity levels many AIVs smallholder farmers cannot supply adequately to meet the increasing consumer demand levels of AIVs in urban and peri-urban markets. This is a problem since most farmers depend on their agricultural output for income and sustenance. Hence when their agricultural productivity is low, their income also lowers consequently leading them to poverty and food insecurity. It is important then to invest in increasing the sustainable

production and utilization of AIVs. This can be attained through initiatives such as ensuring supply of quality seed and development of environment friendly production and utilization technologies. Improved production technologies like spacing, subsidized fertilizer rates and use of organic sources of manure will lead to increased yields and improved nutrition and economic empowerment of the rural communities in Kenya and other parts of Africa, and in urban and peri urban regions (Abukutsa, 2003).

Furthermore, socio-economic and institutional factors are also known to influence agricultural productivity, particularly among smallholder farmers in terms of quantity and quality of agricultural produce (Al-Shadiadeh, 2012; Rogers,1995). Socio-economic factors such as age, gender, income, level of education among others have been found to have great influence on the level of income generation on agricultural commodities especially on the amount produced as well as effectiveness of production (Al- Shadiadeh, 2012). African Indigenous Vegetables' farming, cultivation and consumption have been studied widely according to literature but very little has been done concerning factors affecting AIVs productivity more so the socio- economic factors.

In Kabete sub-county, Kiambu County, amaranths, African nightshade and cowpea leaves the most grown AIVs here, are a source of income and food security to the smallholder farmers (youth included) who produce them and also a source of employment to the youths of the surrounding community. Although many smallholder farmers in Kabete sub-county have been producing AIVs for many years, little is known about their level of productivity and to the levels of extent through which socio-economic factors and other related factors influence their level of productivity together with other farmers of nearby regions. Therefore, the purpose of this study is to assess and document the level of productivity amongst select AIVs' smallholder farmers in Kabete sub-county and the degree to which socio-economic factors have influence on the selected AIVs' productivity in this region. This will therefore help improve the supply of the selected AIVs to meet the increasing demand of AIVs in both urban and rural areas. Selection of Kabete Sub-county is important in the that it is centrally placed and borders Nairobi which is a metropolitan city and provides ready market for the AIVs.

Moreover, it is expected that at the end of the project, the demographic characteristics that influence amaranths, African nightshade and cowpea leaves productivity amongst smallholder farmers in Kabete sub-county will be determined, the contribution of amaranths, African nightshade and cowpea leaves to the household wellbeing of their smallholder farmers in Kabete sub-county will be determined, that major constraints in smallholder amaranths, African nightshade and cow peas leaves productivity in Kabete sub-county will be identified and analyzed and finally the level of youths involved in amaranths, African nightshade and cow peas leaves production in Kabete sub-county will be assessed.

One possible way to address the problem of low productivity levels of AIVs among rural areas is by actively engaging the students and the youths. Students and youths who have studied or are well knowledgeable in the field of agriculture and its related disciplines can offer free consultations and workshop trainings to farmers in the rural areas. This will be made possible by working hand in hand with the agriculture extension officers who are based in the rural areas. This will enable the farmers to have expert guidance and also the crucial information they need so as to solve some of the challenges they face during the production of AIVs and also come up with effective strategies on how to improve on their AIVs' productivity. This will also offer a great opportunity for knowledge and information transfer among the farmers, students and the youth. A definite action that JKUAT has taken to ensure that such an initiative is a success is by ensuring that students in my department as a requirement in

their coursework, they carry out their own research on issues facing their communities and the nation at large and make a positive impact with it. A great motivator for the students and the youths to participate in such activities is the need to promote sustainable agriculture, which is the backbone of Kenya's economy and also improve the livelihood of farmers in the rural areas

In conclusion, we cannot improve what we do not measure, as such understanding how socio-economic factors influence a given crop in each farming community is vital in developing strategies to improve the productivity of that crop.

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Knowledge Dissemination by Linking Actions and Research: Solutions for the Problems Faced by the Farmers in Sri Lanka

Sahitha Lochana Karapitiya
Advisor: Dr. Balapuwaduge Eresha Priyangika Mendis
Faculty of Agriculture, University of Peradeniya, Peradeniya, 20400, Sri Lanka

Background

Agriculture in Sri Lanka faces several challenges due to the poor linkage of research in agriculture and action. This hinders the achievement of economic, social, and environmental sustainability. One of the main causes of these negative circumstances is the poor, declined or inaccurate linkage of research, education, and action in the agricultural sector in Sri Lanka. At present, knowledge dissemination in Sri Lanka is carried out by the Sri Lanka Agriculture Extension Service (SAES). The knowledge generated by research centres and universities are disseminated mainly by officers attached to the SAES. As identified by Wanigasundera (2015), inadequate capacities of extension personnel, limited recognition of extension personnel, inability to build on pluralism in extension delivery, and problems related to downsizing and decentralizing public extension are some of the generic issues of the present agricultural extension service in Sri Lanka. Undergraduates are also an important element of the stakeholders of the agriculture sector in the country. However, the undergraduates of agriculture programs in Sri Lanka do not engage much in the linking of research and action in their undergraduate period.

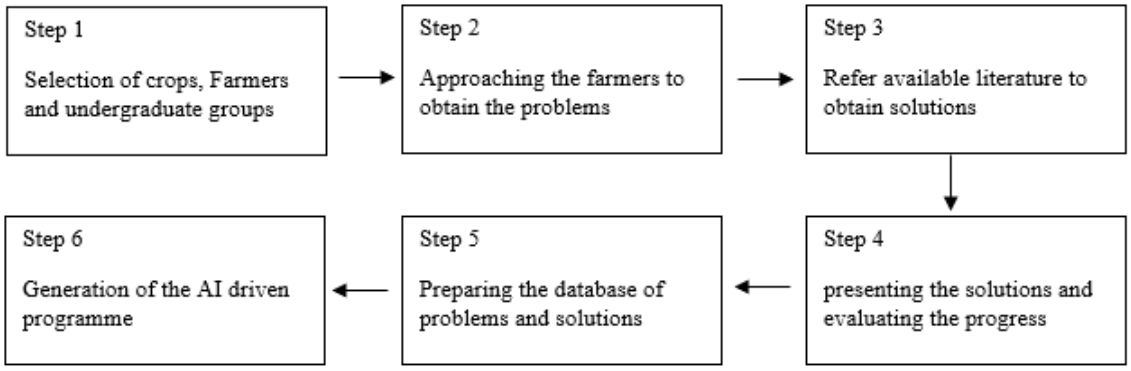
The proposed project is designed to disseminate the knowledge of agricultural research to the farmers and general public via undergraduates of agriculture. The objectives of the proposed project are to link actions, research and education in agriculture value chains, to achieve environmental, social and economic sustainability through agriculture, increase the participation of the undergraduates of agriculture in knowledge dissemination, to increase the productivity quality, efficiency and safety of the farm produce & products, to expose the undergraduates to real world of agriculture, to define problems in agriculture to which practical solutions are not yet applied. In addition to that, develop a database of problems and propose effective solutions based on research, to innovate an autogenerated solution to problems based on artificial intelligence, to raise the acceptance of agriculture academia among the general public.

University Initiative and Students' Role

The project will be initially implemented at the Mahaillupallama Sub-Campus of the Faculty of Agriculture of University of Peradeniya, Sri Lanka. The undergraduates of the Faculty of Agriculture of University of Peradeniya follow a residential course of one semester at the sub-campus. Mahaillupallama is in the dry zone of Sri Lanka. Mahaillupallama is in the Anuradhapura district which is one of the prominent districts in the country with a dense

farming population. Mahaillupallama is an ideal place to promote interaction the undergraduates and the farming community.

The proposed project will be assigned through the faculty as an assignment for the first-year undergraduates with the consent of the faculty along with academic programme. But the project is not originally part of the academic programme. The project will be completed by approximately 6 months. In first week, 100 students are divided in to groups of five students each. In the second week, each group will be introduced to a farming family. During this week, the students will discuss with the farmers to select a crop for investigation. From the third week to the sixth week, the students have to visit the farmers twice a week to obtain the problems on the selected crop. In the seventh week and the eighth week, the students will refer to the available literature local and international to obtain viable, efficient and implementable solutions to the problems faced by farmers, the students will approach the subject experts in the Faculty of Agriculture and various private and public sector organizations. From the nineth week to the twentieth week, the students will present their solutions to the farming family and continuously assess the progress by visiting the famers twice a week. During this period, the students can revise their solutions if the solutions are not viable. From the twentieth week to the twenty fourth week, the students will present the problems, solutions and the progress to the staff by preparing a database. After about two successive terms, the database will be used to generate an artificial intelligence-based program that could auto generates solutions for the problems presented by the users. The author will be involved in the project in designing the project, selecting the farmer groups, coordinating the university staff, farmers and the undergraduates engaged in the project, assigning the undergraduates to groups, monitoring the project.



Anticipated Results

This project will provide an effective solution to the poor knowledge dissemination. This increases the accessibility of knowledge of scientific findings to farmers and general public. The untiring efforts of the researchers, scientists, and academia will become fruitful in the field. This empowers the farmers and entrepreneurs. This paves way for farmers and entrepreneurs to generate more viable solutions based on the scientific research. Since the scientific knowledge is imparted, this could attract the youth to agriculture and hence it increases the participation of youth in agriculture and the economy as whole. The project will also eliminate the social

barrier between the learned and ordinary. Equity is ensured by providing solutions to where it is needed and further could promote institutional stability in agriculture. The above contributes to the social sustainability and agriculture livelihood. The empowerment will increase the living standards of the farmers. The increment in productivity and efficiency could lead to earn higher profits from agriculture. This becomes return on investment for research and scientific work. and alleviates the poverty of farmers. This project will be a path to improve environment sustainability, because the solutions to the problems in agriculture are proposed in a scientific basis. The undergraduates are the most capable segment of youth. Several advantages can be cited in making the undergraduates to participate. They are more capable, novel, innovative, free and more importantly trustworthy. It is observed that the undergraduates of agriculture have keen interest to realize a sustainable development by expanding the circular agriculture in the country. This will be the shear motivation that drives the undergraduates in the project. The opposition of the existing government extension service, non-governmental extension services, the reluctance of farmers to embrace new knowledge and controversies in the implementation of certain research findings in the field might be some of the potential problems that may arise. The proposed project activities will be carried out with cohesion among various stakeholders including the extension officers. The project intends to create an attitudinal development in farmers to promote the acceptance of scientific work.

Anticipated Overall Outcome

The project will ultimately link actions, research and education in agriculture value chains to achieve environmental, social and economic sustainability.

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Promotion of Organic Farming in Kampong Cham Province, Cambodia

Kim muyleang and Oum somara
Advisor: Assoc. Prof. Dr. Touch Narong

Tokyo University of Agriculture,
Graduate school of Agriculture, Department of Agricultural Engineering

Background

Modern agriculture depends on high input of chemical fertilizer and pesticides for crop production. Although such technology-based agricultural practice has increased agricultural productivity and abundance, the resulting ecological and economic impacts have not always been positive (FAO, 2017). Environmental pollution and food safety due to chemical contamination have become a great concern worldwide. In order to cope with this problem, the Food and Agriculture Organization (FAO) proposed "The World Food Summit Plan of Action (1999)" in recognition of the importance of developing alternative sustainable agriculture practices such as organic farming. The goal of the Action Plan was to reduce environmental degradation while creating income from the farming operation. Organic farming is an integrated farming system which involves both technical aspects (soil, agronomy, weed, and pest management) and economic aspects (input, output, and marketing) as well as human health. However, in Southeast Asia, the practices of organic agriculture are still very low (less than 2% share). In the case of Cambodia, organic farming only occupies 0.2% of the total arable land area.

Cambodia is located in Southeast Asia, has tropical climate which is affected by monsoon. Agriculture is shearing about 20.7% for the GDP growth (World Bank, 2019). Paddy rice is a main crop that covers 68% of total agricultural land in Cambodia. The farming system in Cambodia is normally based on the application of chemical fertilizers, chemical pesticide, fungicide, and herbicide (FAOSTAT, 2016). The use of high rates of chemical fertilizers continuously for several years, often lead to unsustainability in production and pose threat to the environment (Smith *et al*., 1990). Traditional farming in Cambodia was depending on the used if farmyard manures, farmyard manure is available year-round, but the amount produced was not enough. In recent years, with the support from the government and non-governmental organization (NGOs), many Cambodian farmers realized and looked for a better agricultural practice which could harmonize with natural environment and human health. Several practices were carried out to promote the use of organic fertilizers such as green manure, compost, and bio-liquid fertilizer in some provinces. The use of organic fertilizers, it can reduce the input of chemical fertilizer, as well as improve soil, water, and environmental quality. So, the purposes of this study were to discuss farmer current farming practices after the promotion of organic farming and effect of organic fertilizer application on productivity and quality of soil.

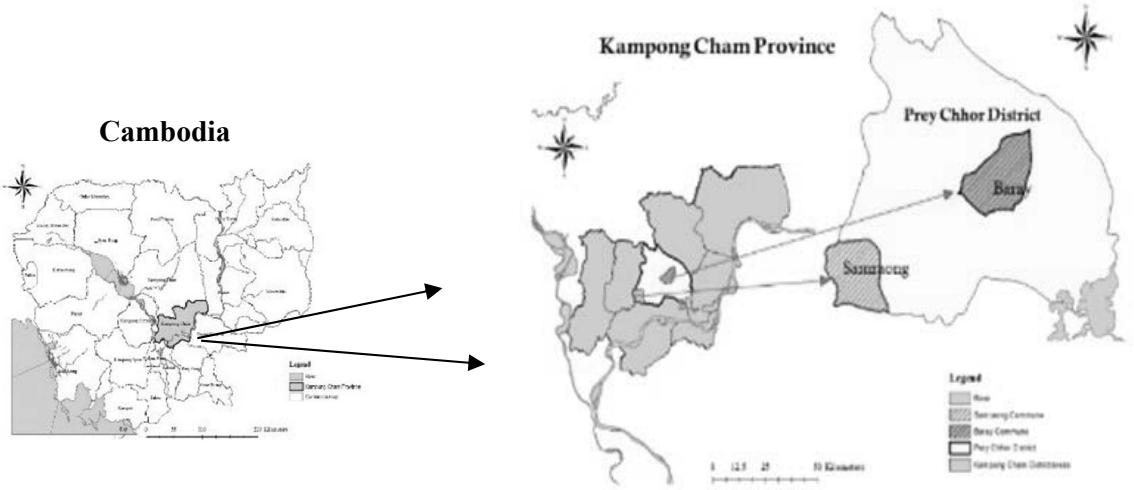

Figure 1. Geographical maps of Prey Chhor District, Kampong Cham Province

Methodology

To understand the farmers' perspective on organic farming, questionnaire surveys were distributed to 100 rice farmers that currently practice organic farming in Samraong and Baray Commune, Prey Chhor District, Kampong Cham province as shown on Figure 1.

Results

Before the project implementation in 2009 more than 90% of farmers were applying chemical fertilizers (N-P-K) and less than 10% applied compost fertilizer (Figure 2). After the project which promoted organic farming, farmers were likely to use organic fertilizer in combination with chemical fertilizers (Figure 3). The amount of rice production in each

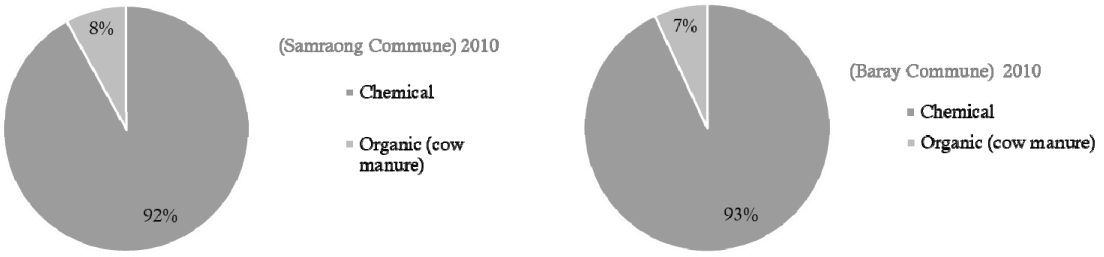

Figure 2. Farmer's fertilization practices before the project implementation in Samraong and Baray Communes 2010

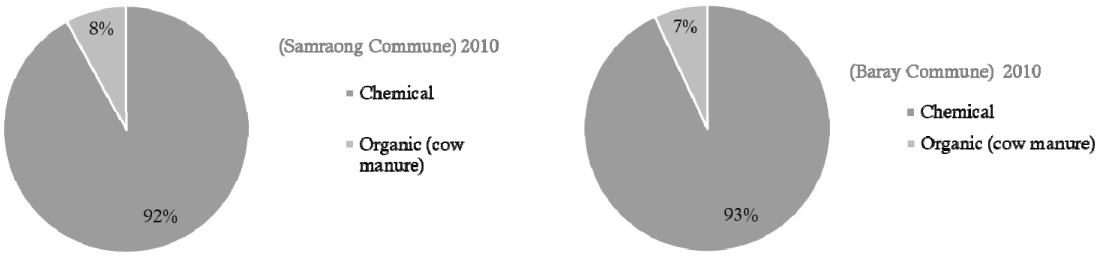

Figure 3. Farmers' fertilization practices after the promotion of organic farming in Samraong and Baray Communes, 2019

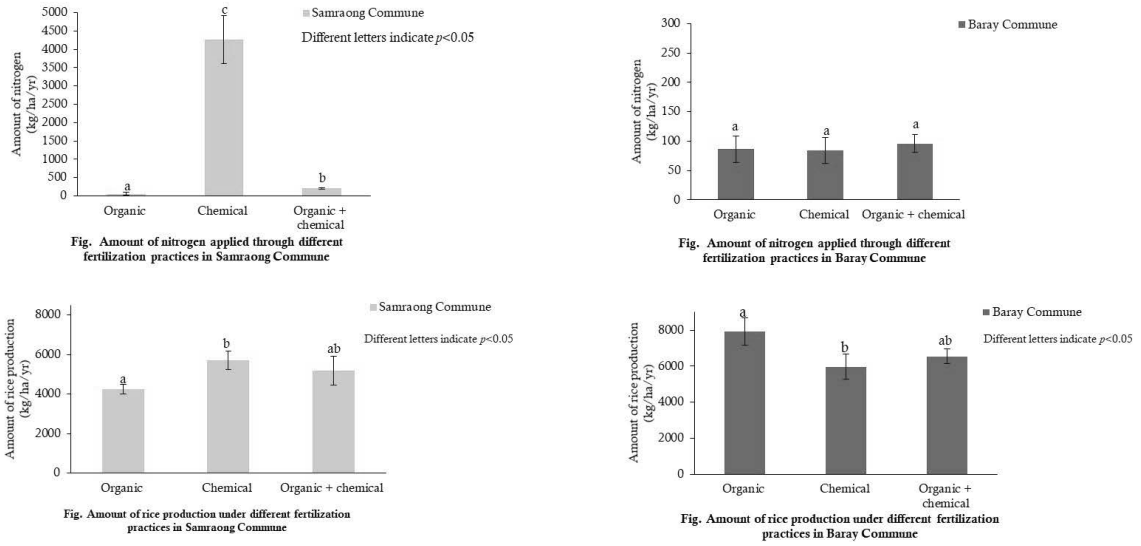

Figure 4. Effects of fertilization practices on rice production in Cambodia

farming system differed; the production with organic fertilization being higher compared to the chemical fertilization practice in Baray Commune (Figure 4). When less chemical and more organic fertilizer were applied for more than 10 years the crop production increased, indicating quality of the farmland soil improved when using organic fertilizer.

Conclusion

After the project implementation on the promotion of organic farming in Samraong and Baray Communes, farmers have changed their farming styles by using organic fertilizer in combination with chemical fertilizers. Also, less chemical fertilizer and more organic fertilizer have been applied for more than 10 years in Baray Commune which affected the soil quality and production. As the results, the rice production was higher in organic fertilizer practice. In short, to achieve the sustainable agriculture, one must grasp the critical importance of soil. Only improving the soil fertility can help agriculture in Cambodia add more potential to productivity, food security and sustainability.

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Group F

Group theme

Education

Presenters:

Patcharawit Wilaikaew, Kasetsart University
Sakshi Chugh, Chaudhary Charan Singh Haryana Agricultural University
Laban Mercey M, Sokoine University of Agriculture
Wachira Joy Njeri, Jomo Kenyatta University of Agriculture and Technology
R Imam Nuryaman K, IPB University

Chairpersons:

Sophavina Bunthan, Tokyo University of Agriculture
Ognen Onchevski, Tokyo University of Agriculture

Application of Image Classification Model in agricultural insect's management

Patcharawit Wilaikaew
Advisor: Chalothon Chootong
Kasetsart University, Sriracha Campus, Faculty of Science at Sriracha,
Department of Computer Science and Information

Abstract - Around 10 million people work in the agro-industry in Thailand, of which 5 million people relate to planting (Office of Agricultural Economics, 2020). However, within natural factors, farmers in the country continue to struggle with low productivity that causes an economic value decreasing in agriculture (Peter & Waleerat, 2020). These factors can be weather, rain volume, soil quality, and pest. Insects also are the main problem of agriculture. There are many insects, some of the benefits for agricultural products, but some species can destroy agricultural products. They will interrupt the growth cycle of farming products. It is easy for an expert person who has the experience to recognize insects and pests which are good or effective to plant. However, many young agriculturists have many problems with insects and plants because they have no experience. There is a problem with a generation gap between old and young agriculturists. Also, primarily young agriculturists have less experience than old.

With the growing up of technology and algorithm, there is a lot of system and application that can solve the agriculture problems such as Plants for U, Farm Manage, Sirrus, Skippy Scout, Crop Nutrient Advisor, etc. Based on my study, I would like to propose the idea to develop a mobile application to solve this problem. The advantages of this application are whether these insects give benefits or not and give knowledge about the advantages and disadvantages of insects. Moreover, we can extend the scope of application to collect agriculture knowledge and compel newcomers to continue to carry on local knowledge and pass it on to the next generations forever. Furthermore, based on the performance of mobile, we can develop a lot of applications that can connect to other devices for planting control.

Currently, it is in the process of producing an application. The tool that I chose to use was object detection merging with a mobile application for easy access by everyone or someone who didn't feel good at technology. First, gather insect information to know what species can benefit or what species can damage agricultural products in this process. We can identify the species of insect. We have to collect more data to train the machine learning model for building an object detection model. After training the model to the satisfactory stage, we will develop a mobile application. The application can easily present a trained model like open this app and scan to the insect in front of you then let the application procedure that this insect is given profits or cause damage to agricultural products.

From the information obtained from THE NEW ECONOMY website (Charlotte Gifford, 2020), pests can cost the economy billions every year. If we have something to solve about

pest's problem, then we can reduce some costs and get more profits. Besides, everyone can efficiently protect the environment use this mobile app. In the same way, we can minimize the experience gap between old and young agriculturists by enhancing immature insects and pests wise with a mobile application database. When pests are eliminated, agricultural products' growth cycle will usually work and result in more productivity. From all the above reasons, it demonstrates that the benefits that are received from this application are all economic, environmental, and social.

Then talking about how other youth will involve from this, everyone will be helping to maintain the agricultural growth cycle. In addition, knowledge about insects and pests can be passed on to future generations by learning from various insect databases in the application. It is also suitable for those who want to know about insects and pests to improve agriculture. What is problematic with this project is how to obtain comprehensive information on all insects and pests, then train it to be a model and enhance the model of the best performance. In addition, there may be unknown insect species on our planet. And there is always research and study of insects every day. As of today, some species of insects may have a positive effect on agriculture. But in the future, if research is to be done, finding that this species does not benefit anymore, that will bring recurrent database updating to keep the information accurate. And some species look like that's why it is hard to detect what species is that. We can extend and focus on doing object detection to the leaves and process what tree disease it is by further development.

Therefore, from all the above information, I would like to summarize in a simple way to understand how beneficial this application will be if it has been developed completely. First, it can know which insects are beneficial to agricultural products or not separating by using insect trained model. So, it is possible to reduce the extermination of beneficial insects and reduce unnecessary pesticide rates. Second, this application serves as a medium of knowledge dissemination. So, it can reduce the gap between old and young agriculturists' experiences about pests and insects.

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Engaging Youth in Indian Agriculture Education for Ensuring Food and Environmental Security

Sakshi

Advisor: Prof. Ravi Gupta

Chaudhary Charan Singh Haryana Agricultural University,

College of Agricultural Engineering and Technology, Hisar (Haryana) India

Agriculture is the backbone of our country; more than 80% of the population is dependent on this sector. In India agriculture is not just a food chain, it is a way of life. In the late 60s India was importing food for its 45 million population but now India is not only feeding its population of 130 million, it has enough buffer stock of around 60MMT. The National Food Security Act 2013 ensures right of food to everyone, even during crises situation like the pandemic of COVID-19 people do not go without food. During the pandemic of COVID, 80 million people are getting free food through government distribution system. The production of food grains is also all time high with a production of more than 300MMT (2020-21). All this was achieved due to trained human resource, science & technology advancement, agriculture research & education and better infrastructure. However, lack of scientific knowledge at user level, improper coordination & management and over exploitation of natural resources brought some black spots to agriculture production system. Major challenges faced by agriculture are small and fragmented land-holdings, insufficient irrigation facilities, lack of mechanization, lack of mechanization friendly varieties, agricultural marketing, inadequate primary & secondary processing units, storage and transport facilities, scarcity of capital to farmers and over dependence on traditional cropping system as well as cropping pattern. .

In order to overcome these challenges, various steps can be taken such as consolidation of fragmented farm lands at the grass-root level under the supervision of the government. The students of agricultural sciences are sensitizing farmers about the FPOs (Farmers Producer Companies) and helping them in creating their own FPO. Though the share of agriculture sector in National GDP is only 14 % but 70-80 % population is associated with this sector. Any social or financial progress cannot be achieved until it is farming centric. Government of India has launched many schemes for the benefit of the farmers and the farming community but most of the times the benefits do not reach those for whom the schemes are meant. Students of agricultural sciences stay in the villages during their graduation program and are now coming forward to sensitize the farming community about these schemes. Various plans have been launched and implemented by Indian government. Some of the schemes are listed below.

- Paramparag at Krishi Vikas Yojana (Traditional Agriculture Development Programme) : This has been launched to motivate groups of farmers to take up organic farming.
- Krishi Sinchai Yojana (Agriculture Irrigation Plan) : This scheme aims to give a boost to productivity by ensuring irrigation facilities. Farmers are being educated about modern irrigation methods to give 'Per Drop More Crop'.

・Soil Health Cards (SHC) : Schemes related to nutrient management like Soil Health Cards (SHC) have been introduced to check the over use of fertilizers and to optimize the inputs for enhancing productivity of specific crops in a sustainable manner. Government aims to issue SHC to all 14 crore holdings in India.
・National Agriculture Market (e-NAM) : This scheme gives an e-marketing platform at the national level and supports creation of infrastructure to enable e-marketing.
・National Mission for Sustainable Agriculture (NMSA) : It is one of the eight Missions under the National Action Plan on Climate Change (NAPCC). It is aimed at promoting Sustainable Agriculture via climate change adaptation measures, boosting agriculture productivity especially in rain fed areas focusing on integrated farming, soil health management & synergizing resource conservation.

After graduation, participation of students in practical farming is very little. Agriculture graduates rarely utilize their knowledge in practical farming .This must change. There are companies working for agricultural development, students can join them as freelancers and make meaningful contribution to the agricultural sector.. Students' bonding with farmers is vital. There are success stories where individual students are working with the farmers in rural area and creating self-help groups in a cluster of villages. Students should also meet farmers and conduct meetings, visit fields, understand the farmers' problems and think how they can solve those issues using innovative processes and ideas. There are Young Agriculture Innovators e.g. 19 year old teenager Veenadhari Kollipara who used technology to improve the efficiency of agriculture. She built an agricultural drone (aerial survey system) which is inexpensive and multi-functional to help the farmers. Similarly, Mr.Rajpal Rathore of Madhaya Pradesh (INDIA) left a lucrative job in Europe and is now helping farming community in solving their technical and social issues. He is also helping by linking social media to agriculture. A few of our post graduate students took farming as a career and they are role models for all of us. One of such student is Manoj Bhatia (Karnal, Haryana – India), a post graduate in vegetable Science doing scientific vegetable production and marketing through FPOs.

Government of India has recently launched National Education Policy 2020 (NEP 2020) The aim of the policy is to create knowledge based society; it should not be about passing information or knowledge, it should be about developing critical thinking, The main purpose of the policy is to develop good human beings capable of rational thought and action, possessing scientific temper and to create good education institutions where a wide range of learning experiences are offered to all students. NEP envisions an education system that will transform India, that is Bharat, sustainably into an equitable and vibrant knowledge society, by providing high-quality education to all. This will help young kids see agriculture as a potential career. Agriculture graduates can avail this opportunity and contribute a lot as master trainers for agriculture education.

There are new opportunities and challenges for students engaged in National Agriculture Research and Education System for ensuring food and environmental security. The policy support system should promote students to setup agri-business this will connect public, people, and peasant, partnerships that would help price mechanism, value addition, and marketing

innovations. Some of the new areas for start-up can be as follows:

1. Data analysis and development of decision support system: Big data analysis is required for creating synergies among various interactions for sustainable agriculture. Analysis of quality data and information chain is essential to make decisions. Students can take up this as a new challenge.
2. Crop marketing: Farmers are not good businessmen. Students can develop market intelligence research system. Students can help them in setting up good supply and marketing chain. However, when it comes to money farmers compromise their health and go for productivity. At times they even don't care about their own families. They must be educated about ill effects of indiscriminate usage of chemicals. They should be told about the benefits of the balanced use of traditional and non- traditional ways of farming. Economic incentives must be given to farmers to grow chemical free crops. This will lead to sustainability as well as nutritional security.
3. Extension services: Extension services have to be proactive to really convey clearly at grass root level. A combined and wholesome message should be conveyed to farmer. Include nutritional proficiency and profitability that the farmer would get by adopting different policies and technologies. Nutritional security along with food security is very important.
4. Research services: Student's research should be able to guide us what to grow under what conditions, when to grow and where to grow, and how to grow. All this research should keep economic incentive at centre stage.

No matter how best we do in agriculture in terms of production and research but farmers' income is the first and foremost requirement in the sustainable development process. This can only be achieved through young minds putting their thoughts together for bringing competitiveness, increase in efficiency and eco-costing considerations in agriculture production system.

Acknowledgement: I thank Dr. Aparna, Associate Professor (English), Department of Languages & Haryanvi Culture, College of Basic Sciences & Humanities CCS Haryana Agricultural University Hisar, Haryana (India) for helping me in preparing the manuscript.

Personal factors affecting consumer purchasing decisions towards women skin care products (A case study at Saba Saba ward in Morogoro Municipality)

LABAN MERCEY M

Advisor: Ms. MARCEL M,

Sokoine University of Agriculture, College of Agriculture, Department of Food Technology, Nutrition and Consumer Science

Purchase decision is the thought process that leads consumer from identify a need, generating options and chose specific product and brand (Roseta et *al.,* 2020). Consumer purchase decision is the decision-making process used by consumers regarding the market transactions before, during and after the purchase of good or services. It can also be seen as a particular form of cost benefits analysis in the presence of multiple alternatives (Harahap and Amanah, 2020). Personal factors are characteristics that are specific to a person and may not relate to other people within the same group. These characteristics may include how a person makes decisions, their unique habits, interests and opinions (Lee *et al.,* 2019). Personal factors include age, life cycle, economic status, life style, personality and self-concept. These factors influence consumers` decision during purchasing process (Khuong and Duyen, 2016).

Many Tanzania women purchase skin care products because of the word of mouth when they meet with sellers (Rekha and Gokila, 2015). And recently they continue to use damaging skin-bleaching cosmetics that contain dangerous chemicals (mercury) that may increase their rates of infertility, skin cancer, and serious skin/brain/kidney disease despite government effort towards providing skin care products education and prohibition of those harmful skin care products (Djafarova and Rushworth, 2017). Women continue to use those products for removing pimples, rashes, skin disease ,to have soft skin, to be browning, "beautiful," and more European looking (Sanny *et al*., 2020). Not only that but also they use to remove the adverse effects of extended skin bleaching use on the body, to satisfy one's partner and/or attract male mates, to satisfy and impress peers and others they want to look like famous and popular celebrities who advertise a skin care products (Pollock *et al.*, 2020; Jackson, 2016). This study focused on how these factors influence women towards skin care products purchasing. The study aimed at assessing women awareness about personal factors influencing them during purchasing of skin care products, to find out general factors affecting consumer purchasing decisions towards women skin care products, to assess personal factors influencing women purchasing decisions and to assess women strategies before purchasing skin care products in Morogoro Municipality. Face to face interview was conducted to 146 respondents from Sabasaba by using questionnaire contained both open ended and closed ended questions, then data were analyzed by using SPSS software version 20 and Microsoft Excel (2010).

Results revealed that 116 (79.5%) of respondents were aware about skin care products and 30 (20.5%) were not aware about the skin care products. The awareness among

respondents were obtained through different sources where by 61 (41.78%) got information from social media, 40 (27.397%) from family members, 37 (25.34%) from friends, 6 (4.10%) from co-workers and 2 (1.369%) from shops. About general factors influencing women purchasing decisions towards skin care products this study revealed that 100 (68.49%) of respondents were influenced by advertisement, 27 (18.49% by popular brand and 19 (13.01%) by price. Based to personal factors, results revealed that 75 (51.36%) of respondents were influenced by status, 60 (41.09%) by attraction, 6 (4.10%) by uniqueness and 5 (3.42%) by their personality. In term of purchasing strategies results revealed that 112 (76.71%) of respondents conducted research before purchase of skin care products by asking the shopkeepers, asking friends and search in the internet and 34 (23.28%) of respondents did not conduct research they just bought from any shop. The factors affecting consumer purchasing decisions towards skin care products reported from this study were similar to those reported in a study done in Thailand by Chin et al. 2018).

From the finding of this study it was concluded that majority116 (79.5%) of women at Sabasaba ward in Morogoro Municipality became aware on skin care products through friends, family members and internet. General factors influenced their purchasing decisions were price, popular brand and advertisement while personal factors were status, uniqueness, personality and attraction. Therefore, results from this study recommend that government should provide enacting laws that will monitor and regulate manufacturing and distribution of skin care products to ensure safe products and burn all skin bleaching products. Additionally, skin care products advertisement should be presented by naturally look African celebrities rather than focusing on Europeans so that African women can see themselves as beautiful and attractive. Furthermore, skin care products industries they should focus much on manufacturing of skin care products that contains natural ingredients so that to prevent skin damages among women. Moreover, this study advices Tanzanian women to embrace themselves by considering purchasing of skin care products that contains natural ingredients from plants because skin-bleaching products have been associated with problems like skin cancer, infertility and respiratory problem.

Not only Government but also female University students should be ambassadors for natural skin care products so that other women who live around universities to learn from them. Responses of the University students from Morogoro on the use of natural skin care products will help other women in Morogoro region to learn and hence start using natural products since most women believe that female university students know best products for skin care. Moreover, students from Family and Consumer Studies from Sokoine University of Agriculture should exercise their consumer education knowledge in educating Tanzanian women on the proper selection and use of skin care products as well as the negative impacts that may result due to the use of skin- bleaching products. They can also use their consumer counseling knowledge to counsel women who have been affected by skin-bleaching products and advise them to opt for natural remedies and skin care products.

Likewise, I as Family and Consumer expert I will use my knowledge and experience from this study to teach women on the proper selection of skin care products, basic ingredients to

consider in selecting skin care products, harmful ingredients to avoid in selecting skin care products, effects of skin-bleaching products as well as the impacts of those effects on the individual health as well as the community at large. I will also emphasize them on the use of natural skin care products and remedies for those already affected by harmful products. I believe that my knowledge and position as a role model on the usage of natural products will impact many women and hence save their money and time to be wasted on purchasing skin-bleaching products as well as for treating skin damages resulting from the use of those products.

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Development and assessment of the physiochemical characteristics of cookies made using a flour blend of wheat, sesame seeds and Bambara groundnut.

Wachira Joy Njeri

Advisor: Dr. Lynette Dinga

Jomo Kenyatta University of Agriculture and Technology

College of Agricultural and Natural Resources

School of Food and Nutrition Sciences

Department of Human Nutrition Sciences

Production of functional foods with beneficial nutritional properties, remains a challenge for developing countries including Kenya, especially with the increased consumer interest in functional foods that can fulfill consumer needs. Urbanization has led to nutrition transition towards processed and convenience foods among urban dwellers, due to lack of resources such as time and energy required to prepare their own foods. A study reviewed by the African Population and Health Research Centre (2019) on the dietary transition in Kenyan cities, indicated that out of 144 individuals, 89.9% consumed energy dense, nutrient poor foods and that an additional 57.65% ate sweet foods. Low income urban households face an increased risk of malnutrition problems not only from their limited financial resources but also from accessibility constraints to clean water supply and sanitation required for making nutritious meals.

One of the objectives of the National Food and Nutrition Security Policy (2011) is to increase the quantity and quality of food available, accessible and affordable to all Kenyans at all times. One way of achieving this is through dietary diversification. This is an example of a micro intervention that aims to change food consumption patterns at the house hold level. Incorporation of some local foods in the diet will ensure affordability of high, nutrition dense foods which would in turn make them accessible to the population especially those living in rural and low urban income areas who lack the resources to prepare nutritious foods.

Promotion of some of the traditional crops could also help increase access to nutrient rich foods. Underutilized and neglected crops are especially important in ensuring sustainable agriculture as they have a high nutritional profile, adaptability to climatic conditions as well as resistance to drought, pests and diseases. Bambara groundnut (*Vigna subterranea*) is a good example of this type of legumes which has been shown to be more superior in terms of its nutritional profile compared to other foods. In their work (Murevanhema et al., 2013) pointed out the comparability of bambara groundnut to that of soybean. They also compared the protein content of bambara groundnut and whole fresh cow milk and found it to be 15-25% and 3.2% respectively. Most studies have focused on improving the seed varieties so as to increase its growth and production rather than its utilization. This particular area of study has been overlooked, hence the need to examine its potential use as flour.

A growing body of literature has investigated the use of non-wheat food materials in

making of composite flours. These composite flours are advantageous as they enable the use of indigenous/neglected crops and they also reduce the over-dependence on staple crops. In addition, the use of composite flours results in nutritional complementation due to the various cereals and legumes used, which make up for the lacking nutrients in each. Data collected by the United States Department of Agriculture (2021) and Biodiversity for Food and Nutrition (2015) highlighted the iron content in wheat flour as (3.88mg/100g), bambara groundnut (3.3/100g), sesame seeds (14.6mg/100g) whereas protein content of wheat flour and bambara groundnut was (13.7g/100g) and (18.1g/100g) respectively. In this context, the aim of my study will be to evaluate the functionality of composite flours in making of different products and whose research could help increase the use of composite flours in the future.

This project will consist of two phases. The first phase will involve subjecting the sesame seeds and bambara groundnut to a number of processing methods so as to improve the sensory properties and overall quality of the final product. Some of the students from the Jomo Kenyatta University of Agriculture and Technology will take part in a descriptive sensory analysis of the cookies. A hedonic test will be performed to evaluate the sensory attributes of the cookies. The information obtained from the analysis will be used to determine the overall consumer acceptability of the cookies.

The second phase will consist of comparative physiochemical tests in order to determine the effect of addition of these flours on the physical and chemical properties of the cookies. This will include carrying out proximate composition analysis to quantify the amount of the main components of food as well as microbial tests to determine the shelf life of the cookies. The experimental procedures will be done in compliance with the AOAC methods of 1995. Consequently, the findings will be interpreted and put into comparison with existing literature with the hope that the results may broaden the current knowledge on composite flours as well as their application in the future.

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Farmer Ranger: A New Paradigm Shift of Youth Agriculture Development in Indonesia by Optimizing Local Institution and Ag Big Data

R Imam Nuryaman K

Advisor: Prof. Dr. Ir. Ujang Sumarwan, M.Sc

Department of Communication Science and Community Development

Faculty of Human Ecology

IPB University

Indonesia's founding father firmly stated that "Food is a matter of the life or death of a nation". This paradigm continues to strive as a rationale embodiment of Indonesia's existence for decades to come. However, Indonesia is currently undergoing an imminent threat in the form of a triple-burden of farmers which includes a decrease in farmer quantity, lack of agricultural human capital, and weak farmer governance institutions. The number of farmers kept sinking recently as recorded by the World Bank (2021) which showed a roughly 12% decline in the last decade. This problem is getting complex due to the fact that only a third of young people are working in the agricultural workforce in Indonesia (BPS, 2020). On the other hand, the low quality of agricultural human capital also shares a meta urgency for agricultural productivity. Accordingly, the education level of 83.12% farmers in Indonesia are only in the basic level status (BPS, 2020). Whereas, the demographic structure of Indonesian farmers is in the aging mode, with 52 years average age (BPS, 2018). This in fact shares a major shock for Indonesia's agricultural sustainability, given the fact that the level of education is predominantly correlated with agricultural productivity and farmer shares (Aryawati and Budhi, 2018). The problem of farmers' decline and its quality issues are also exacerbated by the weakness of farmer institutional governance. Based on the report (Idris et al., 2018), these problems include lack of supporting regulations, limited number of development programs, lack of synergy between institutions, small economies of scale, and institutional disorientation. The triple-burden of farmer's pitfalls illustrates the critical challenges of agriculture development in Indonesia which resulted in the shock of farmer welfare. Though the agricultural sector shares 9.41 % for countries GDP, nonetheless this sector is listed as the lowest sector that provides income per capita among others (Siregar, 2017). Based on the BPS report (2020), the average level of farmers' net income in Indonesia is only Rp 1.050.600 per month. Meanwhile, 46% of them are now currently living below the poverty line (Antara, 2021).

At the same time, Indonesia is experiencing an enormous megatrend of demographics bonuses in 2030, when the number of productive population is greatly-dominating the workforce supply (Afandi, 2017). In response to that, it's necessary to provide the availability of qualified jobs in harnessing the fullest potentials of it (World Bank, 2020). The demographic bonus is a flinch point for the agricultural sector, considering that the majority of the demographic distribution belonging to the young age lives in rural areas and 87% of them are predominantly specialized in agriculture sector (BPS, 2018). On the other hand, Indonesia's agricultural development is enjoying a unique advantage of the covid-19 pandemic. The rising concern

related to the urgency of food security during the pandemic have triggered more intervention to be directed to the agricultural production sector, including to ensure the agricultural labor market remain resilient, despite the fact that there is emerging trend job transition to the agricultural sector and democratization of economic activity in rural areas (The World Bank, 2020). In fact, this pandemic shows the agricultural sector as the most resilient sector with its significant contribution to the economic growth as well as a buffer of national economy (Suryana et al., 2020). Nonetheless, the foreseeable challenge requires a breakthrough intervention which could also resolve the triple burden of farmers whilst harnessing the current megatrend order for achieving Sustainable Development Goals (SDGs).

The Government of Indonesia has launched numerous interventions on youth agriculture development, such as promoting youth agriculture entrepreneurs program (PWMP), strengthening the role of Agriculture Extension Centers (BPP) through the Kostratani program, the Youth Entrepreneurship and Employment Support Services (YESS) program, and the Millennial Farmer Program. These programs have targeted young-energetic students to become new slots farmers in Indonesia through the agriculture training, assistance, and agricultural grants. The rising of youth-lead agribusiness start-up is one of the success stories coming from the aforementioned program, mentioning Rizal Fahreza as a former student of IPB University as well as a CEO of the Eptilu, a leading one-stop agribusiness start-up which could reach million dollars by providing agropreneur, agrotourism, and agro-education services (Nadhira, 2020). However, the intervention program enacted by the government remains partially delivered with its limited scale of inclusion, considering the miss-matched linkage between program value chain where the aspect of youth agriculture institution has not been optimized as the locus of agricultural development in Indonesia. Hence, it is necessary to provide a strategic ecosystem that connects various accesses of strategic institutional development for youth in agriculture.

The development of youth agriculture institutions has not strategically been designed in the agricultural development action plan. In fact, this institution was organically emerged at the grassroot level under the Taruna Tani group. This youth farmers group consists of roughly 10-20 members of student and rural youth who are running agricultural activities. It is therefore important to harness this local institution as a locus for agriculture development with a strategic ecosystem toward increasing the economy of scale of youth farmers, such as the Corporate Farming scheme. This institutional governance reform needs to be tailored with the inclusion of technology 4.0 such as big data and artificial intelligence (AI), as an operational basis of this strategy. Hence, the author proposes a breakthrough innovation, called Farmer Ranger, an institutional governance reform strategy of youth agriculture by using smart institution within the ecosystem framework of building youth corporate farming in each Agriculture Extension Centers district (BPP). Farmer Ranger optimizes the role of smart institution comprising big data and artificial intelligence (AI) in order to design a digital ecosystem which can produce a precise series of recommendations for advanced youth agriculture institutional development programs in realizing the fullest potential of farming in a timely and coordinated manner.

Farmer Ranger entails four recommended features which target students and rural youth under the scheme of Kopertani, including as follows: First, Tanyatani, which enables young farmer groups to connect with personalized agricultural extension and consultant services.

Second, Bisatani, which offers a revolutionary framework of integrated agriculture capacity building program for students with the existing one-stop penta helix program. Third, Opportani, which could support young farmers or students to connect with strategic agricultural internship and exchange programs in respective partners of agricultural enterprises. Last, Lokatani, which delivers a breakthrough innovation in agricultural grants procurement for youth farmers or students in a precise manner. The whole activities of Taruna Tani in running the designated recommendation can automatically be monitored by the Agriculture Extension Centers district (BPP) through the digital dashboard. The digital dashboard is an interconnected system which can clusterize each Taruna Tani young farmer group's standing position. Thus, the Agricultural Extension Center can periodically measure an appropriate intervention needed, especially in building youth corporate farming from the consolidation of Taruna Tani group. As the downstream factor of the strategy, youth corporate farming are specialized into three business models, comprises as follows : 1) Agropreneur, focused on food production and commercialization of the nationals prioritization agricultural commodities alongside with the local potential such as porang commodity; 2) Technopreneur, specialized on technology-based agricultural products and services, such as consultant for smart farming infrastructure; 3) Sociopreneur, designed on creating added value for social impact in agriculture sector as meta orientation of business development, such as profit sharing for women in agriculture. The implementation of the Farmer Ranger strategy requires a collaborative measure through the Penta helix approach, mentioning the role of government, private sector, academia, civil society, and media. This approach, aside from optimizing the program's implementation, also offers mutually-exclusive benefits to each stakeholder which ensures the involvement of students to foster the agriculture sector in a prosperous way.

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Group G

Group theme

Environment

Presenters:

Euan Tomes, University of the Highlands and Islands
Igor Cemercic, University of East Sarajevo
Sofiia Salnyk, National University of Life and Environmental Sciences of Ukraine
Julius Mwangi Kamita, Jomo Kenyatta University of Agriculture and Technology

Chairpersons:

Fredrick Mwaikenda Mussa, Tokyo University of Agriculture
Parneel, Tokyo University of Agriculture

Deer Management Practices in European Forestry and their Potential Future Applications in Scottish Forestry

Euan Tomes

Advisor: Amanda Bryan, MSc.

University of the Highlands and Islands, Scottish School of Forestry

Managing wild deer populations in woodlands is a challenging yet essential part of sustainable forest management and development. Scotland is home to 4 species of wild deer: native Red Deer (*Cervus elaphus*) and Roe Deer (*Capreolus capreolus*), and nonnative Sika Deer (*Cervus nippon*) and Fallow Deer (*Dama dama*). The Scottish Deer Working Group Report in 2020 estimated that there is between 750,000 and 1 million wild deer in Scotland, a population figure that is higher than any time in the recent past (Deer Working Group, 2020). These population densities of deer are unsustainable, and the damage they cause to sensitive habitats, agriculture and forestry is significant. Managing deer populations is a challenging task in any landscape, but particularly so in forests, as the tree cover provides shelter and hiding places for the deer, making it very difficult for deer managers to gain access to the animals and manage them in an effective and humane way. Current deer management practices in forestry in Scotland are stalking (the act of locating animals at a distance and then slowly approaching to within a shootable distance), and night-shooting, where deer are located with and shot under the light from a powerful spotlight, usually from a vehicle. Both methods require large areas of open space to locate and access the deer, and most night shooting requires vehicular access, which is very limited in forests (Deer Best Practice, 2021).

In 2019, the updated Scotland's Forestry Strategy 2019-2029was published, which outlined the Scottish Government plans to increase woodland cover in the country from 18% to 21% by 2032 (Scottish Forestry, 2019). Within the strategy, there is also an emphasis on the increased long-term sustainability of woodlands and their management, which will involve a move towards Continuous Cover Forestry (CCF) and away from the clearfell system which is currently widely employed across the country. The nation's goals for increasing both the size and sustainability of our forests, coupled with the everexpanding deer population, is set to magnify the difficulty of managing deer in forests. The current methods will become less operable, as greater numbers of deer are found in larger forests. This will increase not only the level of difficulty in managing these populations, but also the potential level of environmental and economic damage caused by the deer.

Many countries in mainland Europe already have much higher levels of tree cover than Scotland, and many of these countries also use CCF as their main management technique for their forests. These countries have developed methods of managing wild deer populations in their woodlands despite the high level of tree cover and lack of large open spaces (clearfells), which allow for highly effective and humane management of wild deer, coupled with a culture

of sustainable meat sourcing from hunting (FACE, 2021). Currently, there has been very little research into the potential application of continental management practices in Scotland.

Recognizing the challenges above I have been investigating and developing the research proposal for my BSc Hons dissertation at the Scottish School of Forestry. I will first investigate the methods used for managing deer in these mainland European countries, researching not only the methods themselves but also the legislation surrounding them, and the practicalities of carrying out these methods (manpower, other resources etc.). Once the data has been gathered, I will assess whether these methods could be a solution to the increasingly complex issue of deer management in Scottish Forestry, as both forest cover and deer populations increase. This will involve two aspects; first, the legislation for deer management in Scotland will be assessed, and any changes needed to enable the potential use of European methods of deer management to take place will be proposed. Secondly, a survey of deer managers in forestry across the country will be undertaken, asking about their views on the issue of deer management in forests, and how they would view the introduction of other management methods from Europe. The responses to this survey will be analyzed and considered when assessing the viability of the potential future application of European deer management methods. The outcomes of this research will be shared widely and used to stimulate discussion with land managers, including fellow students at the UHI's student Integrated Land Use Conference in March 2022, with the overall aim of improving the effectiveness of deer management in Scottish Forests in the medium to long term. By analyzing the methods of deer management in countries with high levels of tree cover, it may therefore be possible to develop more efficient practices for deer management in the evolving forest landscapes of Scotland. I would be interested in hearing from ISS participants about experiences of managing large mammal management impacts on forestry and agriculture from other countries to help inform my research.

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Geographic Information System in environmental protection

Igor Cemercic

Advisor: associate professor Branislav Draskovic

Faculty of Agriculture, University of East Sarajevo

We need to understand that human existence is quite impossible without the presence of a healthy ecosystem. Our environment comprises all living and non-living components and their interactions within a natural habitat.

The fundamental goal of environmental research is to understand and solve environmental problems, focusing on how humans use natural resources and how human activities change the environment (Xuan Zhu, 2016). Environmental protection is the practice of protecting the natural environment by individuals, organizations and governments. Goals are to conserve natural resources and the existing natural environment and, where is possible, to repair damage and reverse trends. One of the challenges that arise in agriculture and environmental protection is the lack of application of modern technologies that can help in spatial management. The traditional method of agricultural production is still present in developing countries such as Bosnia and Herzegovina (B&H), and environmental protection takes place without the use of some methods such as remote sensing.

Data analysis represented on maps have become a useful instrument in planning, therefore the operation of overlaying maps become very common (Droy, 2012). Use of modern geospatial technologies such as high-resolution satellite data, Global Positioning System (GPS) and Geographic Information System (GIS) should be mandatory in land resources inventory, mapping, monitoring and management at watershed level. Geospatial technologies must be effectively used in generation of digital terrain database, inventory and mapping of soils, land use systems at parcel level, soil suitability evaluation, prioritization of watershed, assessment of carrying capacity and monitoring the impacts at watershed level (Obi Reddy & Singh, 2018).

How to establish a GIS project? We need several information to conduct a land resources inventory map: Base map (political boundaries and roads), aerial photos, topography, plant communities and wildlife, soils, water features (lakes, wetlands, and watercourses), floodplains, natural areas/open space, other community specific information. Most of this core information is available statewide for free or at low cost. Most of them are already on the internet.

GIS is a powerful tool for environmental data analysis and planning. GIS stores spatial information (data) in a digital mapping environment. A digital basemap can be overlaid with data or other layers of information onto a map in order to view spatial information and relationships. GIS allows better viewing and understanding physical features and the relationships that influence in a given critical environmental condition. Factors, such as steepness of slopes, aspects, and vegetation, can be viewed and overlaid to determine various environmental parameters and impact analysis (Sharma *et al*, 2009).

Under environment protection, it's implied prediction of all the negative impacts of any

human activity, intervention or change in environment with the goal of disabling the cause of degradation or destruction of the environment in which humans live, and excessive waste of human resources and space (Mehta, 2017). Satellite detection plays a big role here which can easily register source of the air pollution. Next one is remote research where we can follow consequences of ecological catastrophes on seas and oceans, also important causes of degradation of the environment we can count human activities like industrial and agricultural production, urbanization and the construction of infrastructure and others.

GIS is a widely used tool with significant relevance for farmers and the agriculture industry. An example of applying geospatial technology and GIS in agriculture would be when implementing fertilizing crops, machine sensors gather information about the crops, and the GPS records the exact position it is applied on the field. Then GIS is in use to analyze that information and make decisions where to do the application of fertilizer, which will be only to the areas where it is needed, and this can vary the rate of application to target nutrient-deficient sites. This saves money on fertilizer product, as well as the environment from over application and runoff into local streams and rivers.

With the satellite detection we can measure changes in nature using different measurements and records such as water and air pollution, damages that occurred with natural and social causes, global change of the atmosphere, devastation of the environment and others. GIS became universal tool for whole analysis of the geological, geomorphological, ecological studies of the environment. With remote methods we can look and exanimate fires and with satellite records which detect fires and mapping burning area with GIS system there are multiple benefits especially with the estimation of damage occurring during fire.

For example, the major reasons for fires in B&H are: no active fire management, high amount of fuel wood in forest; low capacities and bad equipment for fire-fighting, mostly dependent on support from neighboring countries (e.g. from Croatia); ignorance about forest fire risks and prevention measures; carelessness of local population and tourists (FAO, 2015).

At the end perhaps the most important concern for all of us today is protecting the environment we live and breathe in. Climate change issues are creating havoc with erratic weather patterns affecting everything from crop production to untimely melting of ice glaciers. There is a lot to worry about and immediate action is definitely required. It's not that the world has not geared up to take corrective actions, but we need to do more, and GIS can help us to achieve that. GIS is a powerful tool. It is enabling every sector to perform better and the environment is no exception (Obi Reddy & Singh, 2018).

Monitoring and managing of natural resources is an important challenge for a developing country such as B&H. The use of new technologies such as GIS and Remote Sensing can help us to better protect the environment, manage space efficiently, get better crop yields, etc. In this regard, we need more such subjects in the curricula of our universities. This is one of the most important challenges in higher education that we can overcome in cooperation with our professors.

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Environmental education in National university of Life and Environmental Sciences of Ukraine and youth initiatives in Ukraine

Sofiia Salnyk

Advisor: Dr. Alla Kravchenko

National University of Life and Environmental Sciences of Ukraine,

Faculty of Humanities and Pedagogy

No one can deny that we've seen the way our planet suffers from our detrimental impact for quite some time now, but only recent years vividly demonstrated us that if we don't take a step back and rethink the way we treat the planet, it'll find itself on the verge of collapse in no time. It is now way past the time of consideration, it's high time to act and that is what the students of NULES has been doing. As a part of the most motivated and aware Ukrainian youth community we've been making effort to introduce environmental issues into our active discussions, raise awareness and also encourage more ambitious and driven young people to take part in helping finding ultimate solutions. One of the most recent events that the students of our university played a significant role in was XII International Training Course "Radioactivity and Nuclear Energy" 2021.

The Chernobyl disaster that took place in Ukraine in 1986 had a significant detrimental effect on the environment in the whole world, but Ukraine, being the main site of the disaster, suffered the most damage. The Chernobyl nuclear power plant is located next to the Pripyat River, which feeds into the Dnieper reservoir system, one of the largest surface water systems in Europe, which at the time supplied water to Kiev's 2.4 million residents, and was still in spring flood when the accident occurred. The radioactive contamination of aquatic systems therefore became a major problem in the immediate aftermath of the accident. After the disaster, four square kilometres (1.5 sq mi) of pine forest directly downwind of the reactor turned reddish-brown and died. Some animals in the worst-hit areas also died or stopped reproducing. In the accident's aftermath, 237 people suffered from acute radiation sickness, of whom 31 died within the first three months. The risk projections suggest that by now Chernobyl may have caused about 1000 cases of thyroid cancer and 4000 cases of other cancers in Europe, representing about 0.01% of all incident cancers since the accident. It's generally predicted that by 2065 about 16,000 cases of thyroid cancer and 25,000 cases of other cancers may be expected due to radiation from the accident, whereas several hundred million cancer cases are expected from other causes. The disaster and its horrible consequences raised concern about radioactivity, nuclear power and its usage in our country and since we experience its impact and will experience it in the future, the topic of the lecture is relevant and will stay relevant for a long time.

The National University of Life and Environmental Sciences of Ukraine together with the University of Wageningen (Netherlands) has been organizing a joint training course on "Radioactivity and Nuclear Energy" in English for 12 years in a row. Of course, the general

quarantine associated with the pandemic did not bypass this project. Since last year, all activities, including lectures, practical classes, workshops on intercultural communication, group work and consultations with supervisors – were held online. The event of such an importance, especially being held in new and challenging circumstances, required a lot of preparation. All organizational issues were resolved: a combined curriculum was developed in accordance with the requirements of this year's course, provided an appropriate level of theoretical, scientific and practical information. Students actively participated in discussions tackling the following questions: measurement of radioactivity, the impact of ionizing radiation on humans, the impact of ionizing radiation on ecosystems, nuclear energy policy, social opinion on nuclear energy, uranium recycling and enrichment, nuclear waste and its recycling, development of nuclear energy technology, legislation nuclear energy. The lecture that was especially beloved by the students was the lecture that explained the science behind x-rays by Youki Dikstra.

The work continued with a lecture by Wim Tukenburg, a professor at the University of Utrecht, on the consequences of the accident at the Fukushima-1 nuclear power plant. Foodstuffs were contaminated by radioactive material that was deposited on the leaves or directly on agricultural produce such as fruit and vegetables, or that was absorbed via the roots of fruit and vegetable crops.As a result of the Fukushima *accident*, not only was radioactive material released into the atmosphere, but it also entered the water – primarily the water that was fed into the reactors for emergency cooling, but also the groundwater penetrating into the reactor.

Dick Cairns, decommissioning manager of the only nuclear reactor in the Netherlands, shared his experience in a lecture on "From a nuclear power plant to a green lawn." Very interesting experience, given the future decommissioning of most nuclear reactors in Ukraine due to the end of service life.

Nuclear power is a highly controversial topic in the society and there are lots of different opinion on the subject. In the course of the lecture called "Nuclear Energy Policy and Public Opinion" we had an opportunity to start an open discussion and freely speak up on what we think is the right way to pursue the matter. We also had an opportunity to gain a new perspective on the exclusion zone of the Chernobyl NPP as a unique landfill for research on the behavior of radioactive isotopes in the environment.

Moreover, we had the chance to talk to one of the first responders of the Chernobyl accident. He also was one of the people that was able to observe the severe consequences of the accident and its detrimental impact on the environment in the region first hand. Seeing the tragedy through his eyes made quite an impact on all the participants and one more time highlighted the danger of nuclear power and the need of having it under the most careful and strict control.

Igor Gudkov, Professor of the Department of General Ecology, Radiobiology and Life Safety, completed the lecture part of the course. He focused on the radiation situation in Europe, Ukraine, Kyiv and at the university. He also assessed the impact of radiation accidents and the prospects for the return of areas contaminated with radionuclides for commercial use. We as course participants visited the Chornobyl Exclusion Zone. It was a very interesting online trip organized by Chernobyl employees In 3 hours we visited the most important tourist places of the zone, the city of Pripyat, Chernobyl and the industrial site of the station.

Very recently our students also had the opportunity to visit Chernobyl in person. It was organized as the part of curriculum for students of the special English-language master's program "Forest management in Eastern Europe". The main purpose of the trip was to study of the impact of radioactive contamination on the growth and development of trees. It was a priceless experience and which made a lot of sense and brought a clearer picture of the list of obstacles which students may face later on in their fields of studies.

In conclusion, I'd like to add that the course and all the following relating events helped students to face the problem of nuclear power and environment. We had the opportunity to learn the science behind it and got the idea of measures and tools which have maintain control over its impact on the current state of nature. The main purpose of the event was to raise awareness and generate interest in the issue not only among prominent and successful scholars, but also among the new young generation which will be able bring the new perspective to solving these problems in the future.

It's also worth mentioning that the interest in saving our environment is rising outside the walls of our university. Representatives of the most active youth are "pitching in" all over Ukraine. European example certainly encouraged and set off a lot of active movements aimed at the popularization of sustainable politics and lifestyles and one of the evidences of this is the number of new ecoapps in the Ukrainian digital area. The app "Sort" educates people on how to sort litter properly and helps them out with it in general. The app "Let's do it, Ukraine" is created in order to bring together people that want to participate in public cleanouts or want to initiate one themselves. "SaveEcoBot" is Ukraine's first environmental bot to monitor information on permits and procedures for industrial and other pollutants. Those are just a few examples of how Ukrainian tech-people. An environmental project planned by the World-Wide Fund for Nature in Ukraine as a platform to unite the efforts of the community and non-governmental organizations to improve the environment. As a result, an ecological map of Ukraine was created, thanks to which anyone can mark an ecological problem on the map, as well as learn how to solve it. Everything is focused on practical actions: seeing the problem, you can try to solve it with like-minded people.

Ukrainian people as well as the government are becoming more and more "woke" to the problem of environment and climate change. We are embracing the opportunity and coming up with the ways to tackle the issue. We remember that Earth is our most precious resource and it's about time to start treating it accordingly.

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Eco-tourism For Sustainable Environmental Conservation

Julius Mwangi Kamita

Advisor: Prof. John Bosco Njoroge Mukundi

Jomo Kenyatta University of Agriculture and Technology

College of Agriculture and Natural Resources

School of Agriculture and Environmental Science

Department of Landscape and Environmental Science

Deforestation, soil erosion, desertification, water shortage and degraded water quality, poaching and flooding are the main environmental issues in Kenya (Country Profile, 2007). Some local communities especially pastoralist and crop farmers have encroached the game reserve, gazzeted forest and river banks (Oliver et.al 2019). These actions have led to loss of habitat which causes human-wild conflict, changes in natural ecology for plants, animals, fish and other living organisms in the area. According to World Bank report, only about 7 % of plastic waste in Kenya is ever recycled, about 24% is taken to landfills and an alarming 69% ends in water bodies (Clean-up Kenya,2015).Upstream hydrological changes such as damming and water diversion for irrigation and urban domestic water use create threats to delta and water-shed basin ecosystem. Environmental disturbances have resulted to painful measures taken by the government of Kenya, like evictions from the forest and unexpected structure demolition. The locals have the right to live in their environment, but not at the cost of destroying natural resources. Therefore, there is a great need of protecting natural resources that accommodate the present without compromising the ability of future generation to access the benefit of nature.

Eco-tourism has a role of involving the local community in preserving nature and economic growth. The concept of ecotourism has been defined as responsible travel to natural areas that conserve the environment and improve the welfare of local people (Ahmed, 2012). Ecotourism is nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable (Joshi, 2011). Kenya is a popular destination in Africa for ecotourism and is fueled by public and private initiatives that revolve around the country's rich wildlife (*USA Travel tips, 2018*). Ecotourism in Kenya is under the Kenya Tourist Board, which works on four principles: environmental conservation; education and empowerment; social responsibility; culture and heritage preservation (Kenya Tourist Board, 2016).Forms of ecotourism include eco-lodging, eco-trekking, agritourism and community development. Some of the award winning ecotourism organization include Ol Pejeta community, Friends of Karura forest, Friends to Nairobi Arboretum, Murera Springs, Nature Kenya, Lewa Community and Clean-up Kenya (Ecotourism society of Kenya-2018). Ecotourism also involves agritourism that attracts tourist and volunteers to the rural culture to explore agricultural life contributing to development of small farms. Visitors participate in agricultural work alongside farmers in the fields and helps manage livestock on a ranch (USA Travel tips, 2018).

Environmental goals have been achieved through: promoting environmental protection; providing environmental education that increases public environmental awareness; using natural resources efficiently; and maintaining species biodiversity.

The goals of ecotourism in Kenya has been achieved socio-economically through: creating permanent jobs for local people; driving the development of other related industries; upgrading local infrastructure; and earning profits and retaining them within local communities. (USA Travel tips, 2018). Ecotourism ha a crucial role in unlocking the full potential of students, farmers and government workers lies in their ability to access the buildings and equipment they need not just to operate, but to be inspired to help themselves and their community. This is because ecotourism aims to support surrounding communities by tackling key infrastructure issues affecting education, healthcare, water, and energy (Ahmed, 2012).

In the spirit of realizing the role of youths in promoting sustainability in Ecotourism, most ecotourism organization are training youths on environmental conservations. Road trips are organized by NGOs, for example, Red Cross and Rotaract Kenya which involves the young generations (Ecotourism society of Kenya-2018). Youth have been given priorities when joining these organizations with minimum requirements. Youth residing near tourism sites or ecological attraction destinations benefits from local cottage industries in the communities that arise as a result of ecotourism. Youth generate income while achieving conservation goals through honey collection, working as environmental tour guides, offering security, conducting habitat surveys and collecting data and Developing nature/ecological designs (Ecotourism society of Kenya-2018).

Insecurity as a result of cattle rustling and terrorism in some parts of Kenya is the main challenge that affects directly the number of eco-tourists accessing the Kenyan ecosystems. Poor infrastructure such as inaccessible feeder road network imposes huge losses on transportation thus reducing the comforts for tourist (Ahmed, 2012). Insufficient of capital due to government agencies and tourism plans concentrate upon the large developments and major investors and neglect the needs and opportunities of indigenous communities. The general aim of this study is to have sustainable surroundings that conserve natural resources and satisfy local communities while protecting future opportunities.

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Group H

Group theme

Nutrition

Presenters:

Galstyan Mariam Vardanovna, Far Eastern Federal University
Oulaiphone Ouankhamchanh, National University of Laos
Jenipha B. Mayenga, Sokoine University of Agriculture
Maryiano Keziah Anyango Awino, Jomo Kenyatta University of Agriculture and Technology

Chairpersons:

Isaac Otieno Ogallo, Tokyo University of Agriculture
Fariza Junialfatiha, Tokyo University of Agriculture

Bakery product development using stevioside

Galstyan Mariam Vardanovna
Advisor: Bobchenko Victoria Ivanovna
Far Eastern Federal University, School of economics and management,
Basic department of bioeconomics and food security

Abstract: the development and introduction of food products for dietary therapeutic and prophylactic purposes, especially bakery products, are a priority in the development of the food industry, since products designed for mass production do not correspond to the diet therapy of people with diabetes mellitus. Considering the importance of the problem, the aim of the work was to develop a bakery product recipe based on a mixture of spelt and amaranth flour with the addition of stevioside. An analysis of works devoted to the study of problem areas in the technology of diabetic bakery products was carried out. Substantiation for the choice of the proposed ingredients is presented. The recipe for diabetic bakery products was developed.

In recent years, according to the World Health Organization, there has been an increase in the number of patients with diabetes mellitus (DM). The number of patients is growing every year, and at the moment 6% of the adult population of the Earth has a clinical diagnosis of diabetes mellitus (Korolev, 2017). Diabetes mellitus is a chronic disease and affects all metabolic processes in the human body. According to the forecasts of the International Diabetes Federation, by 2030 there will be more than 500 million people with this diagnosis. An unbalanced diet, an increase in the consumption of large amounts of fast food, easily digestible glucose, fatty acids leads to an increase in the number of people with diabetes. The course of treatment includes nutritional correction, the use of foods containing a balanced complex of carbohydrates (Reznichenko & Shcheglov, 2020).

The trade assortment of products for diabetics includes biscuits, crackers, bars, wafers, jams and bitter chocolate. Currently, there is a need for new approaches to developing a range of products in accordance with dietary therapy for a diabetic patient. Bakery products are one of the traditional and common food products in Russia. They occupy an important place in the human diet, and are also an integral part of the national cuisine of many peoples of the world. These foods are included in the daily diet of most consumers. The nutritional value of products made from wheat flour is low. They have a high glycemic index, low protein content, and an unbalanced amino acid composition. They are not normally part of the diabetic diet. But not all patients can strictly adhere to and comply with diet therapy. This is because it is difficult for patients to change their taste preferences and habits. Giving up bakery products entails psychological discomfort. This is not easy to do immediately, especially for those who have been eating bread since childhood, and it has become their habit. They have to resort to a way of replacing bread to make it psychologically easier to give it up. And finding a substitute healthier bread - is a very difficult task.

The aim of the work is to develop a recipe for a bakery product based on a mixture of

spelt and amaranth flour with the addition of a natural sweetener - stevioside.

For the manufacture of stevioside, a perennial stevia plant is used. Stevia lowers blood glucose levels. It is an irreplaceable remedy for patients with diabetes mellitus, while it does not have a sugar-reducing effect in healthy people, it helps to remove toxins, heavy metal salts from the body (Baryshnikova & Paimulina, 2014). Numerous studies have been conducted using stevia for therapeutic purposes. Scientists have found that stevioside is safe for diabetics, and also does not have a hypoglycemic effect in people without diabetes, which makes the plant safe to use, which makes it safe for consumption (Kakhkhorova & Karomatov, 2017). The production and consumption of food with stevioside is evaluated by nutritionists and pharmacologists as a step towards improving the health of the population through the prevention of diabetes, obesity and other metabolic diseases.

As a result of the analysis of published studies, it was revealed that one of the best ways to increase the nutritional value of bakery products is to replace wheat flour with another type of raw material in classic recipes (Androsova *et* al., 2016; Nikitin *et al*., 2018). As an alternative to wheat flour, spelt and amaranth flour was introduced into the recipe; stevioside was proposed as a sugar substitute. Spelt flour is a product obtained by grinding spelled grains. Recently, spelt flour has been of interest for the baking industry from the position of expanding the range of products and creating functional and enriched products (Khrapko *et al*., 2019; Korolev *et al*., 2019).

People with diabetes mellitus, gluten intolerance are recommended to use baked goods using spelt flour. Regular consumption of spelt products helps to strengthen immunity, normalize blood sugar levels, improve the functioning of the cardiovascular, endocrine, digestive and reproductive systems.

Amaranth flour is a valuable dietary product that has a higher nutritional value due to the chemical composition and biological value of the proteins they contain (Kotlyarova & Skoba, 2016). In baking, it improves the nutritional value of bakery products and facilitates the technological process. It has a pleasant aroma and a light nutty taste.

Table 1

Chemical composition of flour

Indicator name	Wheat flour, 1st grade	Spelt flour	Amaranth flour
Proteins, %	10,6	13,9	16,0
Fats, %	1,3	2,4	6,5
Carbohydrates, %	73,8	70,2	66,0
Fiber, %	0,2	5,6	0,85
Vitamins, %	0,7	2,1	0,8

A series of experiments aimed at developing a recipe for bakery products for diet therapy in the treatment of patients with diabetes mellitus was performed in this work. For the production of the studied samples of bakery products, the recipe used spelt and amaranth flour, stevioside, vegetable oil, baking yeast, table salt.

In the finished samples, the shape, surface, color, taste, smell, bakedness were evaluated. All samples had a regular rounded shape, rough surface and nutty smell, dark brown color, well-baked crumb, not wet to the touch, without voids and seals. The addition of amaranth flour significantly improved the organoleptic characteristics in the test samples. The taste of the studied samples is sweet, there were no extraneous tastes.

With an increase in the dosage of stevioside in the formulation, the organoleptic indicators of the finished product worsened, due to strong sweetness and little bitterness.

Based on the results of test baking, the optimal ratio of the flour mixture of flour and stevioside in the recipe was determined. The proposed recipe for bakery products will expand the range and provide people with the necessary nutrition for diet therapy in the treatment of patients with diabetes mellitus. The work was carried out by students studying in the direction of “Merchandising” of the basic department of “Bioeconomics and Food Security” of the Far Eastern Federal University in Vladivostok (Russia).

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Contributing Sustainable Development goal for Food System in Lao PDR.

Oulaiphone Ouankhamchanh
Advisor: Dr Phouvin Phousavanh
National University of Laos, Faculty of Natural Sciences, Department of Computer Science

Laos economic system primarily relies on the agriculture sector. In addition to producing food and materials, agriculture also provides employment opportunities. Unfortunately, a massive increase in population and a severe pandemic could affect the food system in Laos.

Over 70 percent of the Lao population relies on the agriculture sector. However, agriculture production comprises only 16 percent of the country's GDP due to low productivity and lack of modernization (FAO, 2020). Moreover, over the past two years, there has been a negative impact on livelihoods, food security, nutrition, indebtedness, and income due to flash floods, animal diseases, droughts, and rodent/pest outbreaks (WFP & FAO, 2020). Recently, Laos has been affected by COVID-19, which can be a massive challenge to achieving SDG1 and SDG 2. Domestic transportation and regional supply chains collapse, the service sector and tourism industry hit hard, also the unemployment rate increasing from 2 percent to 25 percent (FAO, 2020). People are severely affected, especially the poor, farmers, children, young adults, and pregnant women. For example, people decreased their spending due to the increasing prices of products, farmers' yields could not sell due to the closing of international borders, and some restrictions in domestic areas. A decrease in the availability and accessibility of food could escalate malnutrition problems in Laos, resulting in a 2.4% annual loss of Laos's GDP in 2020 (NIPN, 2020).

During the pandemic, communities that are more self-sufficient in their food will be less impacted by closed markets. Local food production becomes more notable, such as agriculture production at the household level, small lives stock raising, and fish culture to provide enough food. Nevertheless, many households practice subsistence agriculture, which still increases on bought food. Moreover, informal markets supply more processed food with insufficient nutrients, such as instant noodles and sweetened beverages, which are harmful to people's health.

Several issues tackle the food system in Laos, such as insufficient sources to learn about efficient crop growing, marketing, and supply network are small and underdeveloped, especially in the rural areas; lack of knowledge about sustainable development in agriculture. For example, farmers are generally unaware of using chemical fertilizers, synthetic herbicides, pesticides, high-yield crops, and the method of multiple cropping can cause adverse effects in long-term development, such as damage to the environment and human health. Also, environmental degradation and climate change could affect the food chain in the oncoming year. Moreover, the lack of adapting technology in agriculture and food system can cause a massive weight down to the economic growth.

The pathway to help Laos achieve a sustainable food system and ensure safe and nutritious food includes an understanding of nutritional issues, development of evidence-based national dietary guidelines, development and improvement of nutrition standards for school feeding, focusing more on public policies in agriculture, greater investment in infrastructure, and agriculture values chain, implementing a more sustainable and environmentally-friendly cultivation and food production system, such as Organic agriculture, Agroecology, Pesticide free and Agroforestry (United Nations Lao PDR, 2021).

Moreover, promoting campaigns for sustainable development goals in agriculture and environmental issues is a must. Including promoting Laos organic market; competitions enhance technology innovation in agriculture sectors such as Young Scientists and Innovator Forums, Promoting Young Entrepreneurship Innovation on Agriculture and Handicraft Sectors. Last but not least, the government, NGOs, international organizations, local people, small-scale farmers have to work together and make sure that no one is left behind.

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Food and Dietary Related Non-Communicable Diseases in Tanzania

Jenipha B. Mayenga
Advisor: Dr. Theresia Jumbe
Sokoine University of Agriculture
Department of Food Technology, Nutrition and Consumer Sciences

In 2018, WHO reported that 33% of all deaths in Tanzania were due to Non-communicable Diseases (NCDs), two years later, TFNC (2021) reported that about 67% of all deaths that occurs in Tanzania each year are due to food and dietary related Non-communicable diseases (NCDs) like diabetes and hypertension. Diet transition in developed countries to unhealthy eating has accelerated and led to increased rate of NCDs and currently developing countries like Tanzania are facing the same phenomenon (Popkin *et al.,* 2012). This makes diet the most important part in NCDs management and intervention (Isworo *et al.,* 2017). In recent years there have been efforts to raise awareness to communities about the increase in risk factors and incidences of NCDs with their management (Goudah, 2019). However. The low dietary adherence of the patients with NCDs is due to some inhibiting factors (Lestari, 2012). The factors influencing the patients with NCDs not to adhere the diet include income constraints, and miss-information to some of patients. Moreover, there is limited information on knowledge and on analysis of factors which influence adherence to food and dietary recommendation among people about common NCDs like diabetes in Tanzania.

The study was conducted to assess level of awareness and adherence to food and dietary recommendation among patients with dietary related NCDs aged 40 years and above in Kinondoni Municipality. The study was cross-sectional that employed a quantitative approach using a questionnaire through face to face interview at Mwananyamala Hospital. The study sought to investigate the level of knowledge and adherence to food dietary recommended practices of people with NCDs and identify factors that act as barriers to adherence. A sample of 218 respondents participated in the study. Similarly, 24-hour dietary recall assessment and anthropometric measurement of height and weight to determine nutritional status were conducted. Data analyzed by using SPSS, Excel and NutriSurvey software.

Mean age of respondents was 55.63 years which also showed older people above 45yrs are at high risk of developing NCDs. More than half (59.2%) of the respondents were female. About 48% had college education and only 20.6% are married. 7.3% have no any source of income and 41.3% of households have an average household size between 5-10 people.

More than a third (33.5%) of respondents had ideal body weight. A total of 58.7% were both overweight and obese. Majority of the respondents (58.2%) recorded high blood glucose (hyperglycemia) where 34.9% had normal blood glucose during the day of conducting the study. Also, 62.8% of respondents were hypertensive.

80.2% of the respondents have received formal education on food and dietary

recommended practices for food and dietary related NCDs. The study also found poor adherence (34.7%) to dietary recommended practices with only 3.2% of respondents reporting to adhere to the dietary recommendations always. Where 35.6% of respondents never adhere to dietary recommendations at all and 61.2% adhere to recommendations sometimes

The mean intake of total energy for all respondents was 1465.96 kcal which is lower than the normal intake. Fiber intake from plant-based foods which is an important food group in blood glucose, body weight regulation and NCDs management generally, was relatively poor among most respondents, where by only 33.3% consumed the recommended amounts which is 25-50g of fiber per day (Australian Food grocery council, 2011). However, there was no significant difference between males and females on adherence to food and dietary recommendation.

It was established that, level of awareness and knowledge on food and dietary recommendation does not influence adherence among patients. Hence the study identified berries which prevent patients from adherence to dietary recommendations. The barriers reported are unavailability of healthy and quality foods in their areas, economic constraints, and lack of family support, food insecurity, miss-information, health systems, food choices and preferences.

Generally, the study showed that majority of people were obese and overweight. Also, majority are aware of recommendations and right foods to use, but most of them still don't adhere to recommendations and consume relatively low amounts of fibers. Similarly, unavailability and inaccessibility of some healthier recommended meal option remain major barriers to adherence to dietary recommendations.

NCDs have become a burden to a national economy and is now obtaining political concentration, not only in Tanzania but globally. This study has sought to add value on the existing intervention programs, it will help the government and NGOs to set policies, regulation and organize educational and health programs to provide comprehensive education and address factors identified as barriers to adherence to the dietary recommendation rather than focusing only at making people aware since high level of awareness has been reported.

It is predicted that burden of NCDs especially in developing countries to be doubled in the coming 10 years. Hence youth people should effectively and actively participate on interventional programs to reduce this high prevalence of NCDs. Efforts on education should be more towards youth than patients, adults and elders only. As there are low motivation of young people to participate in programs in Tanzania, incentives like certification, money, healthy snacks, giveaways like t-shirts and provision of entertainment by including local artists during implementation of some programs will enhance their participation.

However, there is low promotion on adherence to diet to manage NCDs and nutritional status in country which may be because most of national resources are exhausted on preventing under-nutrition and stunting rates but also nutrition has not stand as its own, the ministry which deals with nutrition issues have prioritized other problems. The absence of certified dietician and nutritionists also make most patients miss-informed on dietary practices

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Solar Dehydration Characteristics of Papaya (*Carica papaya*)

Maryiano Keziah Anyango Awino

Advisor: Prof. Nelson Kennedy Olang'o Ojijo

Department of Food Science and Technology, School of Food and Nutrition Sciences,

College of Agriculture and Natural Resources

Jomo Kenyatta University of Agriculture and Technology

The agriculture sector continues to play a vital role in the rural economy. The sector was one of the first to fully devolve the function of service provision to the county governments underscoring the importance of County Governments' role in ensuring food security. Agriculture is key to Kenya's economy, contributing 26 per cent of the Gross Domestic Product (GDP) and another 27 per cent of GDP indirectly through linkages with other sectors. The sector employs more than 40 per cent of the total population and more than 70 per cent of Kenya's rural people

Farmers also purchase goods and services from their local communities, multiplying their impact and contributing to off-farm employment. The further processing and handling of produce results in additional economic impact which can be directly attributed to agricultural production. Agriculture is also crucial to economic growth: in 2018, it accounted for 4 percent of global gross domestic product (GDP) and in some developing countries, it can account for more than 25% of GDP. Fruits have a value addition importance of accelerating economic growth, reducing income inequality and increasing valuable resources, and value-addition to these resources is key to creating employment and wealth, and to do away with skewed wealth distribution.

The climate, topography and soil variations within biomes are challenging for fruit growing leading to low productivity. Climate change is likely to contribute substantially to food insecurity in Kenya, by increasing food prices, and reducing food production. Food may become more expensive as climate change mitigation efforts increase energy prices. Competition for land increases as certain areas become climatically unsuitable for production. In addition, extreme weather events, associated with climate change may cause sudden reductions in agricultural productivity, leading to rapid price increases. Also any reduction in soil organic matter stocks implies a decrease in fertility and biodiversity, a loss of soil structure, reduced soil water infiltration and retention capacity, and increased risk of erosion and compaction which leads to low productivity of fruits.

Driven partly by the growth of agricultural value chains, Kenyan economy has progressively diversified from traditional cash crops into fruits and vegetables. However, lack of access to finance and poor infrastructure have slowed the progress. Government support, crucial to coordinate the integration of smallholder farmers into larger cooperatives and groups, may be needed in other areas that aid integration with wider markets.

One of the major problem facing the fruits industry is perishability and underutilization of

the local fruits especially in rural areas, and this accounts for more than half of the country's income generation. While improving productivity is key, reducing the existing high rates of global food loss and waste, including post-harvest loss such as perishability of fruits, along the various production and supply chains, will play a key role in tackling the problem of food insecurity in Kenya (FAO, 2011). Farmers put so much labor into growing crops but still most of them rot even before reaching the market and consumers due to perishability. It is almost impossible to preserve the fruits in their fresh state due to immediate metabolic activities that occur even after harvesting and this leads to gradual loss of flavor and nutritional values.

This study will evaluate the efficacy, adoption and scaling up of a solar dehydration technology on papaya (*Carica papaya*) in Kenya with the aim of reduction of post-harvest losses. The solar drying technology will be designed to retain nutrients and improve quality and safety, which are critical in gaining access to dried fruit markets locally and abroad (Temu *et al*., 2008). It is therefore, important to carry out this study to evaluate the performance of solar dryers in different weather conditions and document how nutritional and sensory qualities of the dried products related to the solar dryer parameters. Solar drying systems are faster, more efficient, more hygienic, and result in lower fruit losses as compared to the traditional open-air sun drying method (Muehlbauer, 1986; Chua and Chou, 2003; Karim and Hawlader, 2004; Tomar *et al*., 2017). Drying is a more environment-friendly way of processing fruits as it minimizes the extent of organic waste disposal as compared to wet-processing of fruits, for example, into juices. The latter is often accompanied by huge amounts of bio-waste that poses disposal problems. However, there are technological avenues for turning fruit wastes into viable industrial products e.g. bio-extracts and organic manure.

Fruit agro-industry is a potentially viable avenue for employment of the youth as fruit farmers, traders, and processors. Especially, as it does not require elaborate initial capital outlay, university graduates who cannot secure formal jobs can readily venture into fruit processing businesses even at artisanal or non-mechanized level. What is needed is the right kind of mindset to try own business rather than seek for dwindling and increasingly elusive white-collar jobs. Therefore, part of the activities in this project will be to explore ways of changing the mindset of the youth through peer-to-peer mentorship so that they can consider a vocation in fruit agro-industry.

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Group I

Group theme
Agriculture

Presenters:

Rachel Drobnak, Michigan State University
Yong-Sin Lo, National Chung-Hsing University
Vatsal Arora, Chaudhary Charan Singh Haryana Agricultural University
Intan Afiqah Ahmad Fadzil, Universiti Putra Malaysia

Chairpersons:

Muy Leang Kim, Tokyo University of Agriculture
Parminder, Tokyo University of Agriculture

What do we lose when unfettered capitalism meets under-utilized species?

Rachel Drobnak
Advisor: Rhonda Crackel
Michigan State University, College of Agriculture and Natural Resources

With 30,000 edible plant species available globally, the breadth of agricultural diversity is staggering, but the widespread use of these diverse species is limited to 150 crop species that are easy to breed for specific purposes, commoditize, and transport. They are promoted in numerous environments at the expense of other crops that are more suitable to the growing environments, cropping systems, cultural preferences and dietary needs of the population (Handschuch, 2014; Huggins, 2014; Khojely et al., 2018). In addition, the actual number of cultivars utilized within a species continues to be narrowed (Altieri, 1999), as commodity and seed companies' bottom line centers on profit. There are a multitude of environmental, agroecological, and nutritional benefits to increasing the diversity of the plant and animals species used for food and fiber, including recycling of nutrients, control of microclimates, regulation of hydrological processes, regulation of soil resources (Altieri, 1999; Cabell & Oelofse, 2012; Meldrum et al., 2018), dietary diversity, and improved health and well-being through recognition and maintenance of cultural heritage. Now there are even more compelling reasons to increase agricultural diversity, including climate change and the recent global pandemic that has led to breaks in food systems.

Valuable crop species produced and consumed regionally by various communities, including indigenous populations, have been largely ignored or left out of crop improvement measures to the detriment of agrobiodiversity. These valuable crops, often called under-utilized species, are one important element of agricultural diversity with a key role to play in the future of our sustainable, resilient, and nutritious food systems (Massawe et al., 2016).

In the first two decades of this century, we have seen a boom-and-bust cycle of quinoa that has benefited many, at the expense of agricultural and environmental sustainability. Despite the economic gains from the boom, even for marginal growers of quinoa in the Andes, evidence reveals that past social inequities continued to disenfranchise indigenous communities that were the stewards of quinoa for centuries.

This is proven in the consequences of the unmanaged quinoa boom, from about 2004-2014. During this time, producer prices increased by a factor of seven or greater, and the quantity produced, on average, tripled (Food and Agriculture Organization of the United Nations, 2018). While this change was financially beneficial for many producers, it also caused multiple agronomic and cultural injustices. Specifically, indigenous producers faced cultural tensions with opportunistic producers: growers who moved to the Andean region and began producing quinoa because of increasing demand and price. Oftentimes, their production was less sustainable from the practices of indigenous producers (AVSF, 2014; Kerssen, 2015; Walsh-

Dilley, 2016). For example, cultural management practices to prevent soil degradation were reduced or ignored—especially by opportunistic growers—as production increased to match global demand. These practices include crop rotations, long fallow (or resting) periods, and llama herding. Thus, they were able to outproduce indigenous growers and saturate the quinoa market.

After 2014, supply outweighed demand, and quinoa prices dropped rapidly to pre-boom levels, exacerbating historical inequities (McDonell, 2019). This boom and bust occurred because there was a rushed, unregulated attempt to create a strong global commodity. The governments of Peru and Bolivia were not able to support quinoa producers through institutional measures such as regulated commodity standards. Additionally, traditional quinoa producers were not prepared to design and manage sustainable agricultural systems which would produce uniform, market-class quality quinoa. Finally, indigenous producers were not protected from new growers who were often able to out-produce them.

To prevent these consequences in similar underutilized species and to remedy the problems of quinoa's globalization, we suggest three institutional structures to support producers and responsible land management practices: 1) farmers organizations and cooperatives, 2) equitable and sustainable quinoa companies, and 3) improved agricultural extension offices. Specifically, quinoa companies have the potential to solve some of the short- and long-term consequences of underutilized-species globalization. For example, brands like Alter Eco (USA and Australia) and Kirkland Signature (Costco) work directly with traditional smallholder producers to improve sustainable farming practices, provide stable income to households, and support quinoa communities outside of the commodity chain. Most importantly, these brands communicate their mission, action, and impact clearly to consumers. This helps create a society that values equity over profit.

We use this case study of the quinoa boom and bust cycle to propose a starting framework to ensure the stewards of minor crops lead and benefit fully from a rise in global demand. For example, we are working with Terra Ingredients in Senegal to equitably grow the market for a West African grain, fonio. Future work on fonio and other underutilized species should be framed within the institutional structures outlined above. To create equitable, inclusive commodity chains, the context and values of the culture involved should be foremost in conversations and decisions about global food production. The renewed appreciation of these diverse crops for global food and nutritional security opens an opportunity for cultures to benefit from ancestral knowledge and their stewardship of crops. However, we must ensure the stewards of these crops actually do benefit from, lead and design the pathways towards domestic or global commercialization.

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Raise the awareness of agricultural water shortage issue among new generation in Taiwan

Yong-Sin Lo
Advisor: Dr. Shaw-Yhi Hwang
National Chung-Hsing University
Department of Entomology

Water is the essential source for agriculture, industry and domestic water. The main precipitation of Taiwan was consist of typhoon and stationary front during the spring and summer season, which bring full amount of accumulated precipitation for Taiwan (Shiau & Hsiao, 2012). However, since Taiwan is a narrow island with many high mountains at the central, rainfall was difficult to conserve and will flow into ocean rapidly, so Taiwan was faced the problem of water shortage almost every year within decade. Furthermore, La Niña year happen in 2020 altered the region of typhoon genesis and degree of the subtropical high pressure belt (Li *et al.*, 2021), lead to no typhoon landed on Taiwan. In spring of 2021, the water level of reservoir in mid of Taiwan was significantly lower than previous years and caused the policy of water rationing.

The drought will cause a serious impact on agriculture, not only decreased the yield of rice, fruit setting rate, but also harmful to the plant-pollinator interaction (Descamps *et al.*, 2021). All of them result in the financial loss. However, some people have the wrong concept that water rationing on agriculture will help reservoir conserve more water, but the truth told us that there is only 11% of irrigation from reservoir every year in Taiwan (Tsai, 2021). Additionally, irrigation water for rice can also help to accumulate aquifer and benefit to ecology. So, rationing of agriculture water should not be the priority thing to do during the phase of drought. In order to know the opinion and concept of water shortage issue among young generation in Taiwan, we conducted a questionnaire survey to understand their knowledge about water shortage issue. By this questionnaire, we can clearly know their opinion and conduct some lecture for education.

In questionnaire, there are 218 participants in total, we found that most of the participant don't have the complete concept of water using condition on agriculture in Taiwan. For example, only 13.3% of them know the main water resources of irrigation water in Taiwan is river and barrage, most of them think the main resources of irrigation water is come from reservoir and ground water aquifer. However, 53% of them still disagree with put agriculture in the first place of water rationing. The result indicated that the education about water issue is necessary for young generation in Taiwan.

Due to the global warming influence the climate of the world, the problem of drought or flood will more frequented happen in the future (Naumann *et al.*, 2018). In this presentation, we want to give the young generation student have a complete concept to face these problems. Hope that participants from any country can think about if the situation happen in their

country and prepare in advance.

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Agriculture for youth

Vatsal Arora
Advisor: Prof. Ravi Gupta
Chaudhary Charan Singh Haryana Agricultural University, Hisar (India)

Agriculture in India, isn't merely an enterprise, it is a form of lifestyle upon which depend aspirations of over a billion people. During 2020, when the Indian Gross Domestic Product (GDP) was heading south, agriculture was the only sector which showed growth owing to a good *Rabi* harvest (National Statistical Office, 2020) This reiterated its importance as a sector of unmatched potential and resilience, which supports 17% world's population with limited 4.2% world's water resources and just 2.3% global land (Indian Council of Agricultural Research, 2007). This puts immense pressure on the natural resources which, apart from their rapid depletion and pollution, and also coping with the anthropogenic demands amidst a worldwide pandemic, are already under the threat of ongoing and impending Climate Change.

Agriculture encompasses a wide range of activities that contribute heavily to the rich bio-diversity and nature, while feeding the teeming human population, fueling the global economy, employment among others. Any change in agricultural system is bound to have far reaching consequences. Therefore, it is our responsibility to look for solutions that are environmentally, socially and economically sustainable. Enjoying the world's largest population of under 30 years of age, Indian youth have the responsibility to steer not only India, but the entire world towards a more sustainable and globally shared enduring future. For this, an ecosystem of education, research and extension must be developed to attract youth towards agriculture.

During the last few years, I have tried to equip myself for the challenges we as humanity face viz. food and nutritional security for a growing population, resource depletion, climate change, economic security for farmers, environmental degradation among others.

The potential of precision farming tools has become evident for improving yield per unit area. This is especially important for small and marginal farmers, which form a majority of the farming population. Youth can leverage digital solutions to bring the revolution of Digital India to farmlands. Precision Farming with its Internet-of-Things enabled smart devices, remote sensing and geo-informatics systems can help in site specific micro-management of the soil and plant microclimate. This will ultimately help in improving yield, reducing input costs, conserving water and providing better soil management opportunities. (Kritikos *et al*., 2017) For more practical exposure, I joined an "Experiential Learning Program" on "Hi-Tech Agriculture", where we became familiar with devices like weather meter, smart irrigation systems, site specific applicators etc. to grow horticultural crops. To add to the budding entrepreneurial spirit, we ultimately sold all the plants at the university mart with value enhancement and marketing. This allowed me to practically experience diverse plant groups in different phases of growth and their handling under abiotic and biotic stresses.

A report on role of precision farming in climate action plan for India was presented in the

“India International Science Festival”. Students, innovators and scientists had all gathered to interact, discuss their ideas, and display their prototypes. The energy, scientific aptitude and curiosity that my fellow presenters had was irreplicable.

The fest helped me realize the sheer magnitude of the challenges that we all as humanity are facing.

Climate change is unsettling the very foundation of agriculture. It is estimated that the yield of staple crops in India will be reduced by 50% by 2050 through changes in temperature, rainfall intensity and weather (Rasul, 2021).The abiotic and biotic challenges like sudden droughts, heat waves, floods and increased susceptibility of crops to pests and diseases will pose a considerable challenge to meet the food requirement of the world, which is expected to double around 2050. This can be met by equipping youth with research exposure, mentoring to help them explore their intellectual strengths and abilities. This is of paramount importance for ensuring progress of humanity. I had decided early on, that I wanted to become a researcher. Then luckily, I was accepted in a research involved in improving abiotic resistance of major staple crops. I learnt how to use various kinds of instruments both on and off the field, learnt the principles of working in a lab, to be inquisitive about everything and to deal with seemingly insurmountable problems that had no obvious solutions at first sight. I learnt to appreciate the scorching sun, the sweat and the hard-earned data from the fields. It gave me a broad understanding of the research system and also brought me closer to the subject.

Integrated Farming Systems promote crop diversification, while providing opportunity for Integrated Nutrient Management, conserving soil biodiversity, in-situ crop residue management, and reduction in greenhouse gas emissions while reduce the risks involved in monoculture (Rose *et al*., 2019).This would also improve the soil resilience and provide added nutritional benefits to the local populace.

Consumers have also started to focus on healthier and nutritionally secure food which can provide a boost to immunity. Similarly, the rise of lifestyle related disorders like diabetes will herald a demand for Low Glycemic Index food products. The traditional food value chains will have to be transformed to meet the demands from urban centers. This is possible only if the rural youth learn skills of production and post-harvest technology. This can include value addition to grown food to make them lucrative for the markets. On the village level, jam, pickle and candy making workshops were conducted. Depending on the extra time they had, some women did start taking it up. Apart from local employment, it would also improve their social and economic dignity. It also puts money in the hands of women, which improves living standard of the family. But all this cannot be made possible without instilling in youth a sense of social and civic responsibility. Under the flagship government programme of National Service Scheme, social service volunteers like me survey numerous villages every year and interact with various farmers to experience their day-to-day challenges. Which is followed by discussion sessions with subject matter experts. We encouraged farmers to go for diversification of crops to reduce risk of monoculture while evolving to meet the changing consumer demand of the future. Interestingly, India is the world’s largest producer, importer and consumer of pulses. So, incorporating pulses in the cropping pattern would rejuvenate the soil, as well as the

government treasury. It also includes diversification of farming operations viz. converting Transplanted Paddy Rice into Direct Seeded rice (DSR), which would be instrumental in reducing the Green House Gas emissions from about 30 to 58% as compared to puddled rice and save labor costs, while improving the yield, preserving the soil health and leading to efficient water use. (Kaur & Singh, 2017)

We also found that farmers started to realize the potential of online trading as COVID-19 had disrupted the supply chains due to various lockdowns, trade restrictions and limited movement. We conducted training sessions for farmers to register on various portals for selling their produce online. We had the availability of smartphones and easily available internet, but skilling sexagenarians-septuagenarians was an uphill task. Though it did not immediately cause them to start using the platforms due to technological deficiencies which could not be encountered in the small window of time that we had but we were able to achieve a slight change in mindset. Some younger farmers were aware of such e-commerce platforms, which led to ease in convincing and helping them realize the pros and cons of selling their produce to unseen buyers.

With some luck and hard work, I was able to connect Research, Education and Extension which, I believe, are the most essential for youth to achieve the goal of economic, social and environmental sustainability.

Acknowledgments: I would like to extend my sincere thanks to Dr. Aparna, Associate Professor (English, Phonetics and Spoken English) and Dr. Seema (Assistant Professor), Nehru Library, CCSHAU, Hisar for their critical reviews on this manuscript.

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Freezing Method on Minimally Processed Durian for Long Term Storage

Intan Afiqah Ahmad Fadzil
Advisor: Associate Professor Dr. Juwaidah Sharifuddin
Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia

Freezing is one of the oldest and most extensively utilised methods of food preservation, as it allows for the best preservation of taste, texture, and nutritional content in foods. The freezing process combines the favourable advantages of low temperatures, which prevent microbes from growing, inhibit chemical reactions, and delay cellular metabolic reactions (Delgado and Sun, 2000). Most foods have been successfully frozen for long-term preservation, resulting in a greatly increased shelf life. In Malaysia, durians have variety of texture, taste and aroma as compared to the other counterpart durian producer in Southeast Asia. *Musang King* (MK) is the most popular durian clones among 204 durian clones in Malaysia. According to the Department of Agriculture, Malaysia produced 300,000 tonnes of durians annually and the premium grade MK yielded 69,000 tonnes and a quarter of the premium durian production were exported to China (DOA, 2019). Due to improper handling procedures for marketing and storage conditions during peak season, durian tends to deteriorate between 20% and 25% as fruits continue to respire long after harvest. Furthermore, durian fruits have a relatively short shelf life of three to four days, according to reports (Pauziah *et al*., 1992). As a result, in order to supply and preserve the quality of durians throughout the year, freezing is one of the best options.

In 2018, 2 students from Universiti Putra Malaysia with the help of 2 research officers from Malaysian Agricultural Research Development Institute (MARDI) have discussed about a plan to construct the experiment to identify the suitable freezing temperature of *Durian Musang King* for long term storage and investigate the respiration rates of freezing MK based on the carbon dioxide. This study was conducted by using two different temperature of cold room and 12 samples of MK were stored at both 7℃ and -18 ℃ . From this experiment, we collected the data regarding the condition of the samples everyday and the samples were observed for 7 days and it was found that all samples at -18℃ cold room have seriously cracked after 7 hours of storage while only 1 sample of durian was cracked after 5-day storage at 7℃ . Hence, it was found to be better in storing durian at 7 ℃ because it is still in good condition after 5 days of storage.

There is another alternative that are more powerful to extending durian's shelf life which is nitrogen freezing. Nearly half of durian suppliers in Malaysia applying this kind of freezing method. They freeze it at -90℃ about 1 hour and the frozen durian can be last almost 2 months.

The commodities that can be frozen are frequently the most perishable, as well as the most expensive. As a result, demand for these commodities is lower in developing countries.

Besides, the need for adequate technology for freezing process is the major drawback in my community in competing with industrialized countries. The frozen food industry requires accompanying developments and facilities for transporting, storing, and marketing their products from the processing plant to the consumer (Mallett, 1993). Thus, a large amount of capital investment is needed for these types of facilities.

However, we found that freezing method is one of the most essential strategies for preserving excellent quality in agricultural products over lengthy periods of storage as frozen storage has successfully prolonged the shelf life even though it influenced on quality of frozen durian when preserved for a long time but the changes were not extreme and durians could still be consumed. In this context, students should investigate and learn more about the effect of freezing fruit at certain temperatures to improve the efficiency of this method. Besides, it can be used as a future reference for another researcher about this method.

By adapting this technology, we are confident that it will bring a positive impact to our agricultural sustainability.

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Group J

Group theme

Environment

Presenters:

Nguyen Duc Canh, Vietnam National University of Agriculture
Cao Thi Thu Thuy, Vietnam National University of Agriculture
Érica Coutinho David, Federal Rural University of Amazon
Angelica Tso, The University of British Columbia
Arostegui, Keiji, Tokyo University of Agriculture

Chairpersons:

Somara Oum, Tokyo University of Agriculture
Junya Kodama, Tokyo University of Agriculture

The changes on the consuming habits of Vietnamese youth to deal with microplastic pollution

Nguyen Duc Canh[1], **Cao Thi Thu Thuy**[2]
Advisor: Assoc. Prof. Dr. Nguyen Thi Bich Thuy[3]
Vietnam National University of Agriculture
[1] Department of Environmental Technology, Faculty of Natural Resources and Environment
[2] Department of Molecular Biology, Faculty of Biotechnology
[3] Department of Post-harvest Technology, Faculty of Food Technology

Moving towards the 21st century, the environment in Vietnam have been facing with a large number of challenges and threats that come from many sources. Air pollution, water pollution and soil pollution are which mankind has been solving for sustainable and long-term development in the relationship among Vietnamese economy, society, and environment. The abuse of using plastic products directs to the generation of microplastics in the environment. Microplastic, often known as plastic particles less than 5mm in length (Cole *et al*., 2011; Lots *et al*., 2017), because of their sizes, easily goes to live body via food chains. Whenever microplastics survive in marine environment or other organisms, they can easily absorb accumulated toxins that stick on suface of living creatures and exist there. Microplastic, commonly classified by their shapes, may be filbers, fragments, particle, etc.

The recent research of our teachers and colleagues at Minhkhai district, Hungyen province, Vietnam shows that the plastic recycling village currently has 48 plastic recycling facilities in operation, the average amount of recycled plastic is 2.21 ± 0.095 tons/household/day. The water source used for production obtained from groundwater with a recycling rate of 33.3%. There are 8 main disposal points discharging waste water into receving water. The measured flow rate is 15.1 - 16.8 m^3/h. The analysis results of microplastic content in the environment obtained 0.33 ± 0.05 g/L of resin, in which microplastics had 0.03 g/L. In river water samples, 67% flakes and 33% other plastics were found. In the sediment sample, 0.45% microplastics and 4.63% plastic fragments were detected.

In 2019, we took part in a summer volunteer campaign in Quangxuong district, Thanhhoa province, Vietnam with the theme “Marine environment without plastic waste”. During the 14 days of the campaign, we cleared and cleaned more than 5 km of coastline and raised awareness of limiting the use of plastic utensils to local people. As Vietnamese young, and a student studying in the line of science, we have been actively participating in research on microplastic pollution problems in Vietnam and finding out solutions to deal with the serious consequences of plastic pollution.

Currently, the young generation in Vietnam is witnessing the worst environmental and ecological changes caused by plastic and microplastics. This situation reduces the quality of life and affects the development of future generations dramatically. Therefore, they are more knowledgeable and quickly approach new thinking about green lifestyle in this modern life. “No

plastic" trend has gradually become the most popular lifestyle that Vietnamese youth aim for. The youth now pay more attention to the environment through actively participating in environmental protection activities such as cleaning up garbage in residential areas, beaches or mobilizing people to limit the use of plastic bags. They, even students are active and creative when creating projects and websites to convey information related to plastic waste, microplastic pollution, calling for action by the community such as Green Hero project of the youth from Danang, Rethink Plastic Vietnam Organization, Green Life Facebook page, Eco-Fair Facebook page and website, etc. In addition, famous Vietnamese artists and influencers are also very enthusiastic in changing consumption habits to reduce plastic waste and spread that lifestyle with their followers (*Người Nổi Tiếng Lan Tỏa Thông Điệp*: "*Nói Không Với Sản Phẩm Nhựa Dùng Một Lần*!," n.d.). Remarkably, the youth have had many start-up projects from garbage, making shoes with coffee residue, virtual pants from industrial "garbage" to thoroughly useful "filling" stations (*Lại Đây Refill Station - Trạm Nhỏ Lan Tỏa Lối Sống Xanh | Vietcetera, n.d.; Những Startup "Chơi Trội" Trong "Làng Khởi Nghiệp" Gây Ấn Tượng Xuất Phát Từ Việc Bảo vệ Môi Trường*, n.d.).

However, the popularization of "No plastic" consumption still has to face to a vast of challenges. About 2 years ago, many restaurants, supermarkets and coffee shops switched to using environmentally friendly packaging products instead of ordinary plastic cups and plastic bags. However, nowadays some must give up because of the limited supply sources and the cost of them is more expensive than plastic bags. Besides that, a significant number of people do not have the habit of paying for packaging products. The low cost and convenience of shopping without carrying a bag is one of the reasons why it is difficult to reduce plastic waste. Additionally, if only stopping at advocacy and encouragement without the support of policy and capital for business, few enterprises can participate in green production. Consumers must also consume responsibly because when a huge of consumers use environmentally friendly packaging products, it will contribute to reducing costs and promoting production (*Cơ Hội và Thách Thức Trong Thúc Đẩy Tiêu Dùng Xanh ở Việt Nam*, n.d.; *We Are the Answer to Vietnam's Drastic Plastic Problem - VnExpress International*, n.d.). In addition, eco-friendly products have not been widely sold at convenience stores and these products need to be recognized as meeting the quality standards of the licensing authority to be introduced products to consumers easily. Many environmental experts said that to spread green consumption in the community, it is not advisable to rely on nature because if only the leaves and stems are exploited to make environmentally friendly products without a planting plan, it will direct greater consequences. Accordingly, we highly recommend that the government needs to have specifically support policies for the development of new and eco-friendly products, and to enhance people's awareness of environmental issues, especially plastic waste, nylon products.

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Những startup "chơi trội" trong "làng khởi nghiệp" gây ấn tượng xuất phát từ việc bảo vệ môi trường. (n.d.). Retrieved June 14, 2021, from https://kinhtechungkhoan.vn/nhung-startup-choi-troi-trong-lang-khoi-nghiep-gay-an-tuong-xuat-phat-tu-viec-bao-ve-moi-truong-46821.html?fbclid=IwAR0Ivv5doLHa-mUTdQlVrWeGmK7fx-kXiWGvyYftJZUHTyRVYJuIIHStpKs

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Using agro-industrial by-products to achieve sustainable livestock production in Brazilian Amazon

Érica Coutinho David
Advisor: Thiago Carvalho da Silva
Federal Rural University of Amazon, Institute of Agricultural Science

The use of technologies as high-yield varieties combined with improved crop management practices as irrigation, fertilizers and tractors have promoted a global food production enough to feed the increasing population during the last decades. At the same time, population growth, urbanization, and other factors have increased the demand for animal products especially in Asia and Latin America over the years (Borlaug & Dowsweel, 2005). The aim of this study is show the potential of using agro-industrial by-products as alternative feeds to achieve sustainable livestock in Brazilian Amazon. In this context, Brazilian livestock production systems have the challenge of feeding the world in a country with the second largest forest area (497 million hectares) and the biggest quantity of tree species in the world (9,223 tree species; FAO & UNEP, 2020). Considering the occupation of South and Southeast arable areas in Brazil, Amazon region is an agricultural frontier to be conquered and land-use researches have showed the increase process of deforestation, which is commonly associated with the advance of pasture areas used for livestock production. However, according to Brazilian Institute of Geography and Statistics and National Institute for Space Research database of land-use and deforestation monitoring, respectively, Brazilian deforestation decreased 75% from 2004 to 2017. At the same time, the pasture area decreased 23.8% from 2006 to 2017 in Brazil (IBGE, 2017; INPE, 2020). Brazilian government undergoes a national and international pressure to implement initiatives for deforestation reduction and consequently achieve the goals for reducing greenhouse gas emissions. Some government actions had results until 2013, but deforestation rates have been rising and worsening in preoccupants levels, achieving 11,088km^2 in 2020 since that year (Silva Junior, 2020; INPE, 2020). Brazil have potential for expansion of arable lands that can be used for food production without deforestation of Amazon Forest, with approximately 220 million hectares of pastures that could be managed to intensify production and release area for other cultures (Alves *et al*., 2008), which is already happening. Through the sustainable intensification, degraded pastures have been converted in crop fields and recovered pastures for meat and milk production. These actions have decreased the total pasture areas to 160 million hectares while the yield have increased over the years (IBGE, 2017). Therefore, the possible way to achieve a sustainable production in Amazon is increase productivity in opened areas, by recovering degraded pastures, using integrated crop-livestock production systems, and feed supplementation with non-conventional animal feeds. Alternative and regional feeds have been used in many countries around the world because it does not compete with human feeds and other reasons that will be discussed. The use of by-products from agro-industry is an alternative to supply the nutritional demand of animals to reduce the

cost of animal feeding and to provide a destination to elements that usually to becomes environmental pollutants, as the residual frying oil used in diets for ruminants (Menezes *et al*., 2016; Oliveira *et al*., 2017; Peixoto *et al*., 2017). Murumuru (*Astrocaryum murumuru var. murumuru* Mart.), used in cosmetic industry and cupuaçu (*Theobroma grandiflorum* Schum), a fruit producer of chocolate and consumed *in natura* are examples of potential species with utilization of agro-industrial by-products to substitute conventional feeds (Menezes *et al*., 2016; Rodrigues *et al*., 2015). Agro-industrial by products can also be used to improve the silage quality. Silage is a method of conservation of forage crops and grains based on a fermentation process with preserves feed quality and allows the food storage for later utilization. The gases produced in this process can be significant and become an environmental concern. Silage production of crops with high moisture content produces effluents from the cells rupture and extravasation which can also be an environmental concern. If the silage effluents reach water courses, the pollution is 200 times higher than domestic sewage (McDonald *et al*., 1991). Since 1999 researches have showed that including by-products in silage production decrease gas emissions and effluent production (Megías *et al*., 1999; Santos *et al*., 2014). The use of by-products of murumuru and pataua promoted almost the total elimination of silage effluent and reduced the fermentation losses in elephant grass silage, which represents gains in economic and environmental ways (Menezes *et al*., 2016; Queiroz *et al*., 2020). It is proven that the use of by-products in order to reach sustainability is notable. However, there is a constant need of research evaluation of each by-product considering toxicity and nutritional parameters to define the ideal level of inclusion for each animal diet. The function of university students start being part of researches groups and extensions programs in university as GERFAM (Study Group on Ruminants and Forage Production of the Amazon; https://www.gerfam.com.br/), and as a connection between universities and society, spreading and applying the academic knowledge in society. In Brazil, universities research projects study these and many others by-products in feed diets, but researchers have faced crescents cuts in budget destined to education and research, hampering research conduction in Brazil. Thus, considering the importance of Amazon ecosystem and necessity of increase food production, the use of agro-industrial by-products is an alternative to combine those objectives and achieve social, environmental and economic sustainability.

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Incentivizing Reuse Culture in Metro Vancouver through a Mobile App Program

Angelica Tso
Advisor: Leslie Lavkulich
Global Resource Systems, Faculty of Land and Food Systems, The University of British Columbia

Modern day convenience culture remains one of the largest drivers of society's reliance upon single-use items — a phenomena that exacerbates the growing negative socio-environmental impacts of waste. From coffee cups, to utensils, to takeout boxes, society's tolerance for disposable goods within the food and beverage industry has been increasing especially with the growing market for takeout and delivery services worldwide (Li *et al*., 2020). This project focuses on the issue of disposable cup waste in Vancouver, British Columbia.

Every week, Vancouver throws out an average 2.6 million disposable cups (Standing Committee on Policy and Strategic Priorities, 2018). Despite the fact that disposable cups are accepted within the City of Vancouver's recycling program (City of Vancouver, n.d.), the effectiveness of recycling remains much lower than what most people believe. On one hand, because paper coffee cups are difficult to recycle as the inner waterproof polyethylene (plastic) coating cannot be easily separated (Mitchell *et al*., 2014), less than 1% of all paper coffee cups are ever recycled worldwide (Triantafillopoulos & Koukoulas, 2020). On the other hand, only 9% of Canada's plastic waste is recycled annually which indicates that plastic cup recycling is likewise insufficient (Environment and Climate Change Canada, 2020). Despite the growing prominence of greener alternatives such as compostable polylactic cups, these are in fact rejected by both the City of Vancouver's green bin compost system and its recycling system (City of Vancouver, n.d.). Hence, not only do current solutions fail to tackle the root cause of society's throwaway mindset, but they also have the potential of exacerbating our tolerance for disposability under the false narrative that recycling or greener disposables can sufficiently address our waste issue.

On a macro level, the disposable cup issue is a symptom of society's throwaway culture that values personal convenience at the expense of negative socio-environmental externalities caused by a fundamental disconnect between people and the natural ecosystem. Hence, what our project addressed was the root cause of our convenience-centric social norms by promoting behavior change. By creating a program that encourages consumers to bring their own cups when buying to-go drinks, we hoped to institutionalize and incentivize reuse culture in a way that fosters environmentally conscious habit formation and one that sheds light on the intersectionality between the environmental, social, and economic aspects of our existing disposable culture.

Our project—BYO (Bring Your Own) —is a mobile app-based program that motivates individuals to bring their own cup through a variety of mechanisms such as rewards and

impact tracking. In addition to incentivizing a bring your own cup behavior, a portion of the usual cup discount will be allocated towards a tree planting initiative. By incorporating tree planting, we sought to extend our impact beyond mitigating cup waste—encouraging customers and cafes alike to think bigger while sparking conversations around the larger collective role of consumer practices. The project is a unique combination of cup waste reduction, rewards, tree planting, and community building.

We also hope to leverage BYO as a platform to empower local communities and economies. Locally, consumers will benefit from having access to a compiled network of "bring your own cup" friendly cafes as well as local sustainable businesses and organizations through the rewards portion of our app. Likewise, cafes and reward partners will also be positively impacted by attracting a growing group of eco-conscious consumers, promoting specialty products in the app's reward library, and gaining recognition for their sustainability efforts. By participating in this program, consumers and cafes are also collectively empowering communities overseas. To do so as a part of our tree planting initiative, we are exploring partnering with Eden Reforestation and we envision our program to positively impact communities abroad by supporting tree planting employment.

Alongside these impacts, BYO is using our online platforms as an educational tool to raise awareness around reuse culture, consumerism, and sustainability. A study on ways to encourage environmentally friendly behavior surrounding takeout cup usage revealed that strong environmental messaging and awareness raised through documentaries contributed more to creating lasting behavior change, than monetary incentives, such as surcharges or discounts (Sandhu *et al*., 2021). Hence, BYO can leverage our social media as an educational platform to complement our mission in evoking changes in consumer behavior that extend beyond saving cups. By highlighting the broader intersectionality between our actions and its effects on our surroundings, our goal is to inspire individuals to consider the wider socio-environmental impacts of our existing systems.

The project has been in development for almost one year. Our team consists of students from the University of British Columbia and Simon Fraser University from various academic backgrounds—environmental studies, business, computer science, and visual design—working collectively on BYO's operations and app development. Currently, BYO is undergoing its beta testing phase with an early iteration of the mobile app and 2 pilot cafe partners in Vancouver. This phase allows us to better understand consumer behavior and how our project can best facilitate the adoption of personal reusables. In the following months, we hope to secure more cafe partners, several reward partners, and continue on improving our program to foster an even larger impact on our communities.

We are currently exploring various options to sustain BYO's work including various business models and ideas. Upon a successful pilot program, we hope to continue expanding the BYO program as a social enterprise. Ultimately, our goal with BYO is twofold: to reduce cup waste and to inspire long-term behavioral changes in consumer attitudes. By having participants actively engage in a reuse culture, we seek to normalize an alternative to the current status quo of wasteful consumption—concretizing environmentally conscious habits that

participants can carry forward with in other aspects of their lives within their communities.

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Soil Organic Carbon (SOC) Importance and its influence on Climate Change: an approach new mitigation method

Arostegui, Keiji

Advisor: Prof. Dr. Mihara Machito

Tokyo University of Agriculture, Department of Agricultural Engineering,

Laboratory of Land and Water Use Engineering

Soil organic carbon (SOC) has an important role as a key indicator for soil health due to its contributions on mitigation and adaptation to climate change (Pribyl, 2010). Tropical areas such as Amazon represents the highest amount of soil carbon sources on earth. Although it is affected by human impacts due to deforestation, it is important to maintain and increase SOC of tropical toward an optimal level for meeting challenges such as mitigating climate change effects.

The aim of this study is to analyze the stabilization of soil organic carbon under different conditions of temperature in soil. As part of the methodology, Red-yellow soil was identified and collected from forested areas, following the sampling method of Carter and Gregorich (2008). Air-dried soil was sieve and weighed. Biochar was applied at the rates of 0% (control) and 5% on the dried soil weight under ambient (25℃) and warm (35℃) conditions. In order to analyze the effects of the temperature, the soil respiration ratio (SRR) was measured as well as SOC content by spectrophotometry method (Wallinga *et al.*, 1992) for 150 days.

The experimental results showed that temperature had a significant effect on the soil organic carbon content. In the period of study, the warm conditions resulted in higher values of microbial activity and decomposition rate (Lloyd & Taylor, 1994). The Figure 1.A shows the gradual decrease of the carbon amount at ambient and warm conditions, while the Figure 1.B shows a slight decrease of the carbon values where the action of biochar has an important effect on the stabilization and reduction of carbon decomposition. Woolf *et al.* (2010), described the stabilization of soil carbon by the addition of biochar, which absorb of gases produced by microorganism activity. The action of biochar seems to be an important tool for recover the soil carbon conditions in the short-term.

Additionally, values of soil respiration rate were considerable reduced in the first month. The inputs of Carbon impact directly on the respiration and decomposition process. Thus, biochar works as carbon sources to maintain and increase SOC content, yet stabilization effects on Soil Respiration Ratio (SRR) should be observed in long term.

To sum up, soil organic carbon (SOC) has an important role as a key indicator for soil health due to its contributions on mitigation and adaptation to climate change. Although it is affected by human impacts due to deforestation, it is important to maintain and increase SOC toward an optimal level for meeting challenges such as mitigating climate change effects. In this way, the application of biochar not only provide benefits for plants, but also fulfils a role of maintaining SOC content towards the optimal level for the environment, contributing to

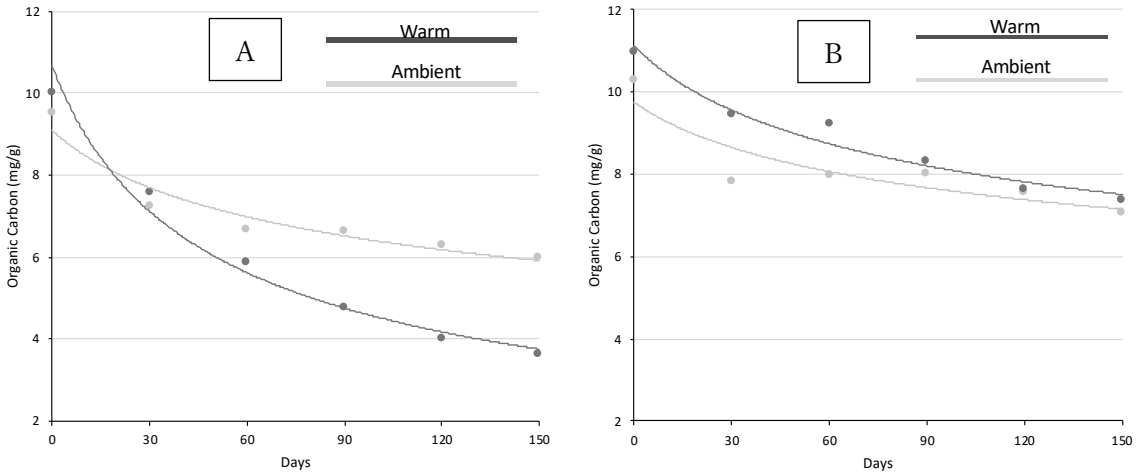

Fig 1. Effect of temperature on soil organic carbon amount in the short-term with application of 0% (A) and 5% (B) biochar (w/w).

achieving the SDG's. For futures research, biochar and soil organic carbon must be studied on the middle-term in order to analyze the different seasons and variation of temperature in the year. Finally, this research is fulfil the gaps of information of SOC, which contribute on new methods of restoration and mitigation of climate change.

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Group K

Group theme
Agriculture

Presenters:

Bethanie Haase, Western Sydney University, Australia
Kim Kufazvineyi, Unilasalle
Irene Akinyi, Jomo Kenyatta University of Agriculture and Technology
Dematagolle Wedaralalage Ovin Jetha Amaratunga, University of Peradeniya

Chairpersons:

Rival Valcin, Tokyo University of Agriculture
Mozelle Millenas Ramos, Tokyo University of Agriculture

Protected Cropping in Australia
Emerging Technologies in Novel Environments

Bethanie Haase
Advisor: Zhonghua Chen
Bachelor of Sustainable Agriculture and Food Security, School of Science,
Western Sydney University, Australia

Globally, we have transformed nearly one third of the Earth's land surface into agricultural landscapes (Leff *et al*., 2004) whilst utilising about 70% of available fresh water (OECD) and impacting ocean and fresh water sources through eutrophication (Ritchie & Roser, 2011). In Australia, over 55% of land use is allocated to agricultural practices, and 25% of potable water extractions are for agricultural purposes [Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), 2021]. Large scale monoculture systems and a global food chain which focuses on mass production of a small subset of products places strain on the natural resources of the Earth and increases the risk of food insecurity (HLPE, 2016). Diversifying food production and cropping methods is important not only in achieving food security across the globe, it is also essential in ensuring adequate nutrition and healthy living for people everywhere (Storkey *et al*., 2019). Developing effective methods of food production which focus on reduced water consumption and land use could well be a key driver in the future sustainability of food production.

Agriculture in Australia is a significant industry producing highly prized consumer commodities for a national and international market generating employment opportunities and strengthening the economies of many regional communities across the country (Hadley, 2017). Although known for some of the oldest and most depleted natural soils in the world, traditional methods of agriculture in Australia have leveraged limited areas of nutrient-rich earth which have provided the basis for large-scale cropping and livestock production (Johns, 2015). The climatic variation which occurs across the continent has also provided unique opportunities to capitalise on both temperate and tropical produces (Williams *et al*., 2002). As the global population continues to grow, countries such as Australia are under increasing pressure to ensure an increasing supply of sustainably sourced food to a domestic and international market.

Protected cropping is Australia's fastest-growing agricultural sector, with an estimated 30% of farms using this suite of technology (Protected Cropping Australia, 2019). Protected cropping encompasses a range of different structures and technologies ranging from basic poly-tunnels with no or low technical input to fully enclosed controlled environments constructed of glass and steel with innovative and advanced technologies applied to nearly every feature (Castilla, 2013; Rabbi *et al*., 2019). Fruit and vegetable exports currently account for less than 7% of Australia's overall agricultural export, however this figure is expected to increase with growing demands from international importers, particularly with an increasing interest from Asian and Middle-Eastern markets (AusVeg, 2018). Production increase will generate

additional employment and trade revenue, however this production increase will need to be met in a changing climate, and in a time where it is essential that we achieve efficient use of resources and a reduction in emissions and other environmental pollutants.

Low and medium technology protected cropping systems such as netting, shade house and poly-tunnels provide relative levels of protection from external factors such as temperature, frost, wind, and pests. High-tech greenhouse (or glasshouse) systems provide not only physical protection to plants and produce, they facilitate controlled atmospheric conditions, water and nutrient output and recapture, and can yield 5-10 times more than field cropping per unit of area with (Rabbi *et al*., 2019). Sustainable energy solutions such as solar power, novel cover materials and cooling systems, can be easily incorporated into the function of high-tech greenhouses, and warrants additional research to ensure the highest possible level of energy efficiency is achieved (Chavan *et al*., 2020; Samaranayake *et al*., 2020; Zhao *et al*., 2021). Investing in high-end greenhouse technology research and adoption will position Australia as a world leader in sustainable, environmentally conscious primary industry production methods capable of contributing to world food security in a meaningful way. In fact, the exportable benefits do not end there; in addition to direct export of agricultural commodities, an uplift in research and education in the field of high-tech greenhouse would serve to strengthen Australia's Education sector, another significant contributor to Australia's export economy.

Australia's geographic location and highly developed economy creates an excellent opportunity to be early adopters of high-tech agricultural methods in the Southern Hemisphere with a strong network of Government and Industry support bodies. This can naturally align with the education sector, and result in high quality education products through collaboration with great appeal to an international market. Expanding a non-traditional agricultural practice has challenges, including engaging a new generation of farmers wanting to embrace innovation and technology which is at odds with the current demographic of Australian farmers, the average age of whom is 52 years old (ABARES, 2018). Engaging new-generation agricultural science students in protected cropping in Australia will support the development of sustainable growing practices, enrich education domestically and internationally, and provide insights into a method of agricultural production which is traditionally set in markedly different climatic regions.

Located on the Hawkesbury Campus of Western Sydney University, in partnership with Horticulture Innovation Australia and Wageningen University, is a world-class greenhouse facility with a strong focus on research and teaching. The greenhouse provides unprecedented temperature, humidity, CO_2 and light control, and has facilitated the ongoing research of protected cropping in arid and dry-land conditions not traditionally associated with greenhouse crop production. Both undergraduate and post-graduate students alongside academic professionals in agricultural science are provided with the space and resources to conduct learning and research activities including growth, produce volume and quality comparisons, pollination techniques and light-wave manipulation and control in a unique context meaningful to the Australian environment. These activities also engage industry and community partners in advanced protected cropping in diverse locations and settings. It is the hope that through

increased dialogue and peer engagement between current and emerging students, industry, and community partners that attention on protected cropping research can increase and ultimately work to support sustainable food production for our worlds future.

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INCREASE OF DROUGHT TOLERANCE IN MAIZE THROUGH THE USE OF GENETIC MODIFICATION USING SbABI5 FROM SORGHUM

KIM KUFAZVINEYI

Advisor: Mr Christophe Gangneux

UNILASALLE

International Sustainable Agribusiness and Food Engineering

According to the United Nations World Food Programme nearly 5.3 million people face food insecurity in Zimbabwe due to poor rains and unpredictable climate change. (USAID, 2021) This results in undernourishment and even death, as Zimbabwe is an agricultural country whose economy solely depends on rain fed agricultural production. Orphan crops such as rapoko, millet and sorghum are some of the few crops that thrive in arid regions of Zimbabwe, unfortunately their yield is very low as their grains are too small to provide an abundant food source and sustain the entire population. It also results in a restricted diet that is centred on starch only. This poses a threat because people will be deprived of basic nutrients such as proteins and vitamins, resulting in deficiency diseases such as kwashiorkor, scurvy, rickets, beri beri and pellagra. The 2018/19 season experienced delay in rainfall due to the EL NINO phenomenon (Jeffrey, 2019), which is the warming of sea currents off the coast causing below normal rain patterns and above normal temperatures which ultimately result in drought. Such Conditions. cause severe hunger and malnourishment and when farmers are not equipped to deal with such conditions its results in devastating effects. As a country Zimbabwe cannot be solely dependent on aid from non-government organisations for food as it is not sustainable. We looked at the case that was reported by Africa News (Dzirutwe, 2021). Most villagers from Mafomoti village trek for 100 kilometres to the South African boarder in search of food. This spike in cases of hunger has also led to a significant number of children having to drop out of school due to lack of food and energy. We can see here the problem that this community is facing in regards to hunger what can be done to stop it?

The aim of this work was to increase drought tolerance of crops through an increased production of abscisic acid. This can be achieved by two methods: increasing the level of expression of the gene responsible for the production of abscisic acid in host plants or by the addition of a more efficient one like the *SbAB15* gene from sorghum.

Abscisic acid is a stress relief hormone that is produced by plants in extreme conditions such as drought. This hormone helps to survive by increasing the plant's stomatal conductivity. When the plant is in low water conditions the stomata will partially close allowing minimal water loss (Basu & Rabara, 2017). This mechanism can retain 56% of water that would have been lost by transpiration. Abscisic acid is produced by most drought tolerant crops such as sorghum. For this plant, this hormone is produced by a multi-step process including the SbAB15 gene (Rodríguez *et al.*, 2009).

By extracting (SbAB15) from sorghum Genome and insert this gene in other plants, they may survive under arid conditions. Abscisic acid works in such a way that there is an efflux of anions and potassium via guard cell plasma membrane ion channels, resulting in decrease of turgor pressure in guard cells and hence stomatal closure when there is high environmental stress (Vishwakarma *et al*., 2017). The gene can be extracted and applied using the following technique. After DNA extraction from sorghum, the gene is isolated by PCR before inserting it in a vector suitable for *Agrobacterium tumefasciens* transformation. This construct is then transferred into *A. tumefasciens* that will act as a carrier for the gene. This bacteria is then used to infect the desired crop (maize for example). We then perform multiple experiments to cultivate the crop in arid conditions and normal conditions to see if the transfer has been successful by the plants. Abscisic acid can also be monitored by direct extraction in plant leaves under the different conditions.

This project would be beneficial to society because it would help to solve the problem of food insecurity in sub-Saharan Africa particularly in Zimbabwe. The goal of zero hunger would be achieved by the increase in agricultural yield due to increase in drought tolerance in plants. This project could also lead to a diversified diet in areas where only a small selection of crops can grow due to drought as there will be more a wider variety of drought resistant crops. This will help lessen malnourishment because a diversified diet is more nutritious. This is far more sustainable as people in the Zimbabwean community will be able to independently be able to produce food and boost their economy at the same time

This project however does have its own limitations, socially, economically and environmentally. Socially the issue of stigma around the production and consumption of Genetically modified organisms can cause major conflicts and people may be hesitant to consume such food products. Environmentally genetically modified products might disturb the natural ecosystem due to crop invasiveness. Pollen from genetically modified plants may also contaminate organic products, hence their products get rejected on the market and might lose their certification. However methods are available to minimize and monitor these risks.

Finally, the difficulties in promoting this project would mostly be the funding of the project as it is a hefty project that requires a well-equipped laboratory and experts in plant biotechnology.

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Quality Improvement of Cocopeat as a Propagation Media through Composting as a Desalinization Procedure

Irene Akinyi

Advisors: Dr. Catherine Ngamau and Dr. Annah Indeche

Jomo Kenyatta University of Agriculture and Technology,

College of Agriculture and Natural Resources, School of Agriculture and Environmental Science,

Department of Horticulture and Food Security

Population sizes in Kenya have lately increased which has resulted in reduced production land. In contrast to the fact that less land is left for cultivation i.e., soil availability is reduced; more food is required to feed the large population. This situation has brought about the importance of finding alternative soilless media for use. Media that have been identified for propagation and that can be used as alternatives for soil include; sphagnum moss, cocopeat, and perlite. Cocopeat is one of the best and the most used soilless media that has been identified and that is used in Kenya. Cocopeat is an agricultural by-product obtained after the extraction of fiber from coconut husk. It can be reused for up to 5 years, it is cheap, easily available and free from pathogenic microorganisms'. As a propagation media cocopeat encourages rooting system, provides good anchorage to the rooting system, has an excellent water and nutrient capacity for the seedlings, and lastly it has suitable aeration conditions (Kumarasinghe et al., 2016). The results of many experiments revealed that cocopeat used alone or as a component of soil medium is suitable for roses (Blom 1997), gerbera (Labeke and Dambre, 1998), many potted plants (De Kreij and Leeuven 2001), and also for vegetables. However, due to high initial levels of potassium and sodium in the cocopeat, treatment programs should be carefully adjusted to plant requirements.

Despite the good characteristic of cocopeat several factors have been reported to affect its quality of cocopeat. For example, the air capacity and water retention can be easily affected by processing and handling techniques. Cocopeat has been reported to have a high C: N ratio of 112:1 (Ilahi et al., 2017). The composition and attributes of cocopeat vary depending on the maturity of the coconut, extraction method and disposal, the period between extraction and use, and environmental factors. Agricultural market information and feedback insights have however shown that farmers who plant directly into the bought cocopeat attain low germination percentages. Studies show that this problem is a result of high salt levels which are toxic to seeds and plant life generally. It is therefore very important to monitor pH and EC values. High salinity levels in the cocopeat have been a hindrance to high seedling production and vegetative propagations. This problem has negative effects and it affects the farmer's productivity and stands out as an indirect reason for food insecurity. This defect can be corrected by the removal of excess salt in the media (Jeyaseeli et al. 2010).

Some of the suggested methods of removing excess salts (desalinization) in cocopeat include leaching, buffering, aging, or composting. However, there is limited information on the

optimal desalinization method that can be adopted by famers for effective plant propagation in the nursery. Hence this project. My aim is to find the best desalinization procedure that can improve the value of cocopeat. Currently a team of 5 other youths and I are analyzing the physical and chemical properties of cocopeat subjected to different desalinization procedures. It is hypothesized that different desalinization methods affect both the physical and chemical properties of cocopeat. The team and I are much focused on composting methodologies of cocopeat for better results. The procedures and the activities of the project have economic and environmental implications.

Composting is a better option compared to washing and buffering procedures (conventionally used methods). Buffering is expensive and therefore unaffordable by small-scale farmers. Washing seems an easy and quick solution but it is laborious and an environmental pollution source. A lot of water is needed to leach away salts from the cocopeat and the salt discharge interferes with the soil health and structure. Water is scarce and getting a lot of it that could be enough to desalinize cocopeat would be a big challenge. Composting is a way of increasing organic matter thus a positive impact on the environment. Composting is environmentally friendly, utilizes locally available resources, and is a sustainable method. Composting is more beneficial as it also reduces the C: N ratio apart from the EC. A C: N ratio of 24:1 is the expected value of a composted cocopeat. It takes 60 days to fully decompose the cocopeat. The cocopeat is disintegrated and broken down to fine organic compound which is profound in a propagating substrate. Mushroom Pleurotus is the fungus used to break down lignin in cocopeat to improve the digestibility of dry matter and organic cocopeat ingredients.

Once the best method is confirmed, promotion of desalinization processes will be undertaken through participation in farmers' field days, agricultural fairs, distribution of extension materials such as brochures, and recoded videos that will be shared on social media platforms such as You Tube and Facebook to reach a large audience. Development of these extension materials will have a cost implication that is a foreseen challenge that require resource mobilization strategies. Stakeholders will be encouraged to partner will this team to ensure that small-scale farmers and propagators are made aware of the findings of these project.

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Changing the Existing Social Identity of a Farming Community to Sustain Their Lives

Dematagolle Wedaralalage Ovin Jetha Amaratunga
Advisor: Prof. Sarath S. Kodithuwakku
Faculty of Agriculture, University of Peradeniya, Peradeniya, 20400, Sri Lanka

Introduction

Agriculture is the most important sector of the Sri Lankan economy, even though it only contributes to 7% of the national GDP in 2019. Moreover, approximately 2.14 million of the workforces, which accounts for 25.3% of the total employed population, are engaged in the agriculture sector, including fisheries and forestry, in 2019 (Central Bank of Sri Lanka, 2020). However, the agricultural sector, which once contributed to more than half of the national GDP, is now facing several challenges due to the recent Covid-19 pandemic and other various problems. These challenges, limitations and uncertainties in the sector caused disappointment forcing the farmers, especially younger farmers, away from agriculture. However, the sector is highly vital in providing food, raw materials and other various goods and services, including ecosystem services. Therefore, we cannot simply neglect the agricultural sector. Consequently, there is an urgent need for a more sustainable and holistic approach to supporting workers in this sector.

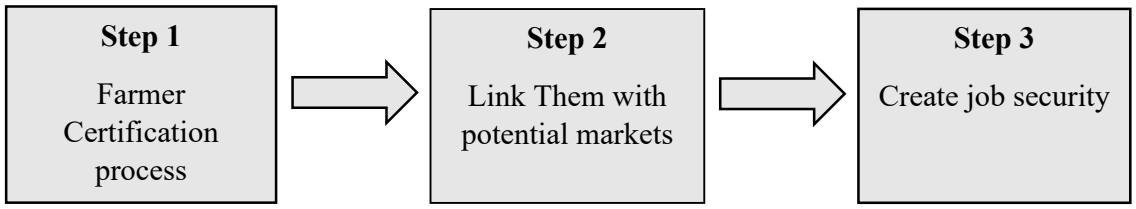
Methodology

Agricultural undergraduates of the Faculty of Agriculture, University of Peradeniya, engage in a farm practice course in the first year, the first semester of their study programme at Sub-campus, Mahailuppallama, Anuradhapura, North Central province, Sri Lanka. During 6-8 months of stay, students get practical exposure to dry zone farming and rural village setting. Being a settlement under the Mahaweli irrigation scheme, most of the inhabitants are farmers. They are resource-poor, small-scale farmers. During the stay at Mahailuppallama, students associate with villages closely and identify their values, attitudes, behavioural patterns, and other critical cultural elements. The villages respect students as scholars and place them in a higher position in their rural setting. So that's the ideal point of turning an idea into a viable project, apart from the academic studies using existing potentials. Being familiar with the farmers who reside in Mahailuppallama, students, while learning from them, can significantly impact their lives. The project can be initiate by focusing on Mahailuppallama, initially targeting 40 farming families with the volunteering of fellow batch mates.

During the stay at Mahailuppallama, students would closely associate with the Farmer organization, Agrarian service center, Irrigation office, and other various governmental agricultural stakeholders. Therefore, we can get the support and expertise of government organizations to initiate and continue this project. At the same time, we can utilize our theoretical knowledge on practical grounds. Not only agriculture, but we can also exercise our

knowledge on Agricultural extension as well. As an author of this project, my responsibility is the preparation of a complete project proposal and grab the attention of interested parties to collaborate, selection of potential farmers, create supportive groups from peers, setting goals & deadlines, assigning tasks and measure continuous performance.

The project intends to enhance the social identity of farmers through a certification process and connect them with a stable business platform to sell their produce. As a first step, the selected farmers will be presented with an opportunity to participate in a series of the extension education program, which we will conduct with the help of academic staff, other governmental agricultural stakeholders and volunteer batch mates. This project's major areas of focus are proper usage of agrochemicals, new technology transfer, training on Good Agricultural Practices (GAP), environmental and natural resource management, and sustainable farming practices. At the end of the project (approximately four months), farmers are provided with a certificate on Good Agricultural Practices (GAP) in collaboration with the relevant government authorities. By doing that, we would gain experience on challenges that one would face when attempting to change the mindset of farmers through problem-based learning. Therefore, this certification process changes the farmers' mindset as they are an integral part of society while allowing us to lay a solid foundation on rural agricultural practices. So, the certification process changes their social identity from a neglected, poverty-stricken, unempowered citizen to a respected, empowered citizen building internal motivation to keep engaging in agriculture by adopting GAP, which is more environmentally friendly and sustainable. This certification process changes their career name as a GAP certified farmer, which will open up opportunities for them to tap into niche markets. As a second step, they will be linked up with GAP certified sales centers that are currently being initiated by the Department of Agriculture. As a third and final step, arrangements will also be made to link the farmers with an Indexed Based Insurance Scheme provided by a leading insurance company. This whole process can be monitored by us for at least a 6-month duration until farmers get familiarize with the process.



Anticipated Results and Problems

Securing the farming occupation creates intrinsic motivation among individual farmers to set a vision for their work. It will lead them to invest in agriculture (new technology), which will enhance productivity, efficient land use, and reduce post-harvesting losses while also creating a sustainable agricultural production system. The insurance coverage compensates for farmers' losses due to adverse climatic conditions, epidemic losses, fire losses, and wildlife damage. The combination of pension schemes and insurance policies creates job security and job safety. Further, it provides accessibility to credit facilities that were restricted previously

due to a lack of stable income. The accessibility to credit facilities paves the way to acquire productive assets, land, and/or machinery, which would create a rapid boost in the livelihood of particular farmers. Further, this concept will prevent the younger generations from stepping down from agriculture due to very low levels of social protection, social recognition and unprofitability of Sri Lankan agriculture. The individual benefits for farmers in socio-economic spheres pave the way to Economic and Social sustainability. The environmental consideration of formal and informal agricultural education systems paves the way to environmental sustainability.

Even though the programme touches every component of sustainable agriculture, it would be more challenging to get some government parties interested to implement this programme. The government infrastructure, management, consultation and monitoring is essential for carrying out this programme. Further, the attraction of older farming groups to implement this project is problematic due to their willingness to change and short-sighted view. Even though they are obliged to follow certain rules and regulations to fulfil the certification requirements, whether they would genuinely participate in the programme is uncertain. Implementing pilot-scale projects with pre-recognized farmers and displaying their progress can be used as a promotional tool to attract more farmers and government bodies to implement this programme.

Conclusion

Considering the novelty of this concept and the possibility to contribute to many Sustainable Development Goals (No Poverty, Quality Education, Decent Work and Economic Growth, Reduced Inequalities) with the active participation of the farming community, this could lead to a sustainable future.

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Group L

Group theme

Food

Presenters:

Alona Lebedko, National University of Life and Environmental Sciences of Ukraine
Rehema Erasto, Sokoine University of Agriculture
Joyline Cheptoo, Jomo Kenyatta University of Agriculture and Technology
Martijn Wals, Wageningen University
Iqra Amin, University of Reading

Chairpersons:

Fredrick Mwaikenda Mussa, Tokyo University of Agriculture
Neo Kawana, Tokyo University of Agriculture

Assistant chairperson:

Saki Fujita, Tokyo University of Agriculture

Competitiveness of Ukrainian agricultural products

Alona Lebedko
Advisor: Tetyana Kuts
National University of Life and Environmental Sciences of Ukraine

The priority task of Ukraine's agriculture is to ensure food security of the population. Ukraine has a unique land potential, which while increasing the efficiency of its use, provides opportunities for the export of agricultural products. Today, Ukraine is one of the world leaders in the export of sunflower oil, corn, barley, wheat, soybeans and chicken.

Given the further dynamic development of agricultural markets, a comprehensive study of the competitiveness of production of both agricultural raw materials and products of its processing is relevant.

The importance of scientific development of competitiveness is growing in the conditions of open markets and active foreign economic activity in order to optimize the volume of agricultural production, processing in Ukraine and exports (Kolesnik G., 2015). At the same time, when increasing production volumes, the agro-ecological consequences of modern intensive business should be taken into account.

Studies of theoretical and practical developments of foreign and domestic experts have established that the interpretation of the category of competitiveness of agricultural enterprises is different.

As a result of research, we consider a comprehensive assessment of competitiveness as a set of four interrelated stages: analysis of market conditions, formation of competitiveness criteria, determination of the level of competitiveness and development of proposals for its improvement.

Competitiveness assessment is a dynamic process that has a certain cyclical nature and is implemented taking into account the following principles: complexity, system, optimality, information reliability and adequacy to environmental factors (Zhovnovach, R., 2011).

In our opinion, the competitiveness of modern agricultural enterprises is the result of a combination of the ability to effectively use its resource potential and the ability to respond in a timely manner to changes in the market and the external environment.

The global trend of ensuring the competitiveness of agricultural enterprises is based on the intensification of production, improving product quality and optimizing costs throughout the supply chain.

Improving the quality of agricultural products is a priority area of competitiveness, which guarantees long-term competitive advantages for the producer and is the main criterion for the consumer. The importance of the qualitative factor of competitiveness is growing in connection with the expansion of the scope of innovative technologies in the production and processing of agricultural products and the growth of environmental requirements for it.

The National University of Life and Environmental Sciences of Ukraine is actively

developing cooperation between research centers of faculties and business representatives to improve the quality of Ukrainian agricultural products. Namely, scientists are working to improve the technical and technological support of agricultural production; develop resource-saving technologies for growing, storage and processing of products; substantiate modern approaches to carrying out agrotechnical measures; automation of business processes using Internet technologies; implementation of quality control at all stages of production and marketing.

Thus, today the competitiveness of agricultural enterprises should be based on the principles of innovation and investment model of development, which provides a combination of effective technical, technological and business solutions based on the achievements of science and technology at all levels of production and marketing.

The main directions of investment and innovation development of agricultural enterprises include: the formation of favorable conditions for the development of product and technological innovations through the creation of business incubators, including based on cooperation with universities; allocation of state grants for resource-saving programs and nanotechnologies, encouraging the transition to alternative energy sources; creation of technology platforms and technology parks, built on the principles of combining advanced ideas of science and business, exchange of experience both in the country and internationally; organization of a single center for service and monitoring of equipment, etc. To ensure competitiveness, it is necessary to further develop market infrastructure enterprises by introducing modern technologies of exchange trade.

Overcoming the contradictions of the legislation in the field of safety and quality of agricultural products is an integral part of measures to increase its competitiveness.

An important prerequisite for competitiveness remains the improvement of the financial and credit policy of the industry, given the lack of free financial resources, tax burden and imbalance of product prices; it is necessary to provide a market mechanism for pricing and overcoming price disparities; search for effective tools for mobilizing financial resources for development; attraction of funds of strategic investors under the state guarantee for complex re-equipment of the enterprises of agrarian branch; improvement of the taxation system, etc.

Understanding the competitive advantages of agricultural enterprises at the micro and macro levels will be supplemented in the future, taking into account the consequences of the Covid-19 pandemic, as new types of goods and sales channels with active use of Internet technologies are already being dynamically created on the market.

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Use of Bio-Fungicidal Extracts in Managing Seed-Borne Fungi for Improved Maize Seed Germination in Morogoro, Tanzania

Rehema Erasto

Advisor: Dr. Kilasi Newton

Department of Crop Science and Horticulture, Sokoine University of Agriculture

Maize (*Zea mays* L.) is among the most important cereal crops grown in world to be used as staple food for human, feed for livestock and raw material to biofuel and starch producing industries (Rahman *et al*., 2008; FAOSTAT, 2014). In Tanzania, production has significantly increased over the past 2 years with average annual growth rate of 6.41% (Mtaki, 2019). About 65-80% of total production is consumed within producing households while only 20-35% enter the commercial channel (Wilson and Lewis, 2015). Although production has recently increased, productivity is still low.

Lower productivity of maize is attributed by several biotic and abiotic factors. Poor maize seeds germination associated with seed deterioration caused by seed-borne fungi, (Mathur and Kongsdal, 2003; Tsedaley, 2016) is the major problem for maize small holder farmers in Morogoro (SAT, 2019). Seed-borne fungi are capable of causing both qualitative and quantitative losses of maize (Gyasi *et al*., 2020). Studies by Tulin and Askun (2006) in Turkey; Niaz and Dawar (2009) in Ethiopia, reported *Aspergillus* spp, *Rhizopus* spp, *Bipolaris maydis, Fusarium* spp, *Cephalosporium* spp, *Helminthosporium* spp, *Mucor* sp, *Penicillium* spp, *Curvularia* spp and *Drechslera carbonum* to be the prevalent seed-borne fungi responsible for maize seeds deterioration. These pathogens not only cause seed deterioration, but can also remain viable for long time to infect the germinating or emerging seedlings and later field epidemics (Tsedaley, 2016). About 40% of all maize diseases at seedling stage are caused by seed-borne fungi (Hussain *et al*. 2013). Moreover, before harvest the pathogens can invade more than 50% of maize grains and produces mycotoxins which contaminate the crop (Charity *et al*., 2010). These mycotoxins, (Aflatoxins produced by *Aspergillus flavus* and fumonisins produced by *Fusarium verticillioides*) are the foremost worry because can cause health problems to consumers (Madege *et al*., 2018).

Farm-saving maize seeds for sowing in the following season is a common practice to smallholder farmers in Morogoro. (SAT, 2019). This facilitates perpetuation and multiplication of fungi within the seeds and become a source of inoculum for new infection (Hubert *et al*., 2015). Management of seed-borne pathogens by seed treatment is an important approach to be used. It reduces survival chances of the pathogen in/on maize seeds and its transmission to maize crops (Niaz and Dawar, 2009). Seed treatment using chemical fungicides has been a common practice for a long time in Tanzania but also worldwide. The continuous use of chemical fungicides regardless their efficiency and reliability, is limited to chemicals non-biodegradability, rapid pathogen's resistance development, cost, residual toxicity causing health hazards and environmental pollution (Debnath *et al*., 2012; Perelló *et al*., 2013; Hubert *et al*.,

2015). Due to that, botanical extracts which are said to be useful, cost-effective, environmentally friendly, non-toxic to mammals, have very low or no residuals on plants and have fungicidal properties, are suggested to be used as alternatives to chemical fungicides (Mbega *et al*., 2012; Hubert *et al*., 2015).

Since ancient time, botanical extracts have known to contain anti-microbial property (Lalitha *et al*., 2010). Coffee, neem and ginger containing chlorogenic acid, triterpenoides (azadirachtin, nimbidine, nimbin nimonol, nimocinol and nimocinolide) and terpene compounds respectively are the botanicals reported to have anti-fungal bioactivities. Most of these products have been used to manage seed-borne diseases in-vitro (Mbega *et al*., 2012; Hubert *et al*., 2015) and managing plant diseases under field condition. These bio-compounds are mostly found in coffee beans, neem plant parts (seeds, leaves) and in ginger rhizomes respectively (Gyasi *et al*., 2020). Generally, botanical extracts are becoming a promising source of agricultural chemicals to manage seed-borne fungi and plant diseases.

This study was conducted to identify seed-borne fungi found in/on maize seeds, but also to determine the efficacy of selected botanicals in managing seed-borne. *Fusarium verticillioides*, *Aspergillus flavus* and *Aspergillus niger* while *Penicillium* spp, *Rhizopus* spp and *Curvularia* spp were the fungi detected from collected samples. In case of botanical extracts, the study found that Neem, Ginger and Coffee have anti-fungal activity in managing seed-borne fungi. Among those, Neem and Ginger found to have higher efficacy than coffee.

In general, this study will help maize growing farmers to use these botanical extracts in seed treatment. This will be of a big advantage to farmers using farmer-saved seeds. It will not only help in improving seed germination and crop productivity, but also will reduce the chances of mycotoxins production hence safeguarding health of maize consumers.

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Effect of Different Processing Techniques on the Biochemical Composition of Purple Tea (*Camellia sinensis* var. kitamura)

Joyline Cheptoo

Advisor: Prof. Nelson Kennedy Olang'o Ojijo

Jomo Kenyatta University of Agriculture and Technology,

College of Agriculture and Natural Resources, School of Food and Nutrition Sciences,

Department of Food Science and Technology

Tea (*Camellia sinensis*) history in Kenya is traced back to 1903 where G.W.L, Caine, a European settler introduced the first seedlings from India and planted them in Limuru near Nairobi (*Tea Board of Kenya, 2010*). It is a traditional beverage which originated from China and it is the oldest, most popular and non-alcoholic caffeine-containing beverage. Its infusion is prepared by brewing of processed leaves (Kumar and Shruthi, 2014). It is grown as a perennial monoculture and its processing methods play an important role in the biochemical changes responsible for the beverage value. Tea cultivars are routinely characterized and classified on the basis of their morpho-physiological traits, cytology, leaf biochemical traits and molecular tools (Mishra *et al., 2006*). The biochemical composition is affected by leaf maturity, variety, soil characteristics, climatic conditions and agronomic activities (Mae, 1997). Colored teas have antioxidants in the form of anthocyanins, total polyphenols, catechins and other natural substances, these arrays of compounds have high antioxidant activity, and have been attributed to unlimited health benefits (Ho *et al., 2017*). The presence of these bioactive compounds in tea has recently been considered to be of nutritional importance in the prevention of chronic diseases, such as diabetes, inflammatory diseases, neurological disorders, and some types of cancers (J.H Weinberger, Jan 2003; H.Mukhtar and N.Ahmad, June 2000).

The most commonly consumed teas are black, green and oolong; all processed from the leaves (Anonymous, 2002). The levels of phytochemicals, flavor, color and sensory ratings in tea vary depending on the processing techniques (Yu *et al.,* 2021). Black CTC (cut, tear and curl) method is the most conventional method of processing tea. In this process, tea is macerated in a CTC machine and fermented for three hours before hot-air drying in fluidized bed dryers (Xu *et al.,* 2002). New tea processing technologies have been introduced and others re-introduced with the aim of improving processed tea quality and organoleptic ratings. These methods include; aerated CTC, non-aerated CTC, oolong, aerated Orthodox, non-aerated Orthodox, post-fermentation and yellow tea processing. Purple tea is analyzed for catechin using High Performance Liquid Chromatography (HPLC), total polyphenols using UV-spectrophotometer, and antioxidant activity using the the 2, 2 − diphenyl-1- Picrylhydrazyl (DPPH) assay.

Some challenges associated with tea processing include low quality tea whereby farmers only specialize in production of bulk undifferentiated tea focusing on volume rather than quality. Moreover, some of the tea biomolecules are lost during processing stages i.e. maceration, fermentation and during firing where tea is subjected to high temperatures thus

reducing its antioxidant capacity.

Extreme weather patterns associated with climate change such as drought and high temperatures have adverse effects on tea production and the resulting leaf quality. Especially, leaf yield, purple pigmentation and anthocyanin content are hampered by climatic variations. In addition, seasonal changes encourage pest infestation of the tea bushes leading to reduced leaf yield and low-quality tea. The major pests and diseases affecting tea plantations are mites and Armillaria root rot. Moreover, most tea bushes in the plantations are old and past their productive stage. However, the cost of planting tea and tending to maturity is high and discourages farmers from adopting new productive varieties.

Tea production has detrimental environmental impacts due to clearance of land to create room for tea cultivation. This causes disruption of the natural ecological balance, destruction of water catchment areas, reduced precipitation, and increases soil erosion leading to pollution of water bodies majorly due to use of inorganic fertilizers and other chemicals such as pesticides and herbicides which are washed off into the rivers and lakes by the rains. Wildlife is also endangered due to destruction of their habitat. **The use of wood fuel** for firing tea dryers results in environmental degradation. E**ucalyptus trees** are often planted as fuel wood stock for dryers; but these use up the water and result in drying up of the water catchment areas.

To address some of these challenges, adoption of minimal processing techniques is being encouraged to ensure most of the biomolecules contained in tea are retained in the final tea products e.g. Orthodox tea which is processed through rolling has more biochemical and higher antioxidant capacity as compared to CTC tea. Reducing the plucking cycles also helps to ensure high levels of biomolecules in the plucked tea. Farmers have also been encouraged to adopt improved clones of tea which are of high quality, drought tolerant, resistant to pests and diseases and to apply adequate amounts of manure and fertilizers to tea bushes. Control of pests and diseases using biological methods is also encouraged to avoid use of chemicals which pollute the environment. Farmers have been discouraged from cutting down trees and instead to intensify the use of available land so as to conserve the environment and preserve biodiversity. Farmers are being discouraged from planting eucalyptus trees which take up water and result in drying up of water catchment areas and instead plant other varieties of trees which enhance conservation of water catchment areas. Implementing wood fuel planting and harvesting policies, factories have developed tree nurseries to provide trees to the farmers at lower prices. The remediation efforts have contributed considerably to sustaining the tea plantations and associated factories thus enhancing the wellbeing of the community through income obtained from sale of plucked leaves.

Purple tea fetches very high prices and has a wide market thus has the potential to improve the economic status of the community through increased incomes. With the current climatic conditions, purple tea variety is considered favorable in terms of productivity, health, market and resistance to drought and hailstones as a result of changing weather patterns. The introduction of purple tea in the tea sector is one adaption mechanism to climate change that tea farmers should embrace in order to compete for current fluctuating market, quality,

productivity as well as fulfilling the Sustainable Development Goals (TRFK, 2013).

Majority of personnel in the tea industry are the youth. The youth play a major role in scientific development of tea through undertaking research by adoption of information technology to facilitate the research process on new cultivars which have high quality yields and are resistant to drought and climatic changes; they also conduct pest and disease surveys in order to reduce the risk of future pest and disease outbreaks in the tea farms and using biological pests control methods to prevent infestation in the tea farms, they also advise farmers on fertilizer application in the farms. They also take part in improving of quality and product diversification of tea products through value addition of tea and transfer the information on developed tea technology and assess the impact on tea production. They are also involved in planting of trees to conserve the environment and prevent global warming issues because trees absorb greenhouse gases. The youth are motivated by the need to promote agriculture, develop new cultivars resistant to drought and pests for sustainable agriculture, and value addition of tea in order to boost the tea sector.

Expansion and sustenance of food and agriculture can be done by running projects and programmes that address issues holding back the sustainability of purple tea cultivation through partnering with the Ministry of Agriculture to provide regulatory, research and value addition operations and promote and assist in the production of food and agricultural raw materials for food security and incomes, the ministry also promotes advancement of agro-based industries and agricultural exports and sustainable use of land resources as basis for agricultural ventures. Involvement of the stakeholders such as the Tea Board and KTDA (Kenya Tea Development Agency) in order to promote activities such as education of farmers on tea cultivation and to foster the development of small-scale tea growing in Kenya.

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The Effect of Retail Promotions on the Price Elasticity of Demand of Conventional and Organic Food Products

Martijn Wals
Advisor: Dr. Rico Ihle
Agricultural Economics and Rural Policy Group, Wageningen University

How would one react to a 20% discount on the newest electronics compared to a similar discount for food products? Where one would heavily react to the 20% discount on electronics, the 20% discount on food products will lead to smaller changes in consumer demand. These differences can be explained by the price elasticity of demand which measures the responsiveness of demand, that is, the change in demand for a commodity when its price increases by 1%. This responsiveness of demand can be inelastic having a value between 0 and -1 or elastic having a value of less than -1. An elastic demand indicates a demand which is sensitive to price fluctuations, that is, demand reduces by a higher percentage than price increases.

In my research I determined the effect of promotion on the price elasticity of demand on four different food products. The price elasticity of demand can simply be estimated by looking at to the demand change after price fluctuations. However, spontaneous and above average price reductions, caused by promotions, may interfere the price elasticity of demand over time. Promotions cause large price drops and subsequent demand peaks. An illustration of this interference is given by the consumption of a certain necessity good, which has a constant, annual, inelastic demand. However, only it occurs that if consumers buy a certain necessity good when it is on promotion and stockpiles it until the next promotion. Under these circumstances it seems like the consumer is heavily reacting to price fluctuations. Although, in some form this conclusion is correct, the annual demand of this certain product is still constant. Hence, it is the question what can be seen as the real price elasticity of demand.

Research on promotions shows that promotions may be a problem when estimating the price elasticity of demand. The temporary stockpiling effect, which can be caused by promotional price reductions, may boost sales more than regular price reductions (Blattberg *et al.*, 1995). To better understand this problem, the price elasticity of demand can be divided into a structural and promotional elasticity (Blattberg *et al.*, 1995). The structural elasticity of demand is the price elasticity based on regular prices changes, whereas the promotional elasticity is based on large price drops due to promotions (Blattberg *et al.*, 1995).

When promotions interfere when estimating price elasticity of demand, the promotional elasticity exceeds the structural elasticity. This assumption is hard to generalize, since research shows a conflict of empirical results (Blattberg *et al.*, 1995). The conflict in empirical results may be explained by differences between categories (Narasimhan *et al.*, 1996) and differences in promotion frequency of a product (Nijs *et al.*, 2001; Walters and Bommer, 1996). Based on the evidence of Blattberg and Wisniewski (1987), Lattin and Bucklin (1989), and Mulhem and Leone (1991) and the assumption that consumer demand reacts heavier to promotional prices

than regular price changes, this thesis assumes that the promotional elasticity exceeds the structural elasticity of demand.

My thesis is focused on the end of the agricultural value-chain, on the stage where the processed food products are sold to consumers. Food consumption of developed countries, for example the Netherlands, is inelastic (Green *et al.*, 2013; Muhammad *et al.*, 2011). Although, there may be differences between conventional and organic food products. Therefore, the research objective of my thesis was to determine the price elasticity of demand of conventional and organic milk, and conventional and organic pork meat, taking into account the effect of promotions on these products and their substitutes.

Price elasticities of demand is determined by the microeconomic theory of demand. The microeconomic theory of demand shows that the optimal consumer choice is explained by the price ratio of two goods which must be equal to the marginal utility of both goods. From this, Marshallian demand functions are determined, which shows that the sales of one product are not only dependent on the price of that certain product, but also the price of the other good (s) and consumer income. Furthermore, the promotional elasticity of demand will be explained by the marketing mix, which consists of four elements also referred to as the "4Ps"; price, product, place and promotion.

To reach the aim of this thesis, I used data of Statistics Netherlands, which includes the sales and price of conventional and organic milk, and conventional and organic pork meat. I focus on these two products as both are crucial in the typical Dutch diet (Dagevos *et al.*, 2020). The data has been collected in the Netherlands within a time period of 156 weeks (week 1, 2017 till week 52, 2019). The total consumption of all food products was gathered via the aggregated demand in Dutch supermarkets. Therefore, possible promotions of certain products in individual supermarkets are unknown. However, the data clearly shows for certain products weeks with much lower average prices and substantially higher quantities sold, indicating that some supermarkets with a substantial market share promoted that product in a given week.

The microeconomic theory of demand and the marketing theory are combined to determine a linear relationship between the sales, (cross-) price, income and (cross-) promotions of the agricultural products. The data of the sales and price of each product were logarithmically transformed, so the price elasticity of demand could be directly estimated through a regression model. Moreover, the regression, which tests the linear relationship, included dummies of a 5%-, 10% or 15% (cross-) promotion. Although, the microeconomic theory of demand includes income, this variable is left out of the regression model, because there were no weekly observations available. Therefore, the assumption is made that the average income of Dutch consumers is kept constant during the research period of 2017-2019 and, so, does not have an effect on the model outcomes.

The results of my thesis show that promotions have a dampening effect on the general price elasticity of organic products, that is, they render remand for organic products less elastic. This implies that when an organic product is on promotion, the consumer demand reacts less heavily on the promotional price change than that of a regular price change when the organic product is off promotion. This contradicts my initial hypothesis, that promotions lead to more price elastic behavior. Furthermore, conventional and organic products are shown

to be substitutes. However, the cross-effect of a price change of the conventional product on the demand of organic product is larger than the other way around. Moreover, promotions of the cross-product are found to have a negative effect on the sales of the conventional product. However, the promotion frequency could be measured in the different heights of promotions. The magnitude of the promotion is found not to cause different effects as the results for promotion levels of 5%, 10% and 15% did not significantly differ from each other.

The main finding of my thesis is that promotions have a dampening effect on the price elasticity of demand for organic products, which contradicts my initial assumption that promotions stimulate the price elasticity of demand. Therefore, more research is needed to investigate the reasons. Since the results have been obtained from aggregate price and demand data, it would be interesting to use the same regressions for individual Dutch supermarkets to compare results. Also, investigating the consumer reference points of organic product promotions suggested by Lattin and Bucklin (1989) could also be a possible approach to check the robustness of my results. Future research could include weekly income data in the regressions. This will satisfy the microeconomic theory and, perhaps, could explain a part of the estimation of the price elasticity of demand. Moreover, comparing the results with other categories of products might be interesting to show structural differences in demand responsiveness between product categories. Lastly, investigating demand for more organic products would provide further evidence for the robustness of the results of my thesis, and, therefore, indicate whether my central finding that promotions have a positive effect on the general price elasticity of organic products can be generalized.

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Tackling Food Waste for a More Sustainable Food System

Iqra Amin

Advisor: Dr. Joanne Davies

University of Reading, Department of International Development

Food waste is a key global challenge, and it is estimated by the FAO (2011) that approximately one third of the food produced for human consumption is lost or wasted globally, amounting to 1.3 billion tonnes per year, and producing 8-10% of global greenhouse gas emissions (WEF, 2021), contributing to global warming and climate change. The resources used in the production of food such as land, water, labour, energy, time, and capital are also dissipated when food is wasted, highlighting an inefficiency in the food system. Within the global sustainable development agenda, Food waste is recognised as a critical sustainability issue which needs to be addressed, due to the deleterious impacts it generates on the environment, biodiversity, and natural resources, and its increasing economic and social costs. There is an urgent need to reduce food waste and its associated global impacts, with the UN Sustainable Development Goal (SDG) for sustainable consumption and production (SDG 12, Target 12.3) calling on per capita food waste to be halved by 2030 at both retail and consumer levels (UN, 2021). This is a vital step in the process of shifting towards the creation of a more sustainable food system. This paper aims to discuss the food waste challenges my community faces and the innovative approaches the University of Reading and its students have adopted to tackle the impacts of food waste towards a more sustainable future in the food system.

The Food Waste Challenge in the UK

Within developed countries such as the UK, the vast majority of food wastage occurs at the post-production stage along the food supply chain, at the point of consumption. UK households waste an estimated 6.7 million tonnes of food each year, with 61% of this food waste being avoidable (WRAP, 2008). Consumer waste is often caused by poor purchasing and meal planning, excess and impulse buying, confusion over 'best-before' and 'use-by' labels and preparing food in surplus. This food could have been eaten has it been better managed, thus there is a need for a transformation in the food system, improved education, and adoption of more efficient and sustainable practices.

Food wastage generates environmental, social, and economic impacts within the food system which needs to be tackled to increase sustainability. Environmentally, food waste contributes to greenhouse gas emissions and subsequent climate change, with the global carbon footprint of food waste estimated at 4.4 Gtonnes of CO_2 (FAO, 2015). It also places pressure on land and water resources, which are scarce resources that can become over-exploited and in turn may affect biodiversity. Socially, food wastage impacts food security. 820 million people globally are undernourished (HLPE, 2014) and one billion people are overfed (FAO, 2013). Concurrently, a quarter of the calories intended to feed the population becomes food waste in the food supply chain (IFAD, 2017). The coexistence of starvation, over nutrition and food waste presents a paradox in the global food system agenda which needs addressing, particularly as the UN has predicted that population will grow to over 9 billion by 2050, meaning 50% more food will need to be produced. However, producing more food is not an

efficient nor sustainable solution. Food wastage represents a missed opportunity to feed a growing population and combatting food waste can provide a vital opportunity to source this food and improve food security. Food wastage also generates significant economic costs along the supply chain to producers, processors, retailers, and households. In the UK, an average family wastes an equivalent of £700 every year (WRAP, 2020), which presents an opportunity cost for this money which could have been utilised elsewhere. In addition to the monetary cost of food wastage, there are additional financial costs associated with collecting, managing, and treating waste. It is evident that food waste results in the loss, not only of the food itself but of all the resources that went into producing it, such as land, water, labour, and financial inputs. Thus, tackling and reducing food wastage will reap many benefits such as improved food security, reduction of greenhouse gas emissions, improved biodiversity, and savings of financial capital to name but a few. This will act as an essential step towards the creation of a more sustainable food system.

Innovations and Education as Solutions to tackle Food Waste

Technological applications have paved the way as innovative solutions in combatting food waste in a simple effective manner. Students and the wider community at the University of Reading are playing their part in reducing food waste through the utilisation of two food waste applications: (a) Too Good to Go, and (b) Olio. Both apps aim to reduce the amount of food that ends up as waste by redistributing surplus food amongst local stakeholders in a collaborative and concerted approach. Too Good to Go links consumers to local restaurants, supermarkets, and cafes that have excess unsold food at the end of the day. Consumers can order this surplus food at a discounted price, preventing the food from being thrown away. This app has been a key tool in helping restaurants cut back on food waste and has saved 2 million meals from going to waste, which prevents 5000 tonnes of CO_2 being emitted (Too Good to Go, 2021). The app also helps to fight food insecurity and food poverty, as users can 'pay it forward' and donate funds to provide meals for those in need. Olio works in a similar manner but additionally includes the option to get surplus and unwanted food from local consumers and neighbours, in a process of food sharing. Redistributing surplus food as conducted through these applications not only prevents the waste of money and resources that go into the production of the food, but also ensures that food is available for people to eat, improving food security.

Furthermore, the University of Reading are playing a vital role in combatting the impacts of food wastage and addressing the challenges discussed in this paper, through education. They are strategizing solutions towards a more sustainable future in the food system through its partnership with the European Institute of Innovation and Technology in Food (EIT Food) Europe's leading food innovation initiative, working to make the food system more sustainable, healthy, and trusted (EIT Food, 2021). Through its partnership with the University of Reading, they collaborate with students to strategize, and share innovative solutions and ideas to confront crucial challenges in the food sector and to help build a more sustainable food system for Europe through projects and courses. Amongst students, there is decreasing levels of engagement and knowledge about our food, and we are often unaware and not taught of the food levels discarded, or we lack the motivation and know-how to change food related behaviours that can make an impact in reducing food waste. This makes it difficult to encourage the next generation to make improved food choices as comprehension is poor. Hence it is important we take part in educational opportunities to become aware of the global impacts and contributions we make and what challenges we are exacerbating for us to act and adapt

our lifestyles accordingly in a more sustainable manner. To overcome this challenge, the University of Reading have been involved in the creation of a gamified solution to tackle household food waste habits, known as 'Cook Clever'. Cook Clever aims to provide consumers with the knowledge and motivation to change crucial food waste habits at home. The solution provides useful tips and advice on how to better plan, cook or repurpose food ingredients, and provides the opportunity for consumers to set habit goals, win points for good habits and compete with peers in Cook Clever challenges to win prizes. This free, fun, and competitive approach to tackling food waste motivates students to lead a more sustainable lifestyle.

The University of Reading have also run educational courses and projects with a focus on food waste, which I have partaken in. The educational course 'From Waste to Value: How to Tackle Food Waste', provided the knowledge and understanding of the causes and impacts of food waste and offered the tools to learn the strategies and actions myself as a consumer should implement to act and make a positive difference at a personal, community and national level, in an effective and sustainable manner. Likewise, the 'WeValueFood' project engaged with students as the next generation of consumers. Society is facing major problems such as obesity and food waste, and it is ever more important that we as consumers make improved food choices. This project provided a space of engagement through workshops for students to converse, collaborate and share ideas on food issues leading to us developing strategies which we were able to present to industry experts. The strategies encompassed supermarkets redistributing unsold food to food banks and them embracing imperfect 'wonky' food items which often are discarded in the supply chain. Both projects helped to establish a society at Reading that is more knowledgeable and discerning about where food comes from and how it affects our health and planet. These youth led initiatives offer sustainable actions to reduce food waste and improve food security that could be adapted and implemented by other stakeholders within the global food system.

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Group M

Group theme
Agriculture

Presenters:

James Jacek, University of the Highlands and Islands
Verica Prodanovic, University of East Sarajevo
Mwakyusa Lupakisyo, Sokoine University of Agriculture
Melissa Lok Mei Teng, Universiti Putra Malaysia
Yuzu Nakano, Tokyo University of Agriculture

Chairpersons:

Marvin Kibalama Bogere, Tokyo University of Agriculture
Miyuri Takahashi, Tokyo University of Agriculture

Breaking Down Barriers Between Forestry and Agriculture within Scotland

James Jacek
Advisor: Amanda Bryan
Scottish School of Forestry, Inverness College, University of the Highlands and Islands

In Scotland over the past 10,000 years, the relationship between people and the landscape has helped to define the landscape and the current population. It is thought that 10,000 years ago, the forestry cover within Scotland was approximately 50%, with the next 5,000 years forestry cover had expanded to over 80% of the landscape (Forestry Commission Scotland, 2008). As new land management techniques came into force the effect and new demands on land had a detrimental impact on forestry but greatly benefited agricultural land. Not only did forestry suffer but also the people that inhabited the land. By the end of the 18th Century forestry cover had been reduced to just under 4% (Oostoek, 2013).

Although afforestation took place on large land holdings in the 1600s of European species of Larch and Firs and broadleaves species including maples, this afforestation was not significant enough to have re-establish the significant area cover of forestry once seen in Scotland. This management practice was to increase the revenue of the estates and was to exploit a considerable amount of 'wastelands' especially, on upland estates (Oostoek, 2013).

The Highland Clearances not only greatly impacted the population of upland Scotland but also made way for vast reduction of forestry to allow for the more profitable sheep grazing industry which later led onto help drive the start of the industrial revolution. However as the years have passed the probability of sheep faming and farming in general within upland Scotland has left vast swathes of land being classed as "less favoured area" (LFA) with 65-85% of land within Scotland being given this classification (NFU Scotland, 2021) (RSPB, 2021). This has led to a situation where leading from the 18th century to present day has resulted in there being close to 2.3 million sheep located in the uplands of Scotland, this is the largest number of herbivorous mammals in Scotland and they currently outnumber deer numbers 8:1 and cattle 14:1 (BTO, N/A). The boom in sheep farming as stated before was a direct result of the need for wool and the products it produced for the industrial revolution and was profitable, forestry on the other hand was slowly removed to allow the expansion of agricultural and for the use of wood fuel and other uses within the industrial revolution. Currently sheep farming is less profitable than it was once was, which has led to a decline on sheep on upland Scotland but unfortunately there has been a slow uptake for the forests of Scotland's to return the forests to pre settled farming status during the Neolithic period around 4000 years ago (Scottish Forestry, 2019).

The catalyst which started the new revolution of forestry planting in LFA within Scotland was a direct result of the First World War and the need for timber for use in trench construction to duck boards and munitions crates. This put pressure on Britain and most

importantly Scotland's timber reserves with the result that by 1918/9 there was very little forestry left. This lingering issue for the government was finally recognised as a potential strategic problem for the county as a whole and hence the Forestry Act of 1919 was introduced to address these issues and was the beginning of creation of the Forestry Commission in Scotland, now Forestry and Land Scotland and Scottish Forestry (Scottish Forestry, 2019). Over the last 100 years Scotland's forestry cover had increased from 4% to 19% of mainly fast-growing spruce species. This increase in forestry cover and change of land use has come mainly from LFA agricultural land. This land use change can and has caused conflict to occur between agriculture and forestry. To address this government policy through the Scottish Land Use Strategy and the Scottish Forestry Strategy has been introduced to ensure there is greater integration between all land uses especially with regards to forestry and farming.

The Scottish government has now set out targets for new woodland creation and woodland cover to 21% by 2032 (Scottish Forestry, 2019). Although to get to this target there will need to be further change in land use from LFA agricultural land to forestry which will cause further issues.

Forestry and woodland creation can be viewed as planting up large swathes of land with commercial non-native conifers to meet planting targets, however this is not the only way in which the planting targets can be met. There is a push by the Scottish government to get farmers into agroforestry and help diversify their business by turning poor grazing land into productive forestry and create shelter belts and for the land to integrated into arable and grazing land (Scottish Forestry, 2021). Grants are given out by the Scottish government over a 5-year period for initial establishment and then maintenance costs, other incomes can come from selling carbon credits (Scottish Forestry, 2021). This incentive will attract farmers to adopt forestry, although there may be a loss in livestock numbers however the benefits can outweigh the negatives, and in some cases there has been no loss of agricultural productivity and adds assets to a farm. Through these incentives it is helping to achieve the planting targets and ensure that the Land Use Strategies policies and the Scottish Forestry Strategies policies are followed and improve on the integration of land use and environmental benefits.

It is also important that in addition to policies and incentives that there is a cultural change in land managers. This will involve breaking down centuries of of limited integration of land users. I have grown up around agricultural and although I am not from a farming family I have worked on a Scottish Borders hill farm for the past 10 years and have seen the attitudes of forestry and woodland expansion change from being very negative and not interested to beginning to understand the importance both environmentally and economically. I believe there was limited resources for farmers to see the benefits, also the attitude that these are two very different industries that can be interlinked. Now with more resources available along with the incentives and a younger generation who understand the benefits of integrated land use are allowing areas of land to be planted. Within the Scottish School of Forestry (SSF) the subjects taught are not purely for the benefit of forestry, they focus on the wider land uses that are found in Scotland and how best to ensure integration between all industries. With this

knowledge and experience that I have gained through both the work placement and the education I have received both through the SSF and previous studies I hope to make a difference in my career to ensure planting targets are met and farming is still an important industry within rural upland Scotland.

While I am just one individual, UHI host an annual Integrated Land Use Conference which brings together students from different land and natural resource management courses. Over three days students work in mixed discipline groups on issues such as adapting to climate change, woodland expansion or water/flood management. This enables us to share knowledge across sectoral interests to find joint solutions to problems and to better understand the issues we will face in the future (Engstrand and Bowditch, 2019). It helps us to break down the barriers to getting the most from the land that supports us.

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Organic Animal husbandry

Verica Prodanovic
Advisor: Tatjana Krajisnik
Faculty of Agriculture, University of East Sarajevo, Department of Animal science

Organic livestock is branch of agriculture, developed as an alternative that will make it possible to find production models in a more humane and ethically acceptable as well as ecologically, economically and socially sustainable way, which will enable sufficient quantities of quality and healthy food for the growing population, while respecting natural processes and moral and ethical norms.

Dealing with the issue of organic production in livestock, it is necessary to define the methods of organic livestock (Law on Organic Production, 2013), which are prescribed by the Regulations on methods of organic plant and livestock production.

Organic livestock production methods include:

- choice of species and breeds of animals,
- method of animal breeding and facilities for animal breeding, nutrition and animal health care,
- transport and slaughter of animals,
- handling animals procured from other farms and
- the method of collecting animal species from natural habitats.

These methods start to be applied from the beginning of the conversion period. Implementation requires a certain transitional period.

As a general principle in organic animal husbandry, it is emphasized that animal breeds should be selected according to their ability to adapt, vitality, resistance to diseases, and these are autochthonous breeds. According to the Livestock Act, these are: cattle: fortune-telling cattle and bush, sheep: Vlašićka pramenka, Podveleška pramenka and Kupreška pramenka; goats: domestic Balkan horned goat; horses: Bosnian mountain horse; pigs: mangulica and poultry: domestic chicken perch or hedgehog. (Law on Animal Husbandry, Article 40. 44/15)

The strategy for the improvement of breeds in organic breeding is based on the application of classical selection principles in pure breed and the application of crossbreeding methods. Research centers, in cooperation with producers, have defined the essential characteristics on which selection programs in organic livestock are based (Van Diepen et al., 2007). Traditional breeds adapted to breeding conditions are favored.Among the best examples of successful organic meat production based on traditional breeds is the cultivation of the Aberdeen Angus breed, which contributes in the best way to the wider promotion of the region.

Selection criteria in sheep and goat breeding are good fattening abilities (fast achievement of optimal body weight of lambs for marketing), good reproductive characteristics, resistance to infectious lameness and parasitic infections.

In general, it can be said that all examinations of the most common problems in organizing the organic production of sheep and goats indicate that the most difficult implementation is the

standards related to veterinary supervision. The biggest problem is the control of parasitic infections (Rahmann et al., 2006; Taylor et al., 2012)

In progress:

- project of the Ministry for the Preservation of Animal Genetic Resources, as well as two master's theses, where students participate in the field by implementing the gene pool of the autochthonous breed Gatačko goveče. Field work involves taking blood, morphometry, taking hair, etc.
- Obtaining Halal and Organic Certificate related to the protection of the geographical origin of 15 products from BiH (Samardžić S., 2021)

Our first goal is the beginning of the use of production with reference to ecology and environmental protection, as well as respect for the principles of sustainable development, social, economic aspect and respect for the values of life and animal life.

The second goal of these projects is to preserve the gene pool of autochthonous animals that we will use on organic farms to get healthy organic products that will get a protected geographical origin and as students we had the opportunity to participate in fieldwork and taking morphometric measures.

The challenges we are trying to respond to during the implementation of the project are increasing the number of indigenous races, insufficient information of farmers, a large number of legal norms that must be met as well as the fear of large initial investments in this type of production. The implementation of the second project, which is related to the producers who fulfilled the first project, is now only of an administrative nature for obtaining certificates and saturation of geographical origin.

Preliminary results certainly show the gradual growth of interested farmers who, in cooperation with the ministry and receiving subsidies from it, in order to more easily master the initial steps during the conversion period.

Finally, the importance of informing and involving all layers of society in our country should be emphasized in order to leave a better and more secure future for the next generations, because "we did not inherit the land from our ancestors, we borrowed it from our descendants." We will achieve this by stop thinking about ourselves and our personal profit, and by understanding and accepting the fact that we are only a small part in a large circle of life.

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Characterization of selected rice landraces tolerance to flooding in Tanzania

Mwakyusa Lupakisyo
Advisor: Dr. Newton Kilasi
Sokoine University of Agriculture, Department of Crop Science and Horticulture

Rice (*Oryza sativa* L.) is one of the well-known important staple food crops for more than half of world population (Umadevi *et al*., 2012). In Tanzania, almost 20% of farmers involve in production of rice (FAO,2015). The crop is ranked as the third important food crop in Tanzania after maize and cassava (FAO,2015). FAO (2015), rice is recognized as an important staple food second to maize with 8% national's caloric intake. Furthermore, the crop serves as source of employment, income and food security for millions in rural areas (IRRI, 2018).

Despite of the value of the crop, but flooding limit production and result in high crop losses (Kwesiga *et al*., 2019). Sakagami *et al*. (2011) reported that, flooding is the major threat in rice husbandry for most of low-lying, non-irrigated zones. Quaye *et al*. (2012) added that, the stress is attributed by global climate changes as well as human activities. Most of the rice produced in Tanzania by small scale farmers are from rain fed zones with approximate 71% while 9% and 20% come from upland and irrigated respectively (IRRI, 2018).

Farmers are experiencing severe crop losses during germination and early seedling growth due to flooding (Singh *et al*., 2020). FAO (2015), 74% of rice produced in Tanzania is from lowland rainfed zones which are prone to flooding. Kilombero flood plain farmers are experiencing less than 2 tons/ha of rice as a result of flooding (Kwesiga *et al*.,2019). Complete submergence during germination and vegetative stage limit access to oxygen for respiration and light for photosynthesis translating to food scarcity to most Tanzanians who are reliant on the crop (Sakagami *et al*.,2011). Flooding restricts gas diffusion hampering biochemical processes (Fukao *et al*., 2012). Furthermore, Singh *et al*. (2020), poor crop establishment or no germination have been experienced in direct seeded rice areas with immediate rains soon after sowing.

There is no any reported cultivar that is tolerant to flooding at germination and vegetative complete submergence in Tanzania. The identification of tolerant cultivars will increase germination, survival and yield against flooding. Therefore, the aim of this work is to identify rice landraces that are tolerant to anaerobic germination and complete submergence at vegetative stage.

About two hundred (200) rice landraces has been collected from different parts of Tanzania. These cultivars will be phenotyped and genotyped with aim of identifying tolerant lines to flooding to be used by farmers. The lines will be tested for two stresses namely: - anaerobic germination and vegetative submergence. The essence of assessing tolerance of these cultivars to anaerobic germination is to increase crop stand in direct seeded system which receive unexpected heavy rains soon after seeding. Furthermore, assessment for tolerance to

submergence at vegetative stage aim at reducing crop losses as a result of flooding at early seedling stage.

For easy screening and saving time, the planting materials will be first screened in the screen house. Then, initial seeds of the identified tolerant landraces will be taken for field experiments in flood prone areas where farmers also cultivate their rice. Same landraces will be used for the two stresses. IRRI (2021) Phenotyping protocol for abiotic stresses will be used for evaluation. A randomized completely block design (RCBD) for both field and screen house experiments. Plastic trays will be used for screen house evaluation while field ponds will be used for evaluation in the fields. For anaerobic germination assessments seeds will be sown directly while for vegetative submergence.

Anoxia germination phenotypic data to be collected includes number of seeds sown per entry, number of surviving seedlings at 3-days intervals starting at 9 days after sowing and continuing up to day 21 of flooding, percentage seedling survival, coleoptile length, growth parameters, yield and yield components while number of seedlings per entry before submergence, number of survivors at 21 days after de-submergence, percentage survival, growth parameters, yield and yield components for submergence at vegetative stage.

After screening genomic DNA from leaves will be extracted using CTAB protocol followed by PCR amplification before running gel electrophoresis using specific primers. At the end, only cultivars having the known genes for tolerance to these stresses will be regarded as tolerant. The identified tolerant landraces will be compared for their agronomic performance and the good ones will be recommended to be used by farmers. Furthermore, those tolerant materials will be asset for future breeding like introgression into high yielding flood susceptible varieties.

The field experiments will be held in flood prone lowland area at Kilombero flood plain in Morogoro region and Rufiji basin involving the native farmers cultivating rice in those areas. These zones are well known for production of rice as major crop which ensure them food security, economic gain and children access to education. The natives will be given awareness of the importance of the experiment and are going to be employed in management practices required in allocated time under my supervision. Most of the rice growers are depressed with low yields and crop losses imposed by flooding. Doing the experiment will stimulate their participation with assurance that the results will be brought back to them. Expectations of the growers is to get best performing submergence tolerant cultivars with their preferred traits.

The success of the program will help farmers to use known tolerant cultivars in their daily agriculture which will increase production potential, increase food insecurity, increase income at individual and national level while reducing cost of importing rice into the country.

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Application of Plant Growth-Promoting Rhizobacteria (PGPR) on *Cucumis melo* to Enhance Plant Growth and Fruit Quality

Melissa Lok Mei Teng

Advisor: Associate Professor Dr. Juwaidah Sharifuddin

Department of Crop Science, Faculty of Agriculture,

Universiti Putra Malaysia

Cucumis melo is known as rockmelon that belongs to the Cucurbitaceae family and is one of the commercial fruits. Rockmelon production reached up to 6,979.38 metric tons in 2019 (DOA Malaysia, 2019). Rockmelon has high economic value but is not enough to fulfill the consumers' demand in Malaysia (Rasmuna *et al*., 2015). Nik and Rasmuna (2016) reported that the yields of rockmelon are highly affected by pests and diseases and environmental issues. The pest and disease damage in the agriculture sector causes a 20 to 40 percent decrease in annual global agricultural yield, which leads to around $290 billion global economic loss every year (Rome, 2019). The common practice to control pests and diseases in Malaysia is applying chemical pesticides. In 2019, Malaysian farmers spent RM 1.5 billion for purchasing agrochemical products (Müller, 2020). Nevertheless, the accumulated agrochemicals in soil and water can adversely affect the environment and ecosystem and even affecting human health due to insufficient food safety (Falconer *et al*., 2018). In addition to this issue, the world is currently facing climate change, which can significantly lead to quality and quantity losses in global crop production (EPA,2016). These situations posed a significant challenge in the sustainable production of rockmelon in the country.

Hence, introducing plant growth-promoting rhizobacteria (PGPR) is an environmentally friendly way to increase rockmelon production in Malaysia. PGPR is a group of bacteria that lives in the rhizosphere or colonizes the root, symbiotic relationship with the host plant. PGPR could serve as a biofertilizer and biocontrol agent, increasing the yield when reducing agrochemical usage (Vessey, 2003; Antoun and Kloepper, 2001). However, there is limited research on the application of PGPR on rockmelon plant growth and fruit quality. *Bacillus subtilis* and *Bacillus tequilensis* as local PGPR strains were selected for the experiment because they have beneficial effects on plant growth and yield on various crops, namely oil palm, sweet potato, banana and rice (Tan *et al*., 2014; Rakiba *et al*. 2020). This study evaluated the application of single and mixed inocula of *B. subtilis* and *B. tequilensis* on plant growth and fruit quality of rockmelon. The study has shown that PGPR inoculated plants had a better plant growth performance and produced good fruit quality than uninoculated plants. Mixed with *B. subtilis* and *B. tequilensis* inoculation significantly increased 37% root volume and 65% tolerance to disease compared to uninoculated plants. Moreover, single *B. subtilis* and mixed inocula inoculation produced high quilty rockmelon fruit that met Malaysia's market standard, which fruit weight and sweetness were above 1.5 kg and 10% sweetness. Thus, it can be concluded even under biotic and abiotic stress, introducing PGPR in rockmelon cultivation can enhance

and improve plant growth and fruit quality that achieved local market standards.

Even PGPR applications can improve different crop yields, Malaysian farmers do not use the application widely in production as the awareness of this technique is relatively low. Nowadays, *B. subtilis* is available in the Malaysian market. Therefore, the Malaysian government, agriculture extension agents, non-government organizations (NGOs), and private companies should promote PGPR applications to local farmers through agricultural extension services by comparing without and with PGPR application in farm practices to show its benefits. For example, common rockmelon cultivation is correlated positively to agrochemical usage to ensure yield production. This farm practice has a relatively high production cost and crop less tolerance to biotic and abiotic stress and might bear high losses when having pest and disease outbreaks and natural disasters. In contrast, PGPR inoculation in the cultivation can reduce agrochemical usage and improve crop yield under biotic and abiotic stress; thus, it can reduce production costs and achieve sustainable farming.

In the 21st century, social media such as Facebook, Instagram and Twitter have become familiar. It is the most convenient and influenceable method to create public attention. Moreover, government agencies should cooperate with private sectors and NGOs. For example, Persatuan Lestari Alam Malaysia is an NGO collaborating with the governments and other organizations that promote sustainable and urban farming community services, especially in Kuala Lumpur and Selangor. Hence, the public will be more concerned about the agriculture, environment, ecosystem, food safety and security issues.

In a nutshell, the application of *B. subtilis* is realistic in Malaysia's farming to increase quality crop yield. The farmers, governments, NGOs, producers and communities must work together to ensure PGPR getting well-known. The application is beneficial to farmers to improve the crop yield under biotic and abiotic stress, reduce the production cost in purchasing agrochemical products and achieve agriculture sustainability. Furthermore, PGPR promotes food safety and security and protects the environment and ecosystem to the public.

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The CHINAMPAS
～ Aztec technology will help developing Agriculture ～

Yuzu Nakano
Adviser: Dr. Maki Hayashida
Tokyo University of Agriculture, Faculty of Agriculture, Department of Animal Science

From this year's ISS theme, I would like to talk about agricultural technology that creates a sustainable environment. During the summer vacation of my freshman year of university, I went to Mexico for a short studying abroad program. During my trip, I encountered a farming method called "Chinampas", which is based on water cultivation, in the surroundings of the lake Sochimilco. This farming method has been practiced since the Aztec era (Yoshida Taro, 2010). I was fascinated by this method of farming because I had never seen anything like it before.

Since the Aztec era, this method of farming has involved assembling the soil at the bottom of the lake and mixing it with vegetable scraps or livestock dungs (Yoshida Taro, 2010). This soil forms square cubes used as seed bed called "BIO-SOIL". Only selected seedlings are then used to grow vegetables. Because of the lake bottom soil, fish droppings and carcasses are also used to nourish the soil, and farming without chemical fertilizers helps to maintain a sustainable environment. "BIO-SOIL" has three useful properties. It is productive, organism- and disease-resistant (Thurston, 1990). Because of these, the Chinampas method can produce crops more efficiently than ordinary soil and makes cultivation possible all year round in the region.

However, there are two issues that need to be addressed. The first is the use of eutrophication water, which is unsuitable for agriculture. This is caused by the use sewage collected from urban areas. Therefore, the local farmers use a device called "BIO-FILTER" to make the water a little more usable for agriculture. Water eutrophication inhabits the growth of aquatic plants and at the same time unbalances the nutrients in the soil. Therefore, water circulation using this device is necessary in order to use the soil for agriculture. Secondly, the number of farmers who use this farming method is decreasing. With the development of ground transportation, the number of people using the lake is decreasing. The current situation is that the phenomenon of using the lake makes it difficult to pass on the tradition.

So, I would like to develop this farming method again in Mexico and make it popular as one of the farming methods in other developing countries. In order to do this, we need to show small and medium farmers that this farming method is productive by using square cube-shaped seedlings and growing vegetables. Then, by selling the seedlings to small and medium farmers, they can learn about the technique and at the same time stabilize their income through organic vegetable production. In addition, the seedlings can be used by ordinary households as vegetable gardens, which will help passing on the tradition.

I believe that this method of farming can be applied to areas where there is a lot of rainfall. My goal is to share this method of farming with as many people as possible so that they will become interested in it and realize that this method helps more stable livelihood for

farmers.

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MATERIALS

TOKYO DECLARATION

International Students Summit on Food, Agriculture and Environment
Date: November 19 - 20, 2001
Venue: Tokyo University of Agriculture, Tokyo, Japan

In commemoration of 110th Anniversary of the Founding of Tokyo University of Agriculture, an International Students Summit on Food, Agriculture and Environment in the New Century is held. Students from twelve countries and area in the world participated and discussed about present conditions and future issues on food, agriculture and environment. With this opportunity, we air our opinions and views raised in this Summit documented in this Tokyo Declaration, which we propose to the world.

1. Agriculture carries an important role of producing food for mankind to live. With the remarkable population increase since the 1950s, food production has been greatly increased through the Green Revolution, but negative effects to the environment and health occurred due to the intensive use of chemical fertilizers and agricultural pesticides. For now and the coming years, global food production increase and poverty alleviation are vital and agriculture plays an important role. "Therefore, we aim at sustainable development in the New Century through the recognition of the value of agriculture as a life industry, and the respect of the unique ecosystem and wisdom of each region. Through the collaboration between traditional agriculture knowledge and wisdom, and modern science and technology, we endeavor to develop environment-friendly technologies and production systems. Eventually, we hope to develop and promote a new form of organic agriculture which will meet social, economic and environmental requirements."

2. Based on science and technology development, various new technologies are being developed and spread in the agricultural field. Among them, biotechnology, especially Genetically Modified Organisms (GMO) is considered the mainstream technology. Consumers also have strong concerns regarding GM crops and foods. "Therefore, we recognize the potentials of biotechnology including GMO based on judgment with right knowledge. At the same time, we, as agricultural students, need to study and research more about the safety of biotechnology especially GMO in relation to human health and environment, and we have a role of disseminating result-related information to consumers."

3. In each region, history gave birth to food culture and molded people. By definition, food should be consistently safe from production to consumption. "Therefore, we create a new system wherein we can continuously be supplied and be able to consume safe foods. Each actor in the system, based on the social infrastructure provided and improved by the government, should consider the importance of safety issues such as pesticide residues at the production level, and post harvest and food additive usage problems at the processing and distribution levels. At the same time, we, as consumers, must think better of healthy regional food culture and are urged to cooperate and understand the added costs for commodities that are produced in a safe and environmentally friendly way."

4. Nowadays, although trade liberalization is progressing under the WTO system, all countries and areas do not have access to fair food distribution because economic infrastructure and social infrastructure gaps still exist. "Therefore, we promote Regional Self-sufficiency mainly for staple foods by making use of the unique ecosystems and regional individuality from the local point of view. Then, in the global point of view, food self-sufficiency in the whole of Asia can be achieved if food self-sufficiency is promoted in each area."

5. In the years to come, we, the students have a huge role to play. More international cooperation is encouraged through human resource exchange and sharing knowledge to overcome barriers such as academic disciplines and geographic borders. "Therefore, we, as the core group consisting of students from thirteen (13) countries and areas, aim to create an International Students Network. Also, we share a new and same value, wherein we need to create a new social system where an environmentally benefiting and safe food production, distribution, processing and consumption exist."

In realization of this *Tokyo Declaration*, we take an oath to make an *International Students Summit Action Plan* for each country and area.

November 20, 2001
Tokyo

International Students Summit Action Plan

In line with the Tokyo Declaration adopted during the 1st International Students Summit organized by the Tokyo University of Agriculture held last November 19-20, 2001, the action plan has been drawn up in this 2nd International Students Summit. As part of the future generation, we students commit ourselves to the following actions.

General Actions

- ✧ We shall study issues of food, agriculture and environment in holistic manners. We shall serve as a bridge between producers, consumers and professionals for the betterment of the society.
- ✧ We shall not limit ourselves to studying; we shall raise our own awareness and put our ideas into practice.
- ✧ We shall reconsider and emphasize the cultural aspect of agriculture.
- ✧ We shall appreciate and conserve our respective traditional technologies and institutions.

Specific Actions

Environmental Conservation

- ✧ We shall study and make public the roles and values of agriculture and environment, by participating in farm training and the like in rural areas.
- ✧ We shall conduct various campaigns and promotions of the present condition and prospects of agriculture and agricultural communities; and deepen consumers' understanding and interest on agriculture and environment.
- ✧ We shall vigorously promote environmentally friendly agriculture such as organic agriculture for establishing the system of stable supply of safe food.

Biotechnology

- ✧ We shall encourage unbiased research and undertaking. We shall publicize scientific information and research results about biotechnology.
- ✧ We shall vigilantly investigate food biotechnology such as GMO and inform the public about the results.

Food Safety

- ✧ We shall review our respective dietary life, conduct surveys and research on food from farm to table, and update the public about recent findings.
- ✧ We shall encourage strict labeling of food. We shall charge appropriate social responsibilities to any company found to have committed food safety violation.

Food Security

- ✧ We shall reduce food wastes. We shall avoid over consumption to conserve resources and promote health.
- ✧ We shall consume what is needed rather than what is demanded, on the basis of energy-saving local production and local consumption framework.
- ✧ We shall promote home production of food using any available space.

Students Network

- ✧ We shall establish the "International Students Forum," on food, agriculture and environment.
- ✧ As a body, we shall actively lobby and take actions on relevant issues, and represent youth in national and international conferences.

The above action plan shall serve as the basis for the country or area level action plans to be made by students of the respective participating university. Thus, we urge the participating universities to make their respective action plan as soon as possible.

November 17, 2002
Tokyo, Japan

Establishing International Students Forum (ISF)

Agricultural science plays a vital role in solving the fundamental problems of human beings in relation to food, environment, human health, and natural resources and energy. Because food production and consumption systems are closely related to the condition of the natural environment, the stage of economic development and food culture in each country and area, their patterns and problems reflect regional characteristics, requiring a multiple region-oriented approach.

Tokyo University of Agriculture organized the International Students Summit on Food, Agriculture and Environment in the New Century in 2001 and adopted the "Tokyo Declaration".

In line with the action plan adopted at the 2nd International Students Summit in 2002, we hereby agree to organize the International Students Forum (ISF), a students' network for the betterment of food, agriculture, and environment problems.

1. Objective

International Students Forum (ISF) promotes information exchange and discussion among the students of agricultural and other related sciences, in order to solve the problems common to human beings, such as environmental conservation, development of harmonious food production and establishment of food safety.

2. Organization

- ISF consists of Committees of International Students Forum set up in the participating universities.
- Members of the respective ISF Committees play an active part while in school and resign from ISF automatically at their graduation.
- Each ISF Committee decides the matters on the management respectively in each country and area.

3. Role

- ISF Members constantly make effort toward solutions of the problems common to human beings such as world environmental conservation, promotion of sustainable food production and establishment of food safety.
- ISF Members exchange information and opinions via the Internet. (Internet International Conference)
- Representatives of ISF committees in the respective universities get together on a regular basis and hold an international conference to present the results of research and study. (International Students Summit, ISS)

4. Activities

- ISF Members play an active role as students for solutions of food, agriculture and environment problems.
- ISF Members work in accordance with the common theme agreed upon at the International Students Summit for the whole year.
- ISF Members are expected to present the results of the previous year's activity and decide on the common theme for the following year.

5. Participating Universities

○ Universidade de São Paulo, Brazil
○ China Agricultural University, China
○ Tokyo University of Agriculture, Japan
○ University Autonoma Chapingo, Mexico
○ Wageningen University, Holland
○ University of the Philippines Los Baños, Philippines
○ Kasetsart University, Thailand
○ Hanoi Agricultural University, Vietnam
○ The University of British Columbia, Canada
○ Bogor Agricultural University, Indonesia
○ Kyungpook National University, Korea
○ Mongolian State University of Agriculture, Mongolia
○ The State Agriculture University of La Molina, Peru
○ National Chung-Hsing University, Taiwan
○ Michigan State University, USA

6. Secretariat

Secretariat of International Students Forum is set up at NODAI Center for International Programs, Tokyo University of Agriculture to take care of related administrative matters.

November 17, 2002
Tokyo, Japan

Establishing Global Network for Environment, Food and Agriculture (Global NEFA)

Since 2001, the International Students Summit (ISS) has been the venue for student discussions on relevant global issues on food, agriculture and environment. Due to the call for a students' network as documented in the adopted "Tokyo Declaration" and "Action Plan", the International Students Forum (ISF) was established in 2002. In total, there have been more than 400 student-participants from around the world. Most of us have already graduated and are now part of the working society. Using the knowledge and experience we gained in the ISS, we are now playing an active role in different fields in various countries. However, there have been limited opportunities to meet and exchange information among ourselves. Therefore, we have established the "Global Network for Environment, Food and Agriculture (Global NEFA)" as an alumni association of ISS/ISF.

Objective

Based on the adopted "Tokyo Declaration" and "Action Plan", the organization aims to contribute to the sustainable development of the international society.

Membership

Membership is initially open to all past ISF members or ISS participants who agree to the objectives of the organization. Other interested persons can join the organization through a recommendation of members.

Activities

- Manage the website and mailing list
- Provide information related to employment and graduate study opportunities for students
- Organize study meetings, symposiums, and similar activities
- Promote information exchange
- Hold annual general meeting

November 25, 2005
Tokyo, Japan

Mission Statement of International Students Forum（ISF）

ISF is an international network of students which encourages cooperation, discussion and research to aid in the sustainable development of food, agriculture and environment into the future. ISF allows students to use their knowledge and expertise in their field of study to promote collective action, which will result in the unity of our global food system and our environment.

We have recognized that in order to implement the objectives of the ISF within our respective countries and area, we must consider the following plans of action:

1. The ISF joint communique and mission statement must be translated into the language of the participants' countries of origin.
2. A clear explanation of the objectives and mission of ISF must be placed online.
3. A pamphlet including the objectives and mission statement of ISF should be circulated to the members of ISF, in the language of the participant's countries of origin.
4. A newsletter should be delivered regularly to past and present ISS participants. This newsletter would include updates from alumni and the ISF.

We have recognized that in order to improve the current structure of the ISS, the following ideas must be implemented:

1. Establish the ISF in each partner university.
2. Support of the ISS student presenters must be maintained, both through the partner universities and ISF-Japan.
3. Create new partnerships with universities, in order to represent population distribution around the world.
4. Promote ISS earlier in the school year, in order to generate a new participant base.

Through the implementation of these suggestions, we believe that the promotion of the sustainability of food, agriculture and environment will be improved.

November 30, 2007
International Students Summit
Tokyo University of Agriculture, Japan

Acknowledgment

The onslaught of COVID-19 is still forcing us to be patient and restrictive in various activities. This is painful, however, on the other hand, it has also opened up new educational possibilities for us; for the first time, we are able to hold the "International Students Summit on Food, Agriculture and Environment (ISS)" online, which allows a wider audience around the world to see the students' discussions.

It would be great if the students could share their activities and ideas, and find new perspectives that they cannot attain from their original ground. We hope the awareness and relationships gained through the ISS will form a new path of agriculture and humanosphere in the near future.

Our grateful thanks go to all those who have helped us put together the 20th ISS.

We are deeply obliged to the ISS presenters who have provided superb content in their areas of study. We are also indebted to the Technical Advisors of each presenter and Tokyo NODAI Committee for Global Education (国際教育専門委員会) for giving valuable academic guidance to the ISS presenters.

We would also particularly like to thank the chairpersons, general chairpersons, and all Tokyo NODAI student groups who tirelessly have dedicated in preparing the 20th ISS, which is held in a completely new way and therefore full of uncertainties.

Lastly, we would like to express our sincere gratitude to the valuable audience for making this event a fruitful and enriching experience for all.

Center for Global Initiatives
Tokyo University of Agriculture

1-1-1 Sakuragaoka, Setagaya, Tokyo, 156-8502, Japan
Tel : 03-5477-2560 Fax : 03-5477-2635
e-mail : isf@nodai.ac.jp website : http://www.nodai.ac.jp/cip/iss