The Twenty-second International Students Summit（ISS）on Food, Agriculture and Environment

Youth contribution toward global agricultural and environmental innovation in achieving sustainability focusing on food security and health.

August 2 - 8, 2023

2023 TOKYO

Organized by
Tokyo University of Agriculture（Tokyo NODAI）

The Twenty-second International Students Summit (ISS) on Food, Agriculture and Environment

Youth contribution toward global agricultural and environmental innovation in achieving sustainability focusing on food security and health.

August 2 - 8, 2023

Statement

Several countries in the world are currently leaving behind the COVID-19 where populations are readjusting to live with it. Nevertheless, it can be said that this pandemic still affecting millions of people who were already made vulnerable by food insecurity as the cumulative results of several years of climate instability. Our communities must take smart and efficient decisions based on our common commitments to reducing to the minimum all emissions of greenhouse gases which impact multiple aspects of our lives. The challenge nowadays is double as the world must still find sustainable solutions to the environment and food crisis, as well as human health issues. This global situation makes it evident and urgent 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. How the youth is act to bring answers to those challenges is utmost needed and represents an outline of what one can expect in the future innovations to tackle such issues.

Tokyo University of Agriculture (Tokyo NODAI) organizes the "International Students Summit (ISS) on Food, Agriculture and Environment" 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 22nd ISS will take place on August 2-8, 2023 around the theme "*Youth contribution toward global agricultural and environmental innovation in achieving sustainability focusing on food security and health*", which was adopted at the 21st ISS. In accordance with the borders opening in several countries, but not all, the event will be held as a hybrid conference, giving the possibility to return to the original in-person ISS format as before the pandemic. We expect to have 29 participants (presenters) from 20 different countries and universities. In addition to this we will have 4 general chairpersons, 13 chairpersons and for the first time 2 ISS students advisors all from Tokyo University of Agriculture. Moreover, ISS recognizes the importance of ideas from our future generation, therefore this year we will have 29 high school students in 7 groups who will present their ideas in the poster presentation sessions.

We expect the participating students to attend physically, to share the activities they have undertaken at their university/schools during their presentations and discussions. The framework of student activity as to the rationale, methods, implications (economic, social and cultural), and constraints should be clarified in order to foster their contributions to the solution of global problems for the sustainability of this world. Basically, one oral presentation will be accommodated for each participating university in the following fields.

Students' Actions in the field of **AGRICULTURE**
Students' Actions in the field of **ENVIRONMENT**
Students' Actions in the field of **FOOD**
Students' Actions in the field of **EDUCATION**
Students' Actions in the field of **NUTRITION**

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

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To the audience of the 22nd International Students Summit

Please check the ISS Tokyo Nodai website for the latest information.

https://www.isstokyonodai.net/

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	Sabra Yusuf	Tokyo University of Agriculture
ISS Advisors	Nguyen Nga	Tokyo University of Agriculture
	Budhika Bandara	Tokyo University of Agriculture

All the chairpersons are students representing Tokyo University of Agriculture

The 22nd ISS Participating Universities

① Sokoine University of Agriculture
② Chaudhary Charan Singh Haryana Agricultural University, Hisar
③ Jomo Kenyatta University of Agriculture and Technology
④ Vietnam National University of Agriculture
⑤ National University of Laos
⑥ University of Djibouti
⑦ Universiti Putra Malaysia
⑧ The University of British Columbia
⑨ Kasetsart University
⑩ Royal University of Agriculture

⑪ University of the Philippines Los Banos
⑫ Chapingo Autonomous University
⑬ Western Sydney University
⑭ IPB University
⑮ University of Peradeniya
⑯ National Chung Hsing University
⑰ Michigan State University
⑱ Mongolian University of Life Sciences
⑲ Tokyo University of Agriculture

Commemorative Symposium of Inauguration of NODAI International Center

~Opening of the 22nd International Students Summit on Food, Agriculture and Environment~

国際センター開設記念シンポジウム　兼　第 22 回食と農と環境を考える世界学生サミット開会式

Addressing Global Agricultural and Food Challenges
~Tokyo NODAI's Past Contributions and Future Directions~

From 13:30 to 15:45 (JST), August 3rd, Thursday
Enomoto Hall, NODAI International Center, Setagaya Campus, Tokyo NODAI
**The symposium will be broad casted through YouTube Livestreaming.*
https://youtube.com/live/_5vub3M2Sh8

～ Program ～

【Opening Remark】 **13:30~13:40**

- Prof. Dr. Fumio EGUCHI, President, Tokyo University of Agriculture

【Keynote Speech】 **13:40~14:00**

Tackling the Global Crisis: Enhancing Food Security in African Countries through Collaborative Efforts - Lessons from Tanzania

- Ms. Edna Dioniz CHUKU, First Secretary, Embassy of the United Republic of Tanzania in Tokyo

【Keynote Speech】 **14:00~14:20**

International Education Exemplified - the Tokyo NODAI's Way: A Lens from a Semi-Outsider

- Prof. Dr. Salvador CATELO, Dept. of Agricultural and Applied Economics, Univ. of Philippines Los Banos

【Cross Talk】 **14:20~14:50**

Double Master Degree Program as New Educational Initiatives

- Assoc. Prof. Dr. Sarah CARDEY, Director, Graduate Institute for International Development, Agriculture and Economics, University of Reading
- Prof. Dr. Tsutomu TAKANE, Department of International Agricultural Development, Tokyo NODAI

【Break】

【Panel Discussion】 **15:10~15:45**

Facilitator: Prof. Dr. Machito MIHARA, Director, Center for Global Initiatives, Tokyo NODAI

Panelists: Ms. Edna Dioniz CHUKU, Dr. Salvador CATELO, Dr. Sarah CARDEY, Dr. Tsutomu TAKANE

M.C: Prof. Dr. Takashi KURAMOTO
Deputy Director, Center for Global Initiatives, Tokyo NODAI

Program

*Please note that there may be many sessions occurring simultaneously

Group A: Students' Actions in the Field of "Agriculture 1"

Aug. 5, Saturday 9:00 AM (Japan time) Room A (Enomoto Hall)

https://youtube.com/live/VMUvur_k3o4

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Gladness Elibariki Kaaya, *Sokoine University of Agriculture*

【Anaerobic Soil Disinfection to Control Soil-borne Diseases on Plants Using Liquid Organic Wastes as Unused Resource】
Miyuri Takahashi, *Tokyo University of Agriculture*

【Use of Non-conventional Aquafeed Resources and Contribution of Students towards Sustainable Aquaculture】
Rishi Pal Yadav, *Chaudhary Charan Singh Haryana Agricultural University, Hisar*

【Soil Fertility Amendment Using Compost Manure to Enhance Food Security among Smallholder Farmers in Kiambu County, Kenya】
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【Animal Welfare in Vietnam: First Steps to End Cruelty and the Role of Students】
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【"Tokyo Farmer Helper's" Creating New Agri-food Connections through Urban Farming】
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【The Use of Indigenous Ecological Resources for Pest Control in Laos】
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【Infield Establishment of Proper Irrigation Scheduling of Drip Irrigation System for Maize Production Using Computer-Based Procedures. A Case Study of Crop Museum Sokoine University of Agriculture.】
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【Innovative Combination of Compost and Eggshells to Improve Saline Soil Fertility in Djibouti】
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【Holistic Approach to Reach Food Sustainability】

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【A Social Craft Hub Towards the Improvement of Food Security in Madagascar: Case from Vakinankaratra Region】

James Michael Stuart Rakotomalala, *Tokyo University of Agriculture*

【Development and Quality Characterization of Cape Gooseberries Sauces and Paste】

Job Nyarimba Ombiro, *Jomo Kenyatta University of Agriculture and Technology*

【Improving the Quality of the Mongolian Horse Breed through Hybridization】

Anudari Ayanga, *Mongolian University of Life Sciences*

Group A

Group theme

Agriculture 1

Presenters:

Gladness Elibariki Kaaya, Sokoine University of Agriculture

Miyuri Takahashi, Tokyo University of Agriculture

Rishi Pal Yadav, Chaudhary Charan Singh Haryana Agricultural University, Hisar

Hunter Bundusi Ogochi, Jomo Kenyatta University of Agriculture and Technology

Chairperson:

Moise Ishimwe, Tokyo University of Agriculture

Minaho Kaneko, Tokyo University of Agriculture

Contribution of Non-industrial Private Forests to the Community Livelihood

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Keywords: Growing stock volume, Community, non-industrial private forest, livelihood

1. Problem Statement

Private industrial-scale forest plantations and non-industrial private forests in Tanzania (individual woodlots, farm trees, and out-grower's schemes) have expanded significantly in recent years, specifically in the Southern Highlands region (Mauya *et al*., 2019). Private forests, particularly non-industrial private forest (NIPF) growers, are becoming more important in Tanzania (Lusambo *et al*., 2021). Furthermore, due to few research documented, non-industrial private forests (woodlots) received little attention while significant portion of the growing stock volume (GSV) is found in these fragmented smallholder woodlots, where estimations of the productive area and yield have not yet been determined which results into less significant information on contribution of GSV that lies in these woodlots to the socio-economic state of the communities. GSV influences prediction of farmers profit as it affects volume of timber to be produced and case of carbon marketing. Last but not least, growing stock volume (GSV) influences decision of forest managers, individual owners, investors in small-scale plantation and it is affecting the credibility of regional and countrywide forest statistic, which are important to climatic change mitigation policies and global forest initiatives of the Food and Agriculture Organization of the United Nations (FAO) hence its contribution to the livelihood of community. Therefore, this study aimed to fill the gap so as to meets the potential of statistical data on GSV to the community livelihood and overall advantages from regional to country level.

2. Student's actions or activities

Regarding the stated problem, I conducted a study as a part of my final year research project on the contribution of non-industrial plantation forests to the livelihood of the community. The study carried out as case study in Mufindi district, where there is rapid increasing of small-scale plantation forests. Data needed for growing stock volume estimation, such as diameter of all trees (measured at breast height of a tree) and height of three trees (largest, medium, and smallest) in established plot, were actively recorded. Based on that, growing stock volume of individual tree was calculated using adopted species-specific allometric volume equation developed (Malimbwi *et.al*., 2016). Also, socio- economic data were collected using questionnaires.

3. Implication /results

Different parameters were measured and the results shows that study area has average number of 1093.55 ± 96 stems per hectares, average basal area 24.5 ± 2.336 m^2 per hectares, average growing stock volume estimated to be 160.77 ± 19.419 m^3 per hectares also average growing stock volume of different measured plots shown in Figure 1 below. In addition, it was clearly noted that *Pinus patula* is the most preferred planted tree species. This could be justified by its fast rate of growth as well as its demand and selling price compared to other species. From the finding, large GSV indicates that small-scale plantation forests were main activity and investment in the study area. Others households benefited from activities were seedling producers and middlemen due to the fact most farmers do not grow their own seedling. However, farmers who grow their own seedlings have an additional source of earnings from selling the seedlings that are left over after planting. Due to the income made from the activities, it proved that small-scale forest plantations were profitable in the study region, enhancing the food security and health of community households.

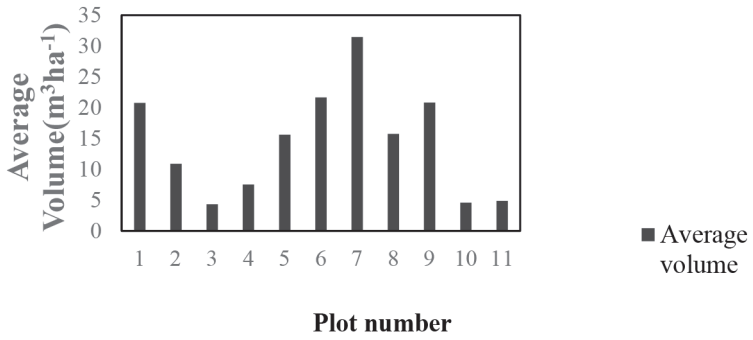

Figure 1: A graph showing average stock volume per plot

The percentage contribution of NIPF to the income of the farmers shown (Figure 2) below, depict that NIPF have great potential to the livelihood of the farmers and community in the study area as the income used to improves their food and health security.

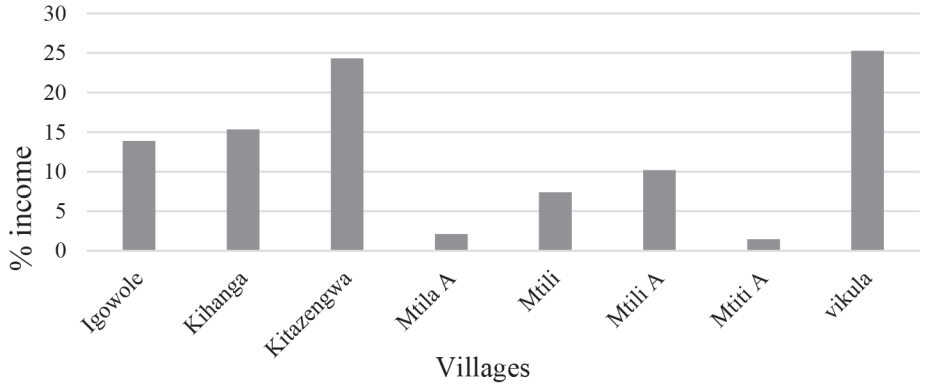

Figure 2: The percentage income of farmers in a village from NIPF

4. Challenges and perspectives

The study and measures were only conducted on a very small scale due to limited funds. Adding limited time and the fact that individual woodlots were more fragmented hence I had encounter difficultness to access all of them. Given a chance, this study could be conducted on a much larger scale to get more scientific statistic for GSV and results be more useful to both individual owners, managers, investor and environmental management systems.

5. How do your actions/ activities relate to the ISS general theme?

It is simple to predicts contribution of non-industrial private plantation forests to the household income and livelihood when there is relevant information on growing stock volume lies in these forests. GSV predicts volume of timber to be harvested hence determines income of a farmer as related to the price of timber in the market. Also, by knowing the volume of the stand, farmer will obtain income from carbon marketing. Income earned from forests can improve Food Security and health. Furthermore, small-scale forests support agricultural activities by providing habitat for pollinators and offering protection against climatic extremes and agroforestry arrangement can increase the productivity of agricultural lands. This also tend to increase income of household to be used for improving their standard of living and hence food and health security. Apart from aligning with ISS theme, activities also align with SDG (s) objectives in term of good health and well-being, no poverty, responsible consumption and production and climate action.

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Acknowledgement

My sincere gratitude is extended to my advisor, who served as a great mentor when I was writing my abstract.

Anaerobic Soil Disinfection to Control Soil-borne Diseases on Plants Using Liquid Organic Wastes as Unused Resource

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Keywords: Sustainable agriculture, plant disease, biological control, microbiology

1. Problem statement

In agricultural production, we are frequently facing plant diseases on the host plants. Many kinds of fungi, bacteria and viruses have been reported as plant pathogens so far. Some of plant pathogens are habitat in soil and they cause plant diseases by infection on the roots of host plants, named as soil-borne diseases. Generally, soil fumigants have been used for soil fumigation to control soil-borne diseases. However, with concerning for the environmental impact on a global scale, some of the soil fumigants have been restricted in agricultural production.

Miyako Island is one of the islands of Okinawa prefecture located in the subtropical region of Japan. Tropical fruits and crops, e.g., banana, mango, and sugarcane, are the major commodities of Miyako Island.

In banana production, Panama disease is one of the most serious soil-borne diseases. The occurrence of Panama disease can be seen almost all the banana producing countries. Disease symptoms of Panama disease are yellowing of the leaves, followed by withering, and lead to low productivity of banana fruits. The causal agent of Panama disease, *Fusarium oxysporum* f. sp. *cubense*, is a fungus which produce chlamydospores which show high resistance against dry and high temperature. Therefore, the fungal pathogen can survive in soil for several years. In 2016, Panama disease was confirmed in Miyako Island (Nitani et al, 2108). However, there are no registration of soil fumigants for fruits production, it is desired to control Panama disease.

2. Student's Actions or activities

Anaerobic soil disinfection (hereafter ASD) is a soil fumigants-independent, eco-friendly soil treatment. ASD was developed in Netherlands and Japan independently in the 2000s. ASD is carried out by amendments of organic matters, green manure (Netherlands) and rice bran (Japan) into the soil with water followed by covering of soil surface with plastic film. Further development has carried out in Japan by using low concentrations of ethanol as a carbon source which can reach more deeper in soil. In the ASD, consumption of amended organic matters by soil microbes causes reductive condition with depletion of the O_2 in soil. Under the reductive condition of soil, Fe and Mn are generated to reductive state, Fe^{2+} and Mn^{2+}, and Fe^{2+} and Mn^{2+}

are supposed to be harmful against most of the soil microbes include plant pathogenic microbes (Momma, 2011). ASD by using low concentration of ethanol was established by Kobara et al. as follows; 1% ethanol solution is irrigated at 100L/m^2 to soil, and then, covered with conventional plastic film for 2 to 3 weeks.

In Miyako Island, distilled liquors, awamori and rum, are popular commodities. In the distillation process, it can divide into 3-fractions as heads, hearts and tails. Generally, although the tails are still containing ethanol, it is disposed as liquid organic wastes.

The aim of my study is to establish ASD by using the tails, liquid organic wastes in distilled liquor production as a carbon source to control soil-borne diseases, especially for Panama disease on bananas in Miyako Island, Japan.

To define the effects of ASD using the tails, treatments were conducted in the island from June to August in 2022. The tails, containing of 38 % of ethanol, was collected from rum production in the island, and diluted to 1 % of ethanol by irrigation water. The dilute was irrigated at 100 L / m^2.

3. Implications/Results

To evaluate reductive condition of soil, I determined by dipyridyl reaction. At a depth of 40 cm, reduction was observed in most of the test areas treated with organic matter (Table). On the other hand, at a depth of 20 cm, reduction was not observed in almost all test areas.

To evaluate the effect of ASD, viable *Fusarium* sp., a ubiquitous fungus in soil including the causal agents of Panama disease on bananas, was detected by a dilution plate method using Komada medium (Komada, 1975) as selective medium. *Fusarium* was present in the no-treated area but was below the detection limit detected in the other test areas.

Table. Evaluation of reductive condition of soil, and viable *Fusarium* sp. in soil

n = 6		Ethanol area		Rum tails area		Water treatment area		No-treated area	
		20cm	40cm	20cm	40cm	20cm	40cm	20cm	40cm
Reduction	Frequency of appearance	1/6	4/6	0/6	4/6	0/6	0/6	0/6	0/6
Viable *Fusarium* sp. in soil	The number	N.D	N.D	N.D	N.D	N.D	N.D	10^2	10^1
	Frequency of appearance	0/6	0/6	0/6	0/6	0/6	0/6	4/6	5/6

4. Challenges and perspectives

The areas where reduction was not confirmed, and *Fusarium* was below the detection limit was considered the effect of solar disinfection. On the other hand, the areas where reduction was confirmed, and *Fusarium* was below the detection limit was considered the effect of ASD. Therefore, ASD is effective for soil disinfection, in summer treatments, a certain soil disinfection effect was observed not only by ASD but also by solar disinfection. In this study, I focus on diseases caused by *Fusarium*, but there are other soil diseases caused by a variety of plant pathogens, and ASD can be applied to a wide range of soil diseases.

5. How do your Actions/activities relate to the ISS general theme?

Low ethanol ASD is a technology developed in Japan, but it is expected to be effective enough in other countries if a certain soil temperature can be maintained. Since it can replace liquid organic matter available to soil microorganisms such as alcohol and molasses, I would like to share the information with our members as a technology that can be promoted in various countries and regions.

6. References

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Use of Non-conventional Aquafeed Resources and Contribution of Students towards Sustainable Aquaculture

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Keywords: Non-conventional aquafeed resources, Sustainable aquaculture, Students' contribution, Aquaculture innovation

1. Problem Statement

Aquaculture is a rapidly growing food industry worldwide, driven by the increasing demand for fish and fisheries products. India currently ranks second in aquaculture and third in fisheries output, with a contribution to the national GDP of 1.07% and the GDP of agriculture of 5.30%, respectively (FAO, 2020). In 2018, the global fish production reached 178.5 million tonnes, with aquaculture contributing 45.99% (82.1 million tonnes) of that total (Handbook of Fisheries Statistics, 2020). The global aquaculture sector plays a crucial role in addressing malnutrition and enhancing food and nutritional security by meeting the ever-growing demand for fish (FAO, 2018). To increase fish production, aquaculture practices have transitioned from extensive to semi-intensive and intensive culture systems. In these systems, nutrition plays a critical role as it impacts production costs, fish growth, health and waste production. In fact, fish feed accounts for about 60-70% of the operational costs in semi-intensive and intensive fish farming systems (Tewari and Kaur, 2022). Traditional aquafeeds, which primarily consist of fishmeal and fish oil these are generally obtained from other animals and fishes after killing them, which are unsustainable due to their high cost, limited availability, and negative environmental impacts. The problem lies in the over-reliance on these conventional aquafeed resources, which contributes to overfishing, habitat destruction, and the depletion of marine resources.

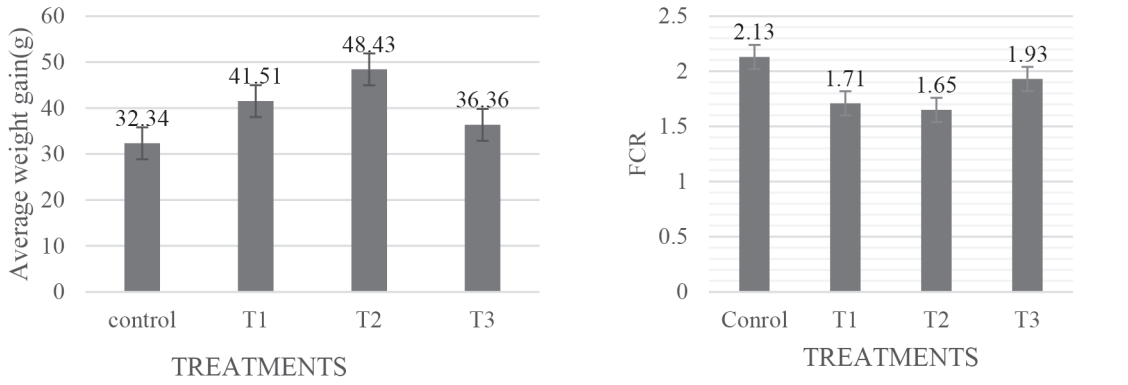
2. Students action and activities

To address the problem, I designed a chart which depicts the requirement of essential nutrients enhancing the growth of fishes. The study was conducted to see the effect of *Moringa olifera* in the diet of *Cyprinus carpio* (common carp) while replacing fish meal with *M. olifera* leaf meal at the rate 0%(control), 15%(T1), 30%(T2) and 45%(T3) fed to 60 days. This feedstuff provides additional protein and vitamins that can improve the growth and health of fishes. Also, moringa has the antioxidant qualities which boost the immune system of fishes and prevents them from occurrence of several disease. Some other plant-based feed for fishes can also be used as feed such as azolla (*Azolla pinnata*), soyabean meal and single cell protein. I motivated fish farmers, my classmates and retailers for collective actions and to spread

awareness about precision aquaculture and timely applications of inputs and encouraged farmers to follow the approach of climate smart aquaculture in their farm management and planning to make out way of life sustainable. By this, I did my foremost effort to reduce the over-reliance of farmers on the usage of conventional aquafeed and encouraged them to adopt use of nonconventional aquafeed that leads to sustainable aquaculture.

3. Implications/Results

Results of my continuous efforts were highly motivating and uplifting. Farmers observed a net increase in profit and decrease in the cost of input and boost in fish health and productivity. There was an observable shift from traditional fish farming to modern aquaculture system and from conventional aquafeed to nonconventional aquafeed. Farmers also developed a keen interest in calculated and scientific application of inputs for rationalizing aquaculture. The below graph shows the results of feeding *M. olifera* to common carp fish in the laboratory of College of Fisheries Science, CCS HAU Hisar.



(a) Average weight gain of fish

(b) Feed conversion ratio (FCR) of fish

Figure: Showing (a) -Average weight gain of fish is higher in all treatments with the feeding of *M. olifera* leaf meal as compare to controlled diet, **(b) -** Feed conversion ratio at different level of inclusion of *M. olifera* leaf meal in common carp diet. The lowest FCR was found in all treatments with *M. olifera* leaf meal as compared to controlled diet

4. Challenges and perspectives

The major challenges in use of nonconventional aquafeed resources are limited availability and supply, nutritional balance and quality, cost and affordability, feed formulation and standardization. The perspectives being sustainability and environmental benefits, resource efficiency and circular economy, alternative protein and nutrient sources, innovation and research opportunities, market and consumer demand.

Overall, the use of non-conventional aquafeed resources holds potential for addressing environmental concerns, improving resource efficiency, and meeting the demand for sustainable seafood production. However, overcoming challenges related to availability, cost, nutrition, and standardization is crucial for wider adoption and successful integration into aquaculture practices.

5. How do your action/ activities relate to the ISS general theme?

The international student summit can serve as a platform for knowledge exchange, collaboration, and inspiration, fostering student engagement and involvement in the use of non-conventional aquafeed resources and the promotion of sustainable aquaculture practices. It is unequivocal that food security be either availability, accessibility, utilization and/or system stability is dependent on climate (Ramesh *et al.,* 2017). My project focuses on the importance of making my communities resilient against the devasting effect of climate change by the implementation of effective management practices, collective effort of youth, cooperation from the farmers and innovators for sustainable development of aquaculture and my country as a whole. I strongly feel that it is the responsibility of youth especially young aquaculture undergraduates, to connect and unify all resources and to use them accordingly to varying climate conditions for modernizing and sustaining aquaculture.

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Soil Fertility Amendment Using Compost Manure to Enhance Food Security among Smallholder Farmers in Kiambu County, Kenya

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Keywords: Compost, Amendment, Food security, Soil fertility

1. Problem statement

Agriculture is among the major economic activities worldwide and is considered the primary source of employment for most Kenyans. Soil fertility is critical for crop production; however, most of the soils in the arable lands in Kenya have been reported to have low levels of nitrogen, potassium, phosphorus, and other nutrients, affecting the maintenance and productivity of soils. Compost application to agricultural lands is a reliable way to improve the physical properties of most soils, especially soils with poor structure and low levels of organic matter (Bauduin et al., 1987, Stratton et al., 1995). The food security profile report for Kiambu County showed that 70% of the population practice crop farming, and most farms (90%) are small holdings (Kenya National Bureau of Statistics, 2008). The latest census data shows that Kenya's population has grown to an estimated 47 million. A high percentage of this population is at significant risk of facing food shortages, and this increasing population continues to put pressure on the arable farmlands in Kiambu County hence intensive cultivation. Intensive cultivation has led to soil nutrient depletion, resulting in a decline in soil fertility on smallholder farms affecting crop yields. The declining crop yields threaten food security for smallholder farmers who rely on their farms for produce.

2. Student's Actions or activities

Between 2021 and 2022, I was involved in a soil fertility project at a kitchen garden. The owner had noticed a decline in the yields of his vegetable crops, such as spinach and kale. He decided to amend the soil fertility by applying compost. My role was to monitor and turn the maturing compost regularly to ensure proper aeration. I also assisted in spreading the compost after it had matured; it was a collaborative effort. The garden is doing well, and the crop yields have increased after using compost on the soil. It took about four months for the compost to mature and three months to notice a significant change after application to the soil. I have seen the positive impacts of compost manure on soil and vegetable crops and believe it will be a valuable means for other smallholder farmers to amend their soil fertility status and improve the quality of their crops. In Kiambu County, different materials end up as organic waste and can be used as compost for smallholder farmers. These materials include organic kitchen waste

from households, post-harvest material, vegetable and fruit peels, and shells from market centers that collectively end up as organic waste in landfills. These materials have different mineralization rates and impacts on the soil. Determining the nutrient mineralization rates and effects of these materials on soil physical properties such as infiltration, bulk density, and porosity will provide crucial data to know the most effective materials to be used in the soils for efficient productivity. Since compost has a long-term effect on soil physical fertility, it is crucial to understand the impact of different compost as amendments and how nutrients are released in the soil for plant availability. The objectives of this proposed study are; to determine the effects of varying compost materials on soil chemical quality, to investigate the impact of different compost materials on some soil physical properties, and to investigate how some of the physical and chemical soil properties affect crop yields.

3. Implications/Results

This proposal is expected to provide a basis for how the productivity of arable smallholdings in Kiambu can be increased and soil fertility amended effectively using compost, thus preserving the land. The results from the tested organic materials on soil chemical and physical properties will be innovative in the county since smallholder farmers compile these materials but need to be made aware of the different nutrient rate mineralization in the soil. Suitable nutrient mineralization is critical for the growth and development of plants, as it provides them with the essential nutrients they need to thrive. The organic material found to have the most efficient output when used as compost will amend soil fertility, thus increasing crop yields on smallholdings and translating to food security through better-yielding crops. Organic waste found in different areas of the county will ensure sustainability by constantly recycling the various organic wastes that would otherwise end up in landfills into valuable resources that amend and improve soil fertility and reduce harmful emissions. This will ensure that the environment is conserved, which will promote health. Increased food security will also be achieved through better-yielding crops. Compost is a cost-effective method of amending soil fertility as it utilizes waste. Smallholders in Kiambu County can use compost to improve their soil instead of expensive chemical fertilizers. Currently, a 50kg bag of chemical fertilizer in Kenya costs Ksh.3500, which can be too expensive for farmers. When working on the soil fertility project in the garden, the farmer opted for compost over chemical fertilizers. Table 1 shows some essential nutrients present in compost manure.

Table 1. Average nutrients per kilogram of compost.

Nutrient	% in Compost
Nitrogen	0.3%-1.5% (3g to 15g per kg of compost)
Phosphorus	0.1%-1.0% (1g to 10g per kg of compost)
Potassium	0.3%-1.0% (3g to 10g per kg of compost)

Note. Adopted from Farmer's Compost Handbook (p.24), by Román, P., Martínez, M. M., & Pantoja, A. (2015). Copyright 2015 by FAO.

These macronutrients are helpful for plant growth, even in small amounts. Applying compost on farm soil has shown remarkable benefits in the soil in various fundamental aspects,

including; higher water content, higher total organic carbon, increased yields, and improved structure.

4. Challenges and perspectives

Educating more local farmers on the importance of soil testing and empowering the youth and other university students in the field of agriculture on the benefits of compost as a soil fertility amendment will be done in liaison with the university, which has open days where members of the public are invited, and the forum is open to all stakeholders. Students like me are given an opportunity to showcase their work, and I will be able to display my work and disseminate the information and knowledge to small-scale farmers and ensure sustainability. Furthermore, we have a student organization dealing with land resources issues where we have an outreach program in partnership with the university and other stakeholders, such as the county and national government. Understanding the composting process and the proper safety techniques are essential to avoid negative implications like potentially spreading harmful pathogens. To ensure sustainable implementation in Kiambu County, financial support, access to organic material and relevant information, training, and technical assistance are some support systems that would be required. Extension agents can provide these and appropriate county government programs and non-profit organizations. Before any implementation can be done, it is essential to understand the potential impacts of the different organic materials in the compost, their nutrient output in the soil, and knowledge of the soil fertility status on a farm by testing the soil.

5. How do your Actions/activities relate to the ISS general theme?

Sustainable agriculture includes using compost to amend soil fertility. To achieve this, better composting methods should be developed, and organic waste should be recycled. Involving the youth in Kiambu in waste diversion and environmental conservation through this study will help to ensure productive soils and sustainable food systems. This will result in increased crop yields, improved food security, and better health. Local success is the first crucial step towards global food security, and the youth have a critical role in making it possible.

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Group B

Group theme

Education

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Animal Welfare in Vietnam: First Steps to End Cruelty and the Role of Students

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Keywords: animal welfare, animal ethics, sustainability

1. Problem statement

In Vietnam, the concept of animal welfare is still rather new. According to Trach (2017), there are many serious animal welfare problems for all three animal groups - domestic animals, agricultural animals and wildlife. A non-negligible percentage of all three groups are being mistreated, and denied their basic needs to maintain natural behaviors. Domestic animals are subject to abuse, neglect, and lack of care when sick. In some places, dogs and cats are raised only to eventually be killed for food, or for special occasions, like Lunar New year or weddings. For agricultural animals, farmers often ignore their welfare. These livestock are often raised in cramped conditions, and only taken care of for their meat or eggs. Wild animals are mainly hunted for food or raised in large quantities to provide raw materials for humans: raising bears for bile, pangolins for their scales; hunting porcupines, squirrels, tigers, pythons, to serve in restaurants, or for specific body parts for health care purposes. Some species of wildlife are kept indoors for entertainment, such as turtles, monkeys, birds, … In addition, some festivals still include brutal animal slaughter as a sacrifice, e.g: Do Son buffalo fighting, Nem Thuong pig-chopping festival, etc. The torturing of farm animals during transportation and slaughter, or the killing of pets for food also remains hard to control.

There are already laws regarding moral treatments towards animals and measures to combat animal trafficking, for example: The Biodiversity law (2008), the Law on Animal Health (2015) and the Law on Animal Husbandry (2018). However, because of the lack of awareness in some parts of Vietnamese society, and the fact that the government has weak enforcement of punishments for crimes concerning animals, these animal welfare problems persist.

The most conspicuous reason for the lack of animal welfare is people's lack of awareness. In some cases, people do acknowledge animals being mistreated, but choose to ignore it. In agriculture, there are four major causes of these persistent animal welfare problems. They are: lack of financial accountability for losses; poor management; wrong financial incentives; and "bad becoming normal", which occurs when conditions deteriorate slowly and people do not perceive the problem. (Grandin, 2018). In Vietnam specifically, the lack of animal welfare comes from the low awareness of farmers. Farmers often only focus on economic profits, they also do not have enough budget or time to invest in animal welfare. On top of that, they are not aware of the long-term economic benefits that animal welfare brings, and only focus on the immediate benefits. However, animal welfare has recently become a topic of interest, and there is a great

prospect that animal welfare will improve through deep international integration. (Hanh & Ton, 2016).

2. Student's Actions or activities:

I joined a club called "I love animals" in middle school. There, zoologists taught us about the characteristics and behaviors of exotic animals. We got to see how the animals were taken care of, and experienced feeding some of them, as well as cleaning the zoo. This experience made me realize that in order to protect animals, you need to learn about them, about their needs, behaviors, their living conditions, etc. With that in mind, and my dream of becoming an animal conservationist and raising awareness about animal welfare, I chose to pursue the Animal production and Health program at Vietnam National University of Agriculture. This major provides me background knowledge on animals, how to take care of and protect them. We also have hands-on experiences taking care of animals, doing experiments and performing operations.

Currently, I'm joining a research group with the topic "The effect of layers raising systems on egg productivity and the quality of animal welfare." My group divide chickens into 2 groups of 45, with 3 repetitions, totaling 270 chickens. One group will be given access to open space, enrichment materials to perform natural behaviors, and to entertain, while the other group will be raised in conventional cages, with 3 hens per cage. From there, we will take care and raise them following the guidelines from the National Livestock Institute. We will assess the effects of raising methods by collecting blood samples on specific weeks, and analyze the cortisol concentration in the blood to identify the stress level of the chickens, allowing us to assess animal welfare and egg productivity.

3. Implications/Results

We just started the research, so there hasn't been any particular result yet. But there are 2 main goals that we want to achieve, which are: To assess the impact of raising methods on layers' egg production and animal welfare quality, and to propose solutions to husbandry methods that both improve the quality of animal welfare and meet the goals of productivity and product value. In current agricultural practice, layers are raised in cramped, constrained cages, preventing them from performing natural behaviors. This causes them to have both physical and mental problems. Chickens can become so stressed that they peck each other, and in extreme cases, become cannibals. Their muscles and bones tend to shrink and can't function well. This is why we hope to prove that more natural and humane raising systems have a significant, positive effect on chickens' welfare, as well as the quality of products. Hence, we may contribute to solving the welfare problems on layers. In the near future, our group will use social media as a means to spread information. As we obtain results from our research, we hope to bring the message about animal welfare to farmers, and more broadly, businesses.

We also believe that the involvement of students in enhancing farmers' awareness of animal welfare is important. One way to do this is by forming groups of students, along with experts to come to underdeveloped, unaware regions (i.e: mountainous areas, ethic minorities's regions...) to conduct surveys, researches to understand their farming practices and perception of animal welfare. Climates and geography are the key factors conditioning the farming

practices (ie; Winters in Northern regions are very cold, farmers sometimes do not know how to save their animals, causing death), hence, conducting socio-economic investigations will help students and experts find suitable support for farmers. Creating online groups to share farmers' experience, feedbacks will help educate others, as well as letting the public help with solutions and funds.

4. Challenges and perspectives

Through the experiences I have had, I realized that there remain many problems surrounding animal welfare in zoos and in agriculture. I hope that by studying about animals, participating in activities working with them, and connecting with experienced people will help me find solutions to improve animal welfare, and put a stop to the act of illegal wildlife hunting and trading in Vietnam.

For agriculture, the biggest challenge is how to approach farmers and their farming methods. It remains very difficult to spread the message about animal well-being in a way that is persuasive for them to change their way of thinking, and to change the awareness that has been deeply imprinted in some parts of Vietnamese society, all without negatively affecting their cultures, traditions, or businesses. This challenge is magnified because in order to change and raise awareness, it must start as soon as possible, especially in young children, and since animal welfare is still a relatively new concept in Vietnam, it has not been adopted into teaching programs.

5. How do your Actions/activities relate to the ISS general theme?

This year's ISS theme is "Youth contribution towards global agricultural and environmental innovation in achieving sustainability focusing on food security and health". On this, healthy animals raised with good animal welfare are more productive, require less care and are more profitable. Products from healthy animals also contain less harmful hormones, thus making them healthier for consumers. Animal welfare is also closely related to sustainability, especially SDG 12 and 15 adopted by the United Nations.

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"Tokyo Farmer Helper's" Creating New Agri-food Connections through Urban Farming

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Keywords: Sustainable, Urban farming, Food System

1. Problem statement

Tokyo is the most populated city in the world. Currently, there are 5,104 farm households in 3,542 hectares of farmland in Tokyo, which is equivalent to 0.001% of the total agricultural area of Japan (2020 by MAFF statistics). The average farm size is about 0.7 hectares per household, and intensive small-scale farming is dominant. Its calorie-based self-sufficiently is only 1% (2020 MAFF). As the land price is high in the center of the city, the farmlands are subject to high taxes. The government enacted the "Production Green Space Law" in 1992, which aims to decrease taxes on urban farmlands and preserve urban farming. A total of 80 percent of the farmers receive the exemption and maintain their farming in Tokyo. According to the Basic Law for Urban Agriculture Promotion. Urban Farming is defined as one of the agricultural systems that are done in urban areas and their surroundings. Urban Farming has six functions: (i) a source of fresh agricultural products, (ii) an opportunity for urban residents to engage in the agricultural experience and exchange activities, (iii) a resource of green space for recreation and well-being, (iv) an opportunity for urban residents to understand agriculture, (v) conservation of land and the environment, and (vi) open space for disaster prevention. Nowadays, the movements of "farm-to-table" and "local production and local consumption" have spread throughout society. In Tokyo, with its large population of young people and university students, the distance between home and farm is short, providing many opportunities to develop an interest and get involved in agriculture. For example, residents can buy agricultural products at direct selling spaces near farms or engage in farming experiences at urban farms as volunteer aids to farmers.

2. Student's actions or activities

The research was conducted on research on the current urban farming situation on-site After visiting several farms and discussions it was decided to create a student circle with members of the Tokyo University of Agriculture to facilitate mutual interactions between students and farmers. The student circle was named, "Tokyo Farmer Helpers" and started its first activity in November 2022. The original objectives of the circle are to understand the actual situation of urban farming in Tokyo and develop a student network to support urban

farmers. Table 1 shows the details of the student circle's activities since November 2022.

Table 1 Activities since November 2022

Categories	Kinds of activity	Contents
Exchange meeting	Held an exchange meeting in farm in April 2023	•Easter game to search for egg toys on the farm •Lunch party using fresh vegetables harvested on the farm
	Paritipate to exchange meeting "Open campus at farm"	•Regular meetings in every 4th Saturday at the farm in Mitaka city, Tokyo •Got together various generations who are interested in doing farming
Field study	Visit "Edo Tokyo vegetables" farm – grow traditional vegetables	•With a University professor in Setagaya •Got knowledge about agricultural history in Setagaya-ku and traditional vegetables in Tokyo
	Visit the JA farmers market selling vegetables and flowers produced in Setagaya, Tokyo	•Got knowledge about the history of the JA system in Setagaya-ku (one of the Japanese agricultural systems of direct sale for helping farmers)
Support for sales	Support to sell vegetables produced in Tokyo	•Sold vegetables with farmers in Hacho-ji station •Could notice some new views of customers' concerning on buying vegetables
Attend farmer's lecture	Attending the lecture to learn about skills for being a farming volunteer in Tokyo by a farmer in Musasino-city, Tokyo	•Learned about skills for being a farming volunteer – farmers' viewpoints •Learned some new views on farming volunteer
Aid to agriculture	Aid to agricultute as farming volunteers	•Help for agricultural activities at the center of Tokyo •Sometimes outside of Tokyo •Total number of farms visited - eleven •Planning to visit another two farms (or more)

3. Implications/Results

Through our circle's actions, I realized the significance of aid for agriculture, as it allows us to hear about the real situation and gain first-hand knowledge on actual farming sites. However, I also encountered some difficulties concerning the limitations of farming volunteers. These activities are voluntary and are sometimes seen as hobbies without responsibilities. Therefore, it is challenging to regularly develop urban farming and secure a consistent number of farm volunteers. Nevertheless, I had the opportunity to meet a farmer who operates a sustainable system of aid for agriculture called Tomizawa Farm in Mitaka City. He has been hosting an event every fourth Saturday on his own farm, called "Open Campus Day in the Farm." This event allows participants to experience farming and make friends. The event's purpose is to facilitate participants' exchange and allow them to experience working with soil and engage in urban farming. I heard from participants of this event that "The farm is so fun and valuable for urban residents because we rarely get the chance to experience farming and interact with people involved in agriculture." During our Easter party on the farm, participants said, "This event is so enjoyable for me since I rarely have the opportunity to experience farming in my daily life." From these cases, I noticed that it can be challenging for people to become familiar with agriculture solely through volunteering on farms, while it is easier and more comfortable to start with food and communicate through fun farming activities.

4. Challenges and perspectives

According to the Ministry of Agriculture and Forestry, Fishers, people can realize and understand the importance of agriculture and agricultural policies through firsthand experience

in urban farming, and these activities can promote "local production and local consumption." I agree with this policy and share the same thought about the need to provide opportunities for buying local agricultural products during our circle activities. Therefore, I plan to establish a place to sell agricultural products produced through urban farming in Tokyo for our next mission. I propose creating a sales platform near the university for residents and university students. This platform will offer locally made agricultural products and provide a space for communication between local people and university students.

5. How do your Actions/activities relate to the ISS general theme?

I hope that our actions can serve as a pioneering case for ensuring food security in Tokyo. Additionally, I aim to create enjoyable moments for urban residents through food and agriculture.

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The Use of Indigenous Ecological Resources for Pest Control in Laos

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Keywords: Health, Agriculture, Sustainability, Environment

1. Problem statement

The growing population has led to a surge in demand for food, causing farmers to rely heavily on inorganic pesticides to keep up with the demand (FAO, 2017). In Vientiane, the capital city of Laos, the majority of agriculture practice relies on potent chemicals and pesticides to eliminate pests that threaten their crops. Despite the harmful effects of pesticides on the environment and human health, farmers persist in their use due to their affordability and effectiveness in pest elimination. However, in many cases, these pesticides do not work well, and the pests grow resistant against the pesticides. The farmers then typically blend multiple powerful insecticides (known as tank-mixing) to control the pests more effectively (Laotian Times, 2016). The extensive use of pesticides results in severe consequences on human health, ecosystem, and food security due to their long-lasting and bio-accumulative properties (Sharma et al., 2019). To overcome this, organic pesticides can be used as an alternative derived from natural sources and have a more targeted approach to controlling pests and insects. However, organic farming is not widely practiced in Laos and is only adopted by small agricultural groups.

2. Student's Actions or activities

The research aims to study sustainable agriculture by examining the utilization of local natural resources in creating organic pesticides. It will also involve studying the management of an organic agriculture group formed in 2006.

The research focuses on the Non-Tae village, known for its organic agriculture group. The study consists of two stages: Firstly, interviews and questionnaires survey conducted with three local farmers from the same household to gather data on natural resource usage. Secondly, field visits carried out to gather information on organic farm management practices. By combining these two methods, the research endeavored to comprehensively understand natural resource utilization and organic farm management within the village's organic agriculture group.

3. Implications/Results

The findings indicate that the natural resources used in producing organic pesticides can

be categorized into two primary characteristics: seasonally dependent resources and resources available throughout the year.

Local seasonally dependent resources include Chili (Capsicum frutescens), Fish Bean Plant (Tephrosia vogelii), Galangal (Alpinia galanga), Ginger (Zingiber officinale), Holy Basil (Ocimum sanctum), Madreado (Gliricidia sepium), Marigold (Tagetes spp.), Ngai Campor Tree (Blumea balsamifera), Onion (Allium cepa), Papaya (Carica papaya), Siam Weed (Chromolaena odorata), and Turmeric (Curcuma domestica) based on the specific season. In contrast, locally all-year resources, such as Tinospora (Tinospora tuberculata), Lemon Grass (Cymbopogon), and Neem (Azadirachta indica), are available consistently throughout the year, ensuring a reliable supply for organic pesticide production. In addition to being available year-round, these resources are the primary components used to create organic pesticides. The characteristics and availability of these resources are essential for organic farmers to develop effective and sustainable pest management strategies. Farmers are also aware of multiple factors, such as crop variety, soil conditions, organic pesticide characteristics, specific pests, and seasonal variations when applying natural resources.

Another finding is that the Non-Tae organic agriculture practice group has demonstrated farm management skills, leading to the successful implementation of organic farming over multiple years. Their approach to farm management is both straightforward and highly effective. Through field surveys, it becomes evident that every plot dedicated to organic agriculture is meticulously organized, with convenient access to water sources throughout the area. Furthermore, each field has a small storage house for storing organic pesticides. To counter potential water scarcity during the hotter seasons, the fields are equipped with one or two tanks to store pumped groundwater. Farmers are experts in proactively planning for each season, which includes crop rotation, effective pest management, and ensuring optimal soil nutrition.

Figure 1. (Natural Resources)

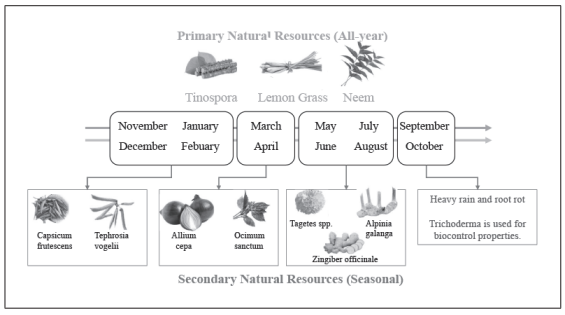
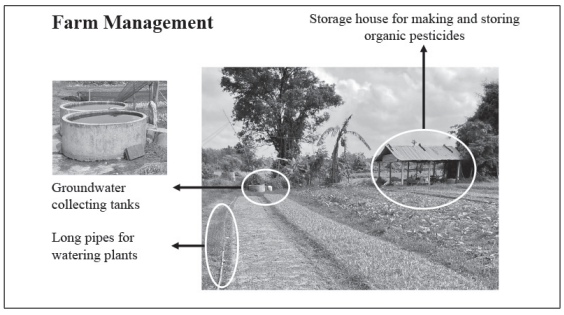


Figure 2. (Farm management)



4. Challenges and perspectives

My initial attempt to develop organic pesticides was unsuccessful due to several factors, including the choice of locations, crop varieties, types of organic pesticides, and the specific pests and seasonal variations involved. However, this setback prompted me to expand my research and delve into local plant species and sustainable farming practices. I came to realize that relying solely on the use of organic pesticides is not an effective solution. It is important to

consider other factors such as location selection, crop varieties, types of organic pesticides, targeted pests, and seasonal variations. Additionally, understanding the local ecosystems, promoting plant diversity, and implementing sustainable techniques like crop rotation and integrated pest management are crucial elements in achieving success.

To ensure long-term food security and promote human health, the use of organic pesticides and the adoption of proper organic farm management are of utmost importance. However, it is disheartening that these methods are currently limited to small farmers' groups in Laos and globally. While the concept of organic farming is not new, there is a need to further explore its potential and encourage innovation in agricultural techniques. By doing so, we can pave the way for advancements and improvements in sustainable farming practices.

5. How do your Actions/activities relate to the ISS general theme?

The activities of exploring local plants, implementing sustainable farm management practices, and promoting the use of organic pesticides directly align with the theme of youth contribution toward global agricultural and environmental innovation in achieving food security and health. By actively engaging in sustainable farming practices, youth can reduce reliance on harmful chemicals, prioritize human health, and prevent contamination of soil and water systems. Through proper organic farm management, they can maintain soil health, prevent erosion, and promote biodiversity, ensuring the long-term sustainability and security of our food supply. These activities showcase the vital role that youth can play in shaping a sustainable future for agriculture and the environment, driving positive change, and paving the way for a resilient and secure global food system that prioritizes the well-being of both people and the planet.

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Indigenous Knowledge, Innovation and Utilization Technologies of Bamboo

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Keywords: Bamboo, indigenous knowledge, innovation, livelihood

1. Problem statement

Bamboo is important and valued resource since it significantly improves the livelihoods of people by boosting household income and food security in Tanzania (Lyimo *et al*., 2019). The local technical knowledge of traditional crafts, processing and harvesting methods represents not only a valuable cultural heritage in bamboo-producing areas but also provide a source of supplementary income for vulnerable communities through selling of the bamboo products produced (Binfield *et al*., 2022; Endalamaw and Darr, 2021). Despite the recognition of bamboo as a potential source of climate-smart, income-generating enterprises and its significant contribution of improving livelihoods to the local communities (Binfield *et al*., 2022); there is a lack of comprehensive understanding of the traditional bamboo uses, knowledge, and technology sources for innovation in the southern highlands of Tanzania.

This information gap hinders the ability of local communities to fully exploit the economic and social benefits that bamboo can offer. Furthermore, the limited influence of bamboo on productive land uses and its underutilization in industries such as furniture, construction, pulp, and paper making contribute to the missed opportunities for local community development. Therefore, there is a pressing need to conduct a survey to explore and document the indigenous knowledge, innovation, and utilization technologies of bamboo in Tanzania's southern highlands, with the aim of identifying strategies to enhance income generation, food security, and local medicinal treatments for the communities.

2. Student's Actions or activities

I conducted a study as part of my final year research project on indigenous knowledge, innovation and utilization technologies of bamboo. The study was carried out in Mbeya, Njombe and Iringa regions in the Southern Highlands of Tanzania. Systematic random sampling by proportional allocation approach adopted from Yamane (1967), using a sampling frame generated with the help of village leaders, was employed for sample determination. Then, data collection involved key informant interviews, focus group discussions and household surveys to obtain the data from bamboo consumers, bamboo producers and bamboo enterprises. Descriptive statistical analysis was performed to know the frequency of use of bamboo for

various products and percentage source of innovation types.

After knowing the potential of bamboo in sustainable social, economic and environmental development to our communities; I engaged in emphasizing use of bamboo in the forest landscape restoration programme which was carried out by our department and actively participated in the restoration activity. The event involved most of students from our department, and community members around the forest.

3. Implications/Results

The study reveal that local communities use bamboo for a diversity of purposes. The interviewees for this study apply bamboo for over 20 different local uses. The frequently mentioned uses were food (young edible shoots) and drinks (bamboo juice and bamboo beer (*ulanzi*)), basketry (hand baskets, winnowing trays, hats), miscellaneous crafts (mats, rugs, fish trapping cages, utensils, decorative materials), house construction, furniture (chair, bed and table), medicine (treating fever) and fuel use.

Findings on innovation technologies of this study demonstrate that indigenous knowledge and personal technical skills are main sources of knowledge for product innovation (**Table 1**). Majority of traditional bamboo enterprises gain the necessary skills, knowledge and creativity via local competitors, mass media and internet.

Table 1. Percentage source(s) of innovation employed by respondents in the study.

Source of innovation	Percentage (%)
Indigenous knowledge	42.27
Personal technical skills	30.28
Local competitors	10.1
Mass media	6.31
Internet	4.42

The socio-demographic information from the study shows that 38.15% of the respondents are youth (18-35 years old), this implies that a significant portion of youth in the local community that are actively seeking for livelihood options.

Bamboo producers also obtain indirect benefits that contribute to climate change adaptation. Bamboo provides them a good animal fodder especially in the dry season when other grass species are scarce. Bamboo grown on the agricultural farms protect the farms from flooding and soil erosion during the rainy season. Additionally, it was noted that the bamboo forests are intact and rhizome-rich, shielding the soil from too much sunshine and other disturbances. This ensures crop production even when there are unpredictable rainfalls.

4. Challenges and perspectives

The local community require awareness on adequate processing and utilization of bamboo resources. The work should have been accompanied by some actions to encourage the communities producing bamboo to upkeep the efforts being done to ensure agriculture sustainability for enhanced food security and health. For example, training programs in bamboo

plantation management, harvesting and product processing. This could be by building capacity for them to understand the co-benefits driven by proper bamboo utilization and thus improve their innovation technologies. In perspective, more research on the value chain, marketing and the best native bamboo management techniques will be needed for improved bamboo sector planning in the southern highlands.

5. How do your Actions/activities relate to the ISS general theme?

Indigenous technologies used by the local community contribute to agriculture and environmental innovation through use of bamboo as nature-based solution in ensuring sustainable food security, health and enhanced environmental conservation of not only the local, but also the global community. These actions align with the global sustainable development goals (SDGs) such as SDG 1 (No poverty), SDG 7 (Affordable and clean energy), SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production), SDG 13 (Climate action) and SDG 15 (Life on land). Therefore, these actions help in achieving a better and more sustainable future.

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Group C

Group theme

Agriculture 2

Presenters:

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Ayoubu Williadi Mtagawa, Sokoine University of Agriculture

Marwa Moilid Aboubaker, University of Djibouti

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Chairperson:

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Farmer Preferences and Willingness to Pay for Improved Seed Cane Varieties in Kenya

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Keywords: Varieties, Preferences, Willingness to Pay, Certified, FGD'S (Focus Group Discussion) KII'S (Key Informant Interviewer)

Problem statement

Seedcane seed systems in Sub-Saharan Africa have over the years been dominated by supply of planting material from sugar millers and the Sugar Research Institute (formerly, the Kenya Sugar Research Foundation). However, since 2016, the Sugar Development Levy which used to support seedcane development was discontinued. As a result, the sugar cane development including multiplication has been severely affected. The result has been farmers' reliance on the informal sector, mainly from borrowing from social networks. This has in turn affected yield levels of the sugarcane, as recycling of seedcane leads to spread of diseases and pests. Kenya, has been affected by this trend, with the country having the lowest production levels when compared with its COMESA counterparts, Uganda, Zambia and Egypt. The country's productivity is at 50-60 tons/ha against a potential of 100-120 tons/ha (Mati & Thomas, 2019). The consequence is that Kenya has continued to be a net importer of sugar with the quantities of imported sugar increasing significantly rising in recent years. On house hold basis the low yield has contributed to low house hold income among other factors.

1. Student's Actions or activities

The student conducted research in Kakamega and Kisumu counties, purposively selected to represent Western, Nyando and South Nyanza sugar belts in Kenya in order to assess the farmers' preferences and willingness to pay for certified seed cane in Kenya which has importance significance in supporting the adoption of improved seed cane varieties.

The three counties were selected because they are among the leading sugarcane producing regions in the country. In addition, the three counties are located in different geographical regions which will allow regional comparisons and testing of hypothesis on intra county variations in findings.

The secondary and primary data was used. Secondary data was collected from industry reports and international datasets such as FAOSTAT and UNCOMTRADE. A mix of methods used to collect primary data which included; Focus Group Discussions (FGDs); This mainly

targeted farmers, farmer groups, and service providers including cane cutters and transporters, Key informant interviews (KIIs); The approach targeted the key actors along the sugarcane value chain including input suppliers, traders, agricultural officers, government agencies in charge of policy and regulation, and support service providers. The selection ensured sufficient representation of all the relevant actor categories and Household survey; The survey targeted sugarcane producing households to seek information on household demographic and socio-economic characteristics, production systems, level of access to seed and farmer attitudes, preferences and willingness to pay for certified cane seed.

2. Implications/Results

The study findings revealed significant differences in various factors, including Gender, Group membership, Credit access, Access to extension services, Sugarcane land size, and Monthly income, which influenced the accessibility to certified seed cane in Kenya, For Gender (Mostly the Male made all the decisions on the sector and very few women had their contribution with regard to any activity and thus making gender factor significant, Farmers who had membership in any agricultural group had high chances to accessing the new varieties due to group benefits like loan access, information access among others unlike farmers who had not joined any group, Credit and Extension access positively enables farmers to be buy and access information with regard to new varieties unlikely who cant access both, Farmers with land Size want to maximise output from their land hence tend to learn more about ways to advance the production.

Furthermore, Education level, Sugarcane seed aid, Distance to the market, Distance to the place of acquisition and Gender were found to have a significant impact on the accessibility to certified seed cane. A predictive model was developed to determine seed accessibility, with the following equation: Seed Accessibility = 0.073 + 0.201DPA + 0.044EDL + 0.094GNDER + 0.418SCNAID + 0.031DMKT. This model incorporates various factors such as Distance to the place of acquisition (DPA), Education level (EDL), Gender (GNDER), Sugarcane seed aid (SCNAID), and Distance to the market (DMKT) to estimate seed accessibility.

Farmers with higher education level due to their level of exposure and information where able to access the improved seeds oftenly and faster compared to farmer with low educational level, Also the closer the farmer to the Place of acquistion the more probability of a farmer to access the new varieties compared to farmers far from place of acquistion as well as the distance to the market. The farmer who get aid where able to acess the new varieties due to financial power given to them inoder to buy and tarnsport to their farm among other activities.

Additionally, the study found that farmers expressed a willingness to pay for improved traits in sugarcane varieties, such as better yield, pest resistance, drought tolerance, and herbicide tolerance. The research also noted that the majority of farmers were aged 35 years and above, highlighting the need to implement initiatives and programs that attract youth involvement in the sector. Proposed measures from the study include farm mechanization, credit facilitation, educational programs, and other interventions aimed at engaging and empowering the youth in the sugarcane industry. Notably, the data collection team comprised

90% youths who were highly motivated to adopt new varieties based on their field experiences. This highlights the positive impact of their involvement in the initiative and their current adoption of new farming practices.

3. Challenges and perspectives

Some of the Challenges experienced included harsh weather condition, poor infrastructure and unwillingness to give response among respondents which made movement difficult hence low number of interviewees per day. Low budget was also a constraint and low number of youths in the farming industry led to few and little information about the youth perspective and information towards the industry.

4. How do your Actions/activities relate to the ISS general theme?

Since most of the farmers in sugarcane industry are mostly middle and old aged hence this research on preference and willingness to pay for improved cane varieties will encourage a lot of youths to adopt the new varieties for increment of their income and food security. Proposed measures from the study include farm mechanization, credit facilitation, educational programs among others which will encourage the youths to engage hence ensuring sustainability in Sugarcane sectors which inturn will contribute positively to the whole Agricultural sector.

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Infield Establishment of Proper Irrigation Scheduling of Drip Irrigation System for Maize Production Using Computer-Based Procedures. A Case Study of Crop Museum Sokoine University of Agriculture.

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Keywords: irrigation scheduling, crop water requirements and effective rainfall

1. Problem statement

There is no proper irrigation scheduling established at Crop Museum-SUA. That leads to use of more water than is required. Surface irrigation methods are used for more than 80% of the world's irrigated land, yet its field-level application is often only 40-50%. Kahimba et al, (2015). According to FAO, (2007) irrigation scheduling is one of the factors that influence the agronomic and economic viability of small farms. It is important for both water savings and improved crop yield. Also, according to Pujara, (2016) proper irrigation scheduling includes deciding when and how much water to apply to a field. In addition, Pujara, (2016) highlighted that good scheduling should apply water at a proper time and in the right quantity in order to increase production and reduce negative environmental impact. Among the merits of proper irrigation scheduling that have been highlighted by many scholars are: It helps to minimize crop water stress and increase yields; Reduce fertilizer costs by reducing surface runoff and deep percolation; Proper irrigation scheduling can be applied under conditions of limited water resources.

2. Student's Actions or activities

I started conducting special project in November, 2022. I have collected four soil samples and sent them to the laboratory for testing soil type, field capacity and permanent wilting point. These soil parameters are inserted into the CROPWAT software together with the climatic data from the CLIMWAT software, and the rooting depth of the crop for the determination of crop water requirement, effective rainfall and irrigation scheduling. This irrigation scheduling was established for use during the dry season for maize production. Currently, I'm in the final stage of preparing the special project report for final submission.

3. Implications/Results

The frequency of irrigation shown in the graph is 12 days and the net irrigation water application is indicated per respective schedule. The net irrigation water requirements, indicate

the amount of water needed to keep crop evapotranspiration at the potential rate. The planned irrigation scheduling will make the crop be between readily available water and field capacity throughout the growing period.

Tanzania covers an area of about 94.5 million ha, of which 44 million ha are classified as suitable for agriculture, of this 23% (10.1 million ha) are cultivated. The country has substantial water resources and irrigation potential of 1 million ha, of which 20% (200,000 ha) is under irrigation. Kahimba et al, (2015). In Tanzania, smallholders practice both irrigation and rainfed agriculture, depending on their location and access to water resources. In areas with water available in large quantities such as lake zone, smallholders practice rainfed agriculture. They rely on regular rainfall to cultivate maize and other crops such as beans, sorghum, and cassava. Small farmers in these areas use traditional farming practices that are adapted to their local conditions. A small holder farmer irrigator in Tanzania is seen as an individual who earns his or her living as an irrigator by owning small plots, usually not exceeding 5 hectares (although there are some who own more than 10 hectares); or one who seasonally rents such plots from other smallholders' farmers. Kweka (1996). Smallholders in the semi-arid regions of Tanzania, such as the central zone and parts of the southern highlands, rely on irrigation to grow crops. They use different irrigation methods such as surface irrigation, sprinkler irrigation, or drip irrigation system. However, the cost of an irrigation system can be prohibitive for smallholders, and they may not have access to the necessary resources or technology to set up and maintain it. The establishment of an irrigation scheduling for a drip irrigation system can be a valuable tool for smallholders, helping to improve water use efficiency, crop yields, profitability and reduce labour. Adaptation of irrigation systems such as the use of low-cost drip irrigation system with low flow rates, use rainwater harvesting and practice of deficit irrigation will help to improve agriculture and hence increase crop yields.

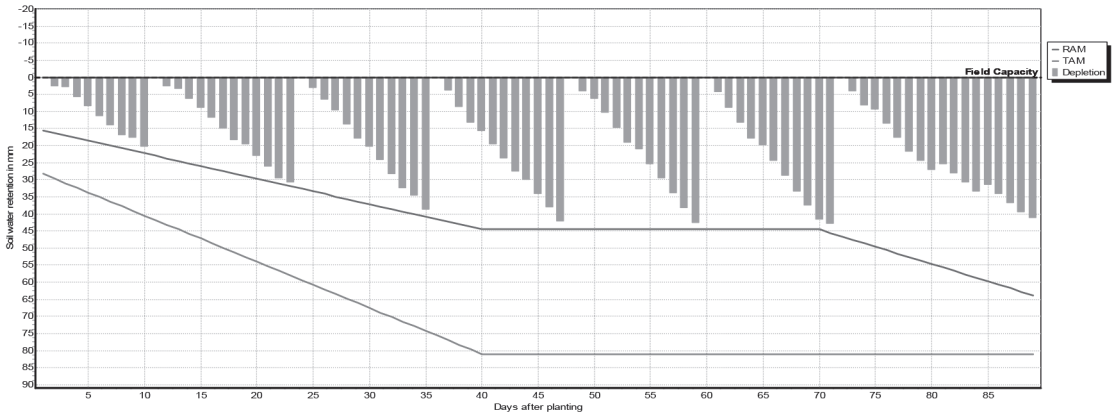

Figure 1: irrigation scheduling graph

4. Challenges and perspectives.

The first challenge is financial. I wanted the system to be computerized but due to having a financial problem I was unable to do so. Where the system would have been installed together with the electronic instruments; soil moisture sensor, microcontroller, automatic switch and valves, which would have led the system to become automatic. The second challenge is

limited time, special project takes place per semester, therefore the same time I am supposed to attend the class and also progress with the special project.

5. How do your Actions/activities relate to the ISS general theme?

These special projects link with the ISS2023 Theme which states that "Youth contribution toward global agricultural and environmental innovation in achieving sustainability focusing on food security and health" because the aim of this project is to establish a proper irrigation scheduling for maize production which will help farmers to apply irrigation water required by the crop at the right time and the right quantity and hence maximize the yield.

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Also, I am very thankful to the project coordinator for allowing me this opportunity to explore the real world and realize the interrelation without which a project can never progress.

Innovative Combination of Compost and Eggshells to Improve Saline Soil Fertility in Djibouti

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Keywords: Eggshells, compost, nutrients, calcium, agriculture

1. Problem statement

Djibouti, located in the Horn of Africa, is a small country spanning 23,200 square kilometers and inhabited by over 1 million people. The nation faces numerous challenges related to food security, agriculture, and the environment. The foremost among these is a scarcity of arable land and low precipitation levels, both of which make food production a daunting task. Given that the most of the land is barren desert and arid regions, rural communities that rely on agriculture for sustenance are particularly vulnerable (Osabohien et al., 2023).

Furthermore, Djibouti's economy and food security are being impacted by the country's fast population growth and escalating food demand, which have resulted in increased food imports. Lastly, the nation is grappling with environmental issues such as desertification and soil salinization, which are major problems.

Soil salinization is a phenomenon that adversely impacts the quality and productivity of soil by reducing crops' ability to absorb water and nutrients essential for their growth (Houssein & Jalludin, 1996). This can lead to a considerable decrease in agriculture yields, land degradation, and loss of biodiversity. Calcium can help remediate soil salinization through a process called leaching. Calcium, being a divalent cation, can displace sodium ions from the soil particles and promote their movement downward through the soil profile. By applying calcium-based amendments, such as eggshells (calcium carbonate) to the saline soil, the calcium ions replace sodium ions on the soil exchange sites. This displacement process helps to loosen the tightly bound sodium from the soil particles and allows it to be leached deeper into the soil. As a result, the overall salt concentration in the soil decreases, and the soil becomes less saline. Additionally, calcium can improve soil structure by promoting the formation of stable aggregates, which reduces soil crusting and improves water infiltration. It also enhances the availability of essential nutrients to plants and helps in maintaining a favorable pH balance in the soil. Overall, the use of calcium-based amendments can effectively remediate soil salinization by reducing the concentration of sodium and improving soil structure and fertility.

2. Student's Actions or activities

Eggshells are rich in calcium, which can increase the soil's calcium content and enhance its overall quality (Soares et al., 2013; Wang et al., 2021). Compost, on the other hand, can improve the texture and fertility of the soil. The use of eggshells in composting can also help diminish the amount of food waste sent to landfills, thereby having a positive impact on the environment. Additionally, the use of compost and eggshells can reduce the costs associated with purchasing fertilizers and other soil amendments, which can be highly beneficial for farmers.

To address the food, agriculture, and environmental challenges in my country, I employed several methodologies. Initially, I gathered discarded eggshells from kitchens and restaurants, which are rich in calcium carbonate and aid in reducing soil salinity while promoting nutrient absorption in plants. After washing and drying the eggshells, I ground them into small pieces using a hand mill. I then created compost from organic waste, such as fruit and vegetable peels, coffee grounds, and carrot tops that are high in nitrogen, potassium, and phosphorus - essential nutrients for plant growth.

I conducted a study using a design of experiments to investigate the combined impact of calcium carbonate and compost on Djibouti university soil. The main objective of this experimental design was to establish relationships between factors such as levels of CaCO3 and compost, and the corresponding responses such as pH and Electrical conductivity of the formulated mixtures.

However, as I began collecting eggshells and compost in February, it is challenging to see tangible results in plant growth given Djibouti's arid climate. Tomato crops were used to measure the performance of combined eggshell and soil. While my work is ongoing, it has the potential to yield positive outcomes.

3. Implications/Results

Despite an increase in the calcium concentration in the mixtures, the initially alkaline pH of the soil (pH = 7.8) remained unaffected. However, this increase did result in a decrease in the electrical conductivity of the mixtures, subsequently leading to a reduction in soil salinity.

The innovative combination of compost and eggshells to enhance soil fertility in Djibouti can have various positive implications, including social, economic, and environmental (Khan et al., 2017). Firstly, for social implications, this approach can improve food security by increasing local food production and decreasing dependence on imported food from neighboring countries. Furthermore, it can bolster the resilience of rural communities by providing them with sustainable farming techniques to cope with climate challenges.

Collaboration among farmers and communities can also lead to the development of sustainable agricultural practices. Secondly, for economic implications, this approach can reduce food import costs and increase local food production, which can improve the local economy. Additionally, it can create new jobs in the local agricultural sector and compost production, and improve natural resource management, reducing long-term agricultural production costs.

Finally, for environmental implications, this approach can reduce the use of harmful

chemical fertilizers and pesticides, benefiting both the environment and human health. It can also decrease soil degradation and desertification, contributing to the restoration of local lands and ecosystems, and reduce water pollution caused by agricultural chemicals. Overall, this innovative approach has the potential to yield significant benefits for Djibouti's society, economy, and environment.

4. Challenges and perspectives

The only challenge I encountered during my collection of eggshells was the difficulty of collecting them, as they are considered waste and thrown away in some cultures. Nonetheless, the innovative combination of compost and eggshells presents exciting prospects for improving soil quality and increasing crop production.

5. Actions/activities relate to the ISS general theme

ISS focuses on finding sustainable solutions to global challenges, and my project is a prime example of a sustainable solution to the challenge of food insecurity and environmental degradation. By using compost and eggshells to improve soil fertility, my project promotes sustainable agricultural practices, reduces the use of harmful chemicals, and contributes to the restoration of local lands and ecosystems. This, in turn, can help increase local food production, reduce reliance on imported food, and improve food security while also creating new jobs in the local agricultural sector. In summary, my project aligns with the ISS theme and has the potential to make a positive impact on food, agriculture, and the environment.

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Effectiveness of Pelletized Oil Palm Ash as a Soil Amendment

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Keywords: Pelletized, Oil palm ash (OPA)

1. Problem statement

Malaysia is now recorded as the world's second-largest producer of oil palm after Indonesia. The barren land in Malaysia was turned into an oil palm plantation that began in the 1960s. The oil palm industries have also become one of the waste producers with 75.61 million tons annually while the oil palm mill produced 65.35 million tons per annum based on the 2015 report (Oseghale et al., 2017). The common practice of the solid biomass waste of oil palm was used to generate energy for the oil palm mill (Hamzah et al., 2019). The ash production known as oil palm ash (OPA) is the by-product of the burning of solid biomass waste of oil palm (Elbersen et al., 2005).

The OPA has a chemical property that is suitable to enhance a soil amendment to raise the pH value of the soil since the majority of the land in Malaysia is acid sulphate soil, high aluminum (Al) and iron (Fe) (Garcia et al., 2022; Muhrizal et al., 2003). However, due to the characteristic of the OPA that is dusty and light, a direct application of OPA contributes hazardous and troublesome to the farmers. Hence, this study is to improve the form of the OPA into a pellet for ease of handling and application to the soil while minimizing the health hazard to the farmers.

2. Student's Actions or activities

The crucial activity for this research is the making of the pellet of oil palm ash (OPA). Where an additional material was added to make the pellet. Which are empty fruit bunch compost (EFBC), and rice husk (RH) were dried in an oven at 40℃ . The dried material was then ground using a cutting mill to pass a 1 mm sieve. The ground materials were then mixed at ratios 1:1:0.5 (OPA:EFBC:RH). The mixture (OPA, EFBC, and RH) was shaped into pellet form using a kitchen mixer and stirred with distilled water. The pellets were then extruded and dried at 40℃ for 24 hours in a forced-convection oven for hardening.

3. Implications/Results

Table 1 shows the chemical properties of the materials that were used to form the pellet and also the chemical properties of the formed pellet. Apart from rice husk, all other materials and the formed pellet were basic (pH >7.0). The carbon content of the oil palm ash and

compost was lower than rice husk. This is most likely because both oil palm ash and compost have undergone thermal and microbial oxidation which has led to the carbon content being lower than rice husk ask which is still intact in its original form (Lorenz et al., 2006).

Table 1 Chemical properties of the raw materials and the produced pellets.

Parameter	Materials			
	OPA	EFBC	RH	Pellet
pH	7.42	7.93	5.51	7.42
Total C	23.32	20.24	36.72	25.13
Total S	0.09	0.33	0.27	0.21
Total N	n.d.	n.d.	n.d.	1.39

Table 2 shows the pH level of soils before and after the application of OPA pellets at different rates. It was observed that the soil pH did not change after the application of the OPA pellet. The findings of the present study contradicted the findings of Suan et al. (2017) who in their study found that adding oil palm ash increased soil pH due to it being rich in calcium and potassium, which can help to increase the pH of acidic soils. It could also be deduced that the effectiveness of the oil palm ash in neutralizing soil acidity may have been diminished due to the reduced surface area of it being shaped into pellets. By reducing the surface area of the oil palm ash by shaping it into pellets, the effectiveness of it in reducing soil acidity is also reduced.

Soil electrical conductivity (Table 2) was reduced after application i.e., after the crop was harvested compared to before the corn was planted. Before the crop is planted, the soil conductivity level is usually low, as there are less organic matter and mineral ions in the soil. As the crop grows, the roots of the crop can uptake water and nutrients, which can lead to an increase in soil conductivity.

Table 2 Soil pH and EC before and after the application of the pellets.

Treatment	pH		EC	
	Before	After	Before	After
T1	7.42	7.93	5.51	7.42
T2	23.32	20.24	36.72	25.13
T3	0.09	0.33	0.27	0.21
T4	n.d.	n.d.	n.d.	1.39

4. Challenges and perspectives

The challenge here is to convince the grant owner about this research will help them to improve their productivity and directly help the farmers with the ease of handling and applying the OPA. As a researcher, we are trying to support both parties which are the industries and the farmers for better agriculture production and food security. This research still needs more work before being commercialized to the market. For the next perspective of research, we are concentrating on the potential application of the products, benefits, and limitations.

5. How do your actions/activities relate to the ISS general theme?

My research is relevant to the ISS theme of Youth Contribution to Global Agriculture and Environment Innovation. OPA is a ash produced from organic material; specifically, pelletized OPA that has been compressed into small pellets for ease of application and handling., and when added to soil, it can improve soil fertility, water holding capacity, nutrient availability, and soil health which in turn, food security and human health. Youth involvement in research on the use of pelletized OPA can lead to new insights and innovative solutions that improve soil quality, increase food security, and help farmers adopt sustainable and environmentally friendly practices.

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Group D

Group theme

Environment

Presenters:

Jason Pang, The University of British Columbia
Piangdow Chiawvitkan, Kasetsart University
Sothea Voeun, Royal University of Agriculture
Shelow Bon Monares, University of the Philippines Los Baños
Junya Kodama, Tokyo University of Agriculture

Chairperson:

Gladness Edward, Tokyo University of Agriculture
Hiroki Sato, Tokyo University of Agriculture

Evaluation of Sustainability Projects Focusing on Food Security and Health at the University of British Columbia's Student Union, Alma Mater Society

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Keywords: Sustainability Projects, Zero-Waste, Food Security, University, Student Union

1. Problem statement

The world is at a crossroads. As Western Canada's largest student union, Alma Mater Society (AMS) of the University of British Columbia (UBC) has taken an active role in creating and supporting sustainability initiatives that take an intersectional approach to help the planet, support its students, and create a better world for all. Through the guidance of the AMS Sustainable Action Plan (ASAP), the AMS has prioritized various sustainability projects that support the priorities and actions listed in the action plan. This article will analyze 3 sustainability projects at the AMS of UBC focused on achieving food insecurity and healthier student communities on-campus.

2. Student's Actions or activities

In 2019, AMS of UBC released the ASAP, a comprehensive guide for the student union's work relating to sustainability. The plan had been co-created in consultation with student leadership, staff, and faculty from across the university and works to combine sociocultural, economic, and environmental factors of sustainability into an actionable outline based on the 17 United Nations Sustainable Development Goals (SDGs). Six key target areas of Facilities Operations, Business Operations, Advocacy & Leadership, Student Services, Campus Coordination, and Indigenous Coordination were identified within the organization as having the greatest potential for meaningful and sustainable impact.

Based on the recommendations provided by ASAP, 2021/22 AMS Sustainability Team worked on 10 different sustainability projects throughout the year. In alignment with the ISS general theme focusing on food security and health, this abstract will evaluate the results of 3 specific sustainability projects: Zero Waste Foodware Strategy, Soapstand: Zero-Waste Refill Station, and Food Security Initiative.

3. Implications/Results

Zero Waste Foodware Strategy, aligning with the UBC Sustainability strategy, Zero Waste and Foodware Innovation is a guideline within the AMS Sustainable Action Plan (ASAP). The implementation plan aims to support AMS Business Operations' transition away from single-use

items and towards reusables to support a circular economy. The AMS analyzed three key topics: Exploring Monetary Incentives for Reusable Containers Amongst UBC Students, Preferences on Compartmentalization of Reusable Food Containers, and Student Perspectives on Participating in a Campus Wide Container Sharing Program. Based on a power analysis of 0.8 and effect size of 0.25, 180 UBC participants were recruited through convenience sampling. Overall, 188 responses were collected and after excluding 19 incomplete responses, the responses were left with valid data from 169 participants. Through the results, hygiene and transparency were the most important considerations when establishing a campus-wide container sharing program at UBC.

Soapstand: Zero-Waste Refill Station, Soapstand started to reduce everyday plastic consumption through a convenient and sustainable way to buy shampoo, detergent, and more. The product is a zero-waste refill station where its touchscreen interface allows a seamless experience for students to refill soap easily and conveniently. After 6 months of operations, over 179.36 L of soap has been dispensed, saving students $555.30 and the preventing over 360 plastic bottles from being consumed.

Food Security Initiative, The UBC Food Security Initiative was created to enhance food security within the UBC community by improving access to food, wellbeing support, and opportunities for advocacy in one convenient online space. The AMS partnered with the university to curate The Food Hub Market, a 9-week UBC pilot market aiming to provide low-cost groceries for the UBC Vancouver campus community, particularly students. A collaboration between UBC Wellbeing, UBC Food Services, and Sustainability Hub, this program offers food products including a range of fresh food (fruits, vegetables, dairy & dairy alternatives), breads, dried goods (pasta, grains), and canned goods (sauces, beans, tuna). This pilot aims to improve food security within the UBC community while supporting the Food & Nutrition targets outlined in UBC's Wellbeing Strategic Framework-- to reduce food insecurity for UBC community members by 2025.

4. Challenges and perspectives

The AMS would benefit from continued consultation with Indigenous and marginalized students as they are often the most affected by new strategies and policies implemented by the Society. Given the irregularities due to the COVID-19 pandemic, the AMS Sustainability Team was unable to initiate a successful consultation process with the input of members of the UBC Indigenous student population. Additionally, the Indigenous Committee, the primary stakeholders of this policy, expressed capacity limitations that extended throughout the academic year. New connections will need to be established with the UBC Indigenous community in bolstering the spirit of collaboration necessary for authentic Indigenous coordination.

5. How do your Actions/activities relate to the ISS general theme?

Through the presentation and abstract, ISS participants will learn more about how to build sustainability for their respective school's student unions using the AMS of UBC as a case

example. ISS participants will also discover various AMS sustainability projects at UBC that display environmental innovation in achieving sustainability focusing on food security and health. As a student union, sustainability projects at the AMS are youth-led. Presented projects utilize innovation and collaboration in achieving environmental, social, and economic sustainability.

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The Biodegradable Krathong and Water Pollution in Thailand

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Keywords: biodegradable materials, water hyacinth, water pollution

1. Problem statement

The Loy Krathong festival is a tradition that has been closely intertwined with the Thai people for a considerable period. The unique feature of this festival is the krathong, a decorative floating basket made from various materials. Such as foam, plastic, and paper, which are stitched together with a paper stapler. The innovative and creative designs of krathongs have attracted a significant number of tourists to participate in this festival.

Despite the many benefits of the Loy Krathong festival, it has also caused some environmental problems in the community. Due to the large number of krathongs that are made and the long time it takes for the materials to decompose, the biodegradation time of plastics is approximately 450 years, while paper takes 5 months to decompose, and foam does not biodegrade (roadrunner, 2020). This leads to water pollution and even poisoning of people who consume water from the affected sources, particularly affecting human health such as respiratory and cancer diseases, heavy metal exposure, and bacterial contamination (Haseena, 2017). According to department of marine and coastal resources of Thailand, for a period of 5 years (2017- 2021). It was found that the quantity of waste in the gulf of Thailand has significantly increased to 85 million pieces in 2021 (DMCR, 2022). Additionally, the excessive growth of water hyacinth, poses a threat to the growth of other aquatic plants and contributes to the depletion of oxygen levels in the water (Tuikrua, 2012).

Picture 1. The old krathong that commonly used in Thailand.

2. Student's Actions or activities

Based on the problem, the author developed a natural biodegradable kratong using the fiber of the water hyacinth and added a specific type of bacteria that can degrade cellulose, aiming to enhance the rate of biodegradation. The decorations such as joss sticks, incenses and flowers were replaced by color extraction from marigold, beetroot, and turmeric, and fragrance

was added by using fresh pandan juice. The entire process took approximately two weeks (January 14-28, 2023) and was showcased as part of the environmental research project under KURDI (Kasetsart University Research and Development Institute) at the Kasetsart Agricultural Fair in 2023.

This project has the potential to reduce pollution of water sources by utilizing 100% natural materials that can biodegrade on their own. Experimental results indicate that the prototype can start to decompose within 10 hours, with complete degradation occurring within 3 weeks. Moreover, the transformation of water hyacinth can help with oxygen depletion. Allowing for natural growth of organisms and safe consumption by humans and communities. Due to its potential for future development and practical application, this project is currently in the development stage with second-year fisheries students from Kasetsart University.

Picture 2. The new krathong made from a fiber of the water hyacinth called "biodegradable krathong."

3. Implications/Results

The biodegradable krathong has implications with the BCG model of Thailand, the BCG Model is a development strategy that focuses on simultaneously developing three economies, namely the Bioeconomy, Circular Economy, and Green Economy. The Bioeconomy aims to create value-added from biological resources, while the Circular Economy emphasizes the use of resources that provide long-term value. The Green Economy is concerned with the sustainable development of resources and the environment. The project also aligns with the sustainable development goals (SDGs) including 1) Good health and well-being. 2) Clean water and sanitation. 3) Sustainable cities and communities. 4) Life below water. This innovation presents itself not only as a solution to reduce water pollution, but also as a sustainable means for community development. By encouraging farmers to transform water hyacinth, a readily available aquatic plant in the community's water sources, into diverse products such as shock-absorbing materials or animal waste absorbent pads, it is possible to enhance the income of the agricultural sector on a year-round basis. As such, this innovation holds potential for promoting economic growth and environmental sustainability simultaneously.

4. Challenges and perspectives

The main obstacles of this project relate to equipment limitations. Nevertheless, this project has caught the interest by the Young Entrepreneur Assembly Hub Thailand and KU Startup, resulting in its advancement towards the industrial sector.

5. How do your Actions/activities relate to the ISS general theme?

Since water is the key to food security, it is the lifeblood of ecosystems by being an indispensable ingredient to agricultural production for crops and livestocks. Thus, the biodegradable krathong lies in its aim to improve the quality of water sources.

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Comparison of Two Scenarios for Land Use/Cover Change Prediction to 2030 in Preah Sihanouk Municipality

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Keywords: land use/cover, sustainable development, CA-Markov Model, GIS, Preah Sihanouk

1. Problem statement

Land use/cover change (LUCC) is one of the most concerning issues globally. LUCC is the most noticeable driver that impacted the biodiversity and ecosystem since its behaviors expand to the habitat area and when land use/cover aggregated globally, it turns into a massive concern that paid attention to environmental trends (Lambin et al., 2001)

To solve this problem, predicting future LUCC is very important for urban planners and decision makers to maintain a sustainable environment (Wang et al., 2018). According to the master plan for Preah Sihanouk Province in 2038 vision, this city tends to turn into an urbanization zone which included areas such as a coastal zone, urban-center zone, industrial zone, service zone, tourist zone, and housing. While previous studies have shown the significance of analyzing historical and future changes in cities in Japan (e.g. Wang et al., 2018), there is limited study in cities of Southeast Asian countries, such as Preah Sihanouk city of Cambodia. Preah Sihanouk City has been experiencing rapid development. Hence, this study aims to understand the future change in Preah Sihanouk City under different scenarios in order to provide alternatives for balancing between development, environment and biodiversity conservation.

2. Student's Actions or activities

Geographic Information System (GIS) is known for the best techniques to detect and observe phenomena occurred continuously. Remote Sensing (RS) provided detailed and pervasive information to inspect what is happening directly or indirectly to the earth, also the environment, and among those, data from satellite production is commonly used (Revuelta-Acosta et al., 2022). In this research, satellite images from Landsat were exploited to derive land use land cover change by using maximum livelihood (supervised classification) method available in ArcMap 10.8. Then Markov model was used to calculate the transition probability matrix that is available in Terrset Geospatial Monitoring and Modeling System.

Markov model is a stochastic process model that estimates how likely it is for one state to transform into another (Arsanjani et al., 2013). The Markov model has a restriction in the land use/cover simulation because, as a statistical model, it is unable to determine the geographical distribution and to overcome this limitation, CA-Markov is the best approach that

can be adopted to analyze spatial trends (Wang et al., 2018).

The Cellular Automata-Markov model (CA-Markov) is made up between cellular automata (CA) and the Markov model. CA-Markov Model simulated complex-spatial pervasiveness by thinking about the cell interaction and driving factors (Na et al., 2021). Then, the projected LULC can be conducted accordingly.

3. Implications/Results

The LULCC between 2000 and 2020 and the predicted future change in 2030 under two scenarios were analysed. Our findings provided significant insights for planners and land managers about the past and future trends of Preah Sihanouk municipality and the future challenges for the sustainable development of the city. The information on LULCC in this study can be used to help in the management of the city toward achieving the Sustainable Development Goal 11 (SDG-11) (i.e., Sustainable Cities and Communities) and SDG-15 (i.e., Life on Land). The result can be described in Figure 1.

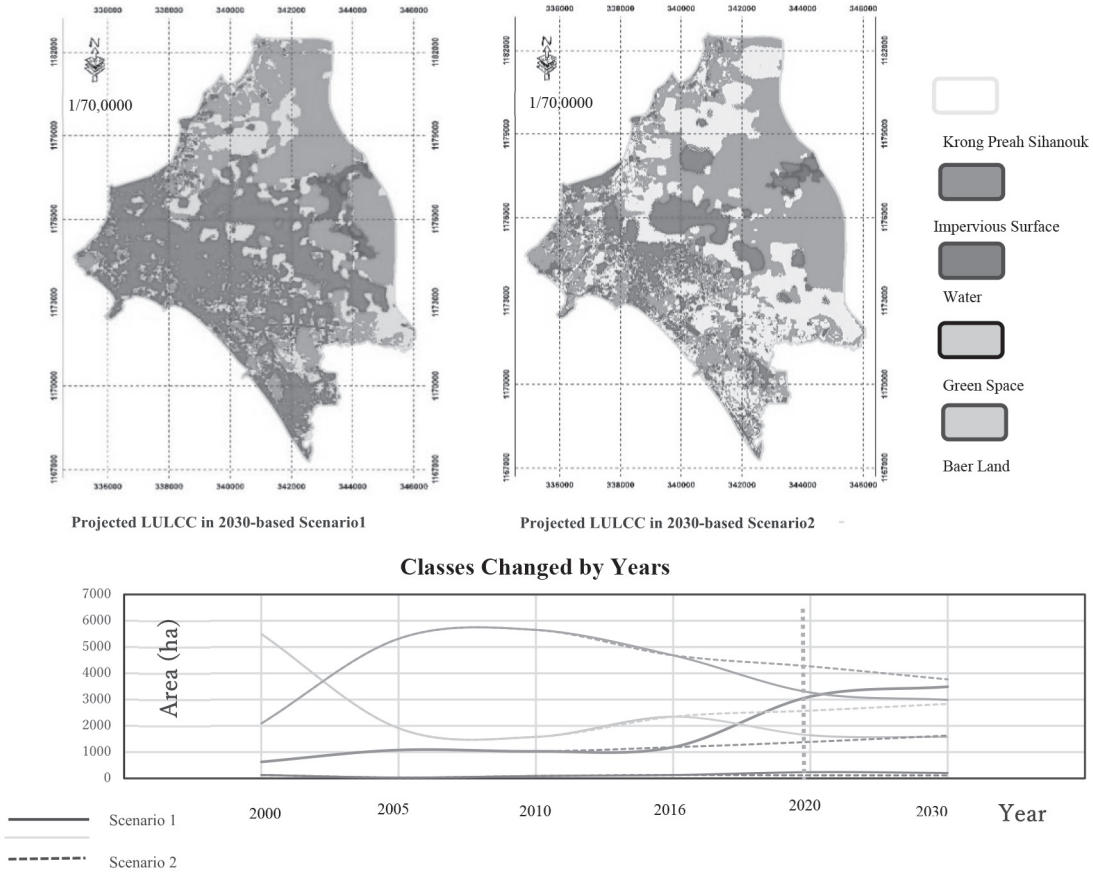

Figure 1. Comparison Maps and Areas.

4. Challenges and perspectives

Although the remoted technology is up to date nowadays, some challenges occurred while conducting this research. For instance: high-resolution satellite images and up-to-date data are not available for addresses in the analyzing process since they are commercial. Hence, we could

only use the open-source data. Furthermore, this study is based solely on scholarly literature. As a result, land managers or environmental scenario makers should be encouraged to present their notion in terms of environmental conservation.

5. How do your Actions/activities relate to the ISS general theme?

It is essential to examine the characteristics of spatial change since LULC is a part of the environmental science. The past trends told us about a particular event changed to another upon the specific period and reasons. And with determining the factors caused to environmental change such as man-made activities (deforestation, water pollution, industrialization, and so on), population increment, and overconsumption of natural resources, we can predict what will happen to the environment. Thus, the decision makers can decide what approach should be used to respond the further challenges.

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Understanding Microplastic Pollution in Soils in Laguna, Philippines: Current Status and Perspectives

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Keywords: Microplastics, Occurrence, Agricultural Soils, Perspectives

1. Problem statement

The Philippines significantly relies on its agricultural sector as a driving force in the national economic development and poverty reduction. In 2016, a total of 24% of the country's land area was used for agricultural activities wherein 90% of it was allocated for growing crops. This accounted for a ~9% contribution of the country's Gross Domestic Product (Go & Conag, 2019).

Laguna, a province located in the Calabarzon region in the Philippines, is known to play a significant role in the overall agricultural output in both regionally and nationally. The province is also home to numerous national and international research institutions, including the Philippine Rice Research Institute and the International Rice Research Institute in Los Baños. Despite being a small area, the town has served as a research hub for numerous global and local scholars, particularly in the field of agriculture.

Over the years, the abundance of Microplastics (MPs) in agricultural soils has raised concerns due to its potential threats in agricultural production posing risks in crop safety, and on a broader scale, a threat on sustainable agriculture.

Microplastics (MPs) are plastic debris and fragments that are less than 5 mm in size. Its ability to interact with heavy metals and persistent organic pollutants (POPs) cites environmental and health safety concerns (Gallo et al., 2018). Microplastics alter the soil chemistry and physical characteristics (bulk density, porosity, aggregate formation), which can have an impact on plant growth and flora nutrition uptake (Wang et al., 2019). Additionally, several researchers have found that MPs enter the food chain and are ingested by humans (Isaac Leon et al., 2022).

Although there are already numerous studies regarding Microplastics (MPs) in different ecosystems, these studies are mostly focused on the marine ecosystem. It is also unknown still unknown how it affects farmer's productivity and how it contributes to challenges in the different agricultural initiatives carried out by the local sectors.

2. Students' Activities/Actions

Despite the lack of researchers on the occurrence of MPs in agricultural soils in the Philippines, the magnitude of this global problem must not be overlooked.

With this, it aims to understand the occurrence of Microplastics in the area and the perception of local farmers in terms how it adds to their current challenges in increasing agricultural productivity.

3. Implications

Although the occurrence of MPs in soils pose various agricultural, environmental, ecological, and health risks, there are still many aspects such as its analytical methods, sources, fate, and ecological risks that need to be further investigated. With the insufficiency of data on the concentrations and compositions of microplastics in soil environments, it is still hard to grasp the total pollution status of microplastics.

It can also be implied there is still needed to raise an awareness on how it affects the farmers' agricultural productivity.

4. Challenges and perspectives

Microplastic pollution across different environmental matrices has become a global problem. The implications can also be a basis for environmental policymakers on implementing environmental-friendly agricultural practices to control the distribution of plastics and minimize the potential impacts of microplastics in agricultural soils.

5. How do your Actions/activities relate to the ISS general theme?

To conclude, understanding how Microplastic abundance in agricultural soils would bring empowerment to the farmers and local society in ensuring food safety and security, maintain soil quality, and promote sustainable farming methods. With a knowledgeable local society, agricultural systems can be sustained over a long run.

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Using Igneous Rocks to Absorb Carbon dioxide and Fertilize Farmland

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Keywords: global warming, fertilization, igneous rocks

1. Problem statement

It is estimated that 2 billion people will go hungry by 2050 (United Nations Information Centre, 2018). Global warming is cited as the cause of this severe food crisis. Global warming causes extreme weather events and crop failures. These food crises are particularly severe in Africa (United Nations Information Centre, 2018).

Therefore, two approaches are required to solve the food crisis. The first is to reduce atmospheric carbon dioxide and prevent global warming. The second is to increase crop production, even under extreme weather conditions. Our research team focused on yams and cassava; two tropical crops important in Africa where the food crisis is expected to be severe. These two crops are resistant to extreme weather events. If we can increase the yields of these crops, we will be able to hinder the food crisis.

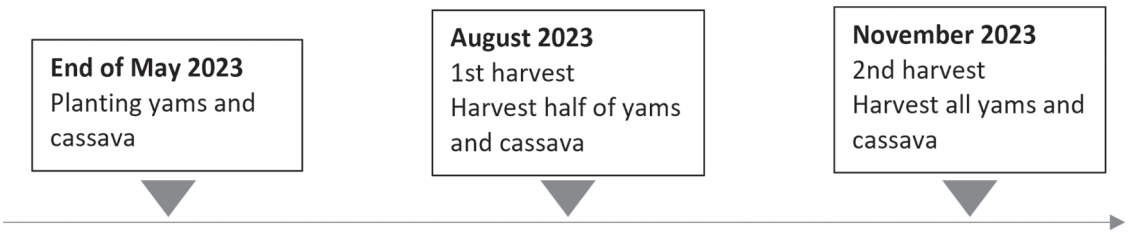
My goal is to create a system that simultaneously reduces carbon dioxide in the atmosphere and fertilizes farmland. This research was inspired by Beerling's (2020) findings showing that minerals absorb carbon dioxide as they weather. We decided to use igneous rocks for our experiment. Igneous rocks are rocks that have cooled and solidified from magma. Igneous rocks are thought to absorb carbon dioxide during the weathering process. They also contain large amounts of Mg, SiO_2, Fe, and Ca, which are important for crop growth. Based on these characteristics of igneous rocks, we devised a method of spreading igneous rocks on farmland to simultaneously satisfy both the absorption of carbon dioxide and the fertility of the farmland. A mechanism was also devised to artificially crush the igneous rocks to expand their surface area and accelerate weathering.

2. Student's Actions or activities

In this study, I will apply artificially crushed igneous rocks to yams and cassava, respectively, to investigate their effects. The test will be conducted on Miyako Island, a remote island in Okinawa Prefecture, the southernmost prefecture in Japan. Miyako Island has a subtropical climate and is warm throughout the year. In other words, it is the most suitable place to grow tropical crops in Japan.

Pot tests and field tests are ongoing for both yams and cassava. In the pot tests, the rate of igneous rocks to be applied was finely divided to study the impact of the igneous rocks on the crop in detail. In the field tests, igneous rocks were applied under actual crop production conditions and their effects on yam and cassava growth will be evaluated.

The timetable of my research



3. Implications/Results

If our research is successful, it will have a positive impact on society, the economy, and the environment.

First, I will discuss the social impact. Currently, chemical fertilizers are widely used in agriculture. The raw materials for chemical fertilizers are produced only in limited areas of the earth. Importing chemical fertilizers leads to the fact that agriculture is affected by the international situation. In fact, the current Russian-Ukrainian crisis has increased the price of chemical fertilizers and caused great damage to the world's agriculture. By using igneous rocks, which are found all over the world (Jennifer Wilcox et al. 2021), as fertilizer, some agricultural activities, especially the need for fertilization, will be less affected by international conditions.

Next, I will discuss the economic implications. "Carbon pricing" is being introduced around the world(The World Bank, 2022). It is a system that requires a financial contribution based on the amount of carbon dioxide emitted. Carbon dioxide emissions can be reduced by using igneous rocks to absorb it. It can reduce economic pressures.

Finally, the environmental impact supposes that igneous rock could be crushed with less carbon dioxide emissions than producing other fertilizers. The igneous rocks can absorb carbon dioxide and fertilize farmland. This will help to reduce global warming and increase crop production.

Relationships with other students

I am not conducting this research alone. I am also assisted by my friends who are staying with me on Miyako Island. There is also a team that is studying the microorganisms in the soil I am growing, and another team that is studying carbon dioxide absorption. I am cooperating with these teams in my research.

4. Challenges and perspectives

Challenges

In this study, the igneous rocks are finely crushed. However, igneous rocks were too fine and were blown away by the wind when it was sprayed on farmland. In addition, rainwater

might separate the soil from igneous rocks, causing igneous rocks to wash away. To solve these problems, the following ideas have been considered. Increasing the grain size of igneous rock powder, coating the surface of igneous rock powder, etc.

Perspectives

In order to actually implement this system using igneous rocks in Africa, first, costs must be reduced. Therefore, I would like to investigate how the effect of igneous rocks applied to the farmland persists over the following years. It is also necessary to conduct research using not only yams and cassava, but also other crops grown in Africa, such as cowpeas, maize, and millet, as well as in Asia.

5. How do your Actions/activities relate to the ISS general theme?

My research will improve both global warming and agricultural fertility issues. This makes food and health sustainable. This means that it is exactly in line with the ISS theme.

The ultimate goal of my research is to prevent global warming and to solve food problems in tropical areas. To achieve these goals, the efforts of our young people are essential. We must also come up with sustainable methods so that agriculture can be continued by the local people. Here I confirm the ISS theme for this year. "Youth contribution toward global agricultural and environmental innovation in achieving sustainability focusing on food security and health."

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Group E

Group theme

Food 1

Presenters:

Naomi Kanini Ngiri, Jomo Kenyatta University of Agriculture and Technology
José Alejandro Gil Flores, Chapingo Autonomous University
Terry Lin, Western Sydney University

Chairperson:

Shunta Kihara, Tokyo University of Agriculture
Ruth Nyambura, Jomo Kenyatta University of Agriculture and Technologoy

Capacity Building Of Youths: The Route To Achievement of Sustainable Development Goals

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Keywords: Food, Youth, Environment

1. Problem statement

The United Nations set 17 goals in 2015 for tracking progress towards making the world "a better place for everyone, without poverty, protect the planet, and ensure prosperity for all by the year 2030". Among the 17 goals are: SDG 1 (eradicating poverty in all forms) and SDG 2 (eradicating hunger and malnutrition) which are of particular interest to agriculture students in Kenya. Kenya is within sub-Saharan Africa where, together with South Asia, 80 percent of the global population living in extreme poverty (less than US$1.90 per day) reside. Although the constitution of Kenya guarantees the right to access of adequate and nutritious food, to all Kenyans, in 2022, Kenya had a serious hunger level score of 23.5, (Global hunger index 2022). Ogelo & Munguti (2016) earlier observed a worrying trend in the country. With the increasing population, more food will be required. The inability to provide adequate food and agricultural products for the majority of Kenyans is due to low agricultural production caused by inappropriate production practices.

Lack of employment for the youth is another serious problem in Kenya which partly contribute to food insecurity. Munene (2021) reported that unemployment rate among the youth aged 20 to 29, including the fresh university graduates, is over 30 percent and projects it to increase to 50 % in the near future. Agriculture students are trained to engage in agricultural activities which are responsible for the production of food and other agricultural materials for industrial use. However, many graduates often lack practical skills required by the industry. This is because the practical sessions offered in their curricula at the training institutions are inadequate and do not fully prepare the graduates for the career demands. There is therefore a need to address the problem of skill gaps among the youths to enable them to join the labor force and contribute to the attainment of SDGs, especially SDG 1 and 2.

2. Student's Actions or Activities

The Horticultural Students Association (HOSA) at Jomo Kenyatta University of Agriculture and Technology (JKUAT) is an initiative that seeks to contribute to the solutions of the above problems. The objective of HOSA is to provide a forum for exchange and exposure to theoretical knowledge and practical skills in the agriculture industry. Through HOSA, students engage in practical and innovative activities in agriculture. The activities include: propagation of seedlings - vegetables, fruits and the indigenous tree; production of vegetables; installation of drip irrigation system and installation of urban gardens.

Raising of seedlings of various crops makes planting materials readily available to the

immediate community thus contributing to increased food production. Through the installation of drip irrigation systems for farmers HOSA helps farmers to optimize on the use of the available water. The students have also come up with other innovations that enhance efficiency in the use of water in farming. The different models of capillary wick system that stores water below the surface of the growth media have helped in reducing the frequency of watering crops. The members also design and install urban gardens that allow people living in urban centers to grow their own food safely.

Fig.1: HOSA members preparing land for planting vegetables (Left) and a client picking fresh vegetables from a vertical garden installed by HOSA (Right).

3. Implications/Results

Through these activities the members apply the knowledge gained in class and develop practical skills. They develop confidence in their ability to perform certain tasks which enables them to take up challenging ventures such as entrepreneurship. The Urban Smart Gardeners Limited, JK Smart Farm Services, Zion Green and Thuku Farm Products and Services are examples of small-scale business startups (started by HOSA alumni) which are providing job opportunities to youths in Kenya. The businesses also provide extension services to farmers hence contributes to food production.

The farmers are able to acquire vegetable seedlings from our propagation unit to grow for their own home use or for sale. The Association has also been providing vegetables to JKUAT fraternity thus contributing to food and nutrition security. During the COVID-19 pandemic, HOSA members were involved in providing vegetables to families affected by lockdown and travel restrictions.

The installation of the irrigation systems such as the drip irrigation and the capillary wick system greatly help in conservation of water which contributes to climate change adaptation. In addition, we have started an initiative called Comrades Against Biodiversity Loss and Climate Change (CABLOCC) where we collect seeds of indigenous trees in Kenya that are at the risk of extinction, we propagate seedlings for planting in order to conserve these indigenous trees. Through this initiative we are contributing to climate change mitigation and conservation of biodiversity.

4. Challenges and perspectives

One of the challenges faced by HOSA is that very few youths want to be involved in

agriculture. Many consider agriculture as an inferior course and rather prefer the white-collar jobs to farming. Furthermore, very few students volunteer to join HOSA for fear of being unable to balance the academics and the activities at HOSA. Consequently, the manpower available to run the association is limited. The other challenge is that the association has limited financial resources for smooth running of its activities. The Association is therefore unable to purchase the items required for carrying out all activities as planned.

5. Relevance to ISS theme

The actions of HOSA are aligned to the two themes of ISS as follows:

Global agriculture and environmental innovation: HOSA activities expose students to the challenges that farmers face, triggering minds to find efficient ways of doing things. For example, the single node cutting propagation method to replace vines in the production of sweet potatoes was developed. The students have come up with different models of the capillary wick system that fits crop production in arid areas. The students are able design and install urban gardens using the available space.

Sustainability: HOSA has been a training hub for sustainability. It shapes the entrepreneur skills in its members training them to be employers in their generations. The activities of the association are geared towards climate change and waste management through initiatives such as composting. The students' rear rabbits which are fed on some of the vegetable remains while providing manure and urine that is used as a biopesticide and a liquid fertilizer. The model has embraced the circular economy system that minimizes on waste production. The indigenous trees project under CABLOCC initiative also utilizes the eco-friendly potting materials while recycling the liquid milk packaging bags to avoid the environmental pollution. There are also plans to undertake mushroom production and rearing of black soldier flies for waste management and production of food and feed.

The activities of Horticultural Students Association therefore contribute to the UN Sustainable Development Goals especially SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 4 (Quality Education and SDG 13 (Climate Action)

6. Acknowledgements

I would like to express my sincere gratitude to my supervisor, Prof. John Wesonga for his guidance in writing of this abstract and willingness to support the association at all times. Thanks to all HOSA members for their dedication and being the change, the society requires.

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Holistic Approach to Reach Food Sustainability

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Academic Advisor: Dr. Javier Ruiz Ledesma

Keywords: sustainability, food security, sustainable agriculture

1. Problem statement

It is undeniable that over the years challenges such as sustainability and food insecurity have become increasingly important. It is essential to adopt sustainable agricultural practices while satisfying food demand and protecting the environment. FAO (1996) defines food security when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Moreover, Nguyen (2018) defines a sustainable food system as a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised. Thus, we need to find a way to achieve a food system that is sustainable and at the same time provides food security for everyone.

In terms of sustainability, agriculture plays a key role since it is one of the main ways to obtain food. Finding a truly holistic sustainable agriculture model can bring us closer to achieving food sustainability. Sustainable agriculture is agriculture that, in the long term, improves the quality of the environment and the natural resources on which agriculture depends; satisfies basic human food and fiber needs; is economically viable; and improves the life quality of farmers and society as a whole (American Society of Agronomy [ASA], 1989, as cited in Rojo González & Ley García, 2018).

2. Student's Actions or activities

We must address food sustainability with a holistic approach, which means that we must face this problem considering its dimensions as a whole, in practice it is this way, we cannot completely isolate each one of these dimensions because we live in an interconnected world. Rojo González and Ley García (2018) list five dimensions of sustainability: economic, social, environmental, cultural, and technological-institutional.

I am going to review some models of sustainable agriculture that aspire to be holistic, analyzing them and classifying their principles in the dimensions of sustainability that I mentioned above. In addition, I will propose a model that attempts to fit these dimensions and is consistent with the definition of the ASA of sustainable agriculture.

3. Implications/Results

Table 1. Some sustainable agriculture models and their principles (classified).

	Agriculture model			
Sustainability dimension	Agroecology [a]	Biodynamic farming [b]	Permaculture [c]	Integrated production agriculture [d]
Economic	・Economic diversification		・Use small and slow solutions	
Environmental	・Recycling ・Soil health ・Animal health ・Biodiversity ・Sinergy ・Input reduction	・Crop diversification ・Crop rotation ・Animal husbandry ・Biodynamic compost ・Solutions using homeopathy	・Catch and store energy ・Use and value renewable resources and services ・Produce no waste ・Integrate rather than segregate ・Use and value diversity	・Agro-ecology approach ・System approach
Social	・Co-creation of knowledge ・Connectivity ・Land and natural resource governance ・Social participation		・Creatively use and respond to change	
Cultural	・Social values and diets ・Fairness	・Lifeforce	・Observe and interact ・Obtain a yield ・Apply self-regulation and feedback ・Design from patterns to details ・Use edges and value the marginal	
Technological-institutional				

Note. [a](Wezel et al, 2020). [b](Jagdish, 2019). [c](AGRIVI, 2022). [d](IOBC-WPRS, 2022).

As we can see, none of the models cover all dimensions mentioned above, and none include any principles on the technological-institutional dimension. Also, it is noticeable that all of them tend to consider the environmental dimension more than any other.

We need a sustainable agriculture model that covers the economic, social, and technological dimension, too. It is necessary to address issues like economic stability for small producers, designing tools that no longer use fossil fuels, promoting circular economies and a fair payment to producers. A truly holistic approach considers all the dimensions of sustainability and reinforces an integral focus, emphasizing the cultural approach, where the new generations are oriented towards a more sustainable future.

4. Challenges and perspectives

To achieve sustainable food production in a holistic way, it is crucial that individuals from all backgrounds and positions work together. The application of methodologies that promote sustainable agricultural practices and education on the socio-economic, cultural, and technological aspects related to this field will lead to change society's perception of this issue and result in a brighter perspective where everyone has access to healthy food.

5. How do your Actions/activities relate to the ISS general theme?

Talking about current significant issues like food sustainability and food security is crucial to raise awareness, particularly among young people. Finding and implementing an agriculture model that fits all dimensions of sustainability will increase the odds of achieving food security, although addressing sustainability holistically is a complex thing to do. Youth must become involved in discussions and initiatives in their local environment, and in this way contribute to reach a sustainable and secure food system.

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Vegetable Protected Cropping in Warm Climates: A Greenhouse Modelling Approach

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Keywords: simulation, climate, greenhouse

1. Problem statement

The world is currently in a race to meet the economic and environmental demands of a future where food production levels may need to rise as much as 70% by the middle of the century (Hunter et al., 2017). This is despite an ongoing competition for arable land, as the worldwide greenhouse market is driven by urbanization, climate change, and population growth. High-tech protected cropping holds great potential to improve global food security by shielding crops from insects and pests, rain and wind, while stabilizing temperatures and light conditions. Consequently, these structures offer increased yields, improved crop quality, and reduced environmental impacts compared to traditional open-field cropping.

Worldwide, uptake of protected cropping is complicated by several common factors. For instance, in Japan, it was estimated that the area occupied by greenhouses and glasshouses comprised 43,232 hectares as recently as 2018, with the total area declining due to an aging population of farmers (Ministry of Agriculture, Forestry and Fisheries 2018). In the Netherlands, rising costs of gas and imported energy coupled with looming carbon emission targets are similarly placing pressure on growers (Paris et al. 2022). Greenhouses (glasshouses, polyhouses and polytunnels) are currently estimated to comprise 32% of all indoor cropping structures larger than 2000㎡ in Australia, amounting to 4,405 hectares compared to 9,905 hectares of shade and permanent net structures (Applied Agricultural Remote Sensing Center UNE 2023). However, it is evident that we share many of the problems in up-front investment costs, ongoing energy costs, lack of new generations of experts, and uncertainty about economic returns, which have limited the adoption of protected cropping in Australia in recent years.

While emerging technologies, such as light-blocking or light-shifting cover materials and desiccant-based air-conditioning apparatus, can potentially reduce ongoing costs, the costs associated with installation and experiment runtime for these technologies remain high. Ultimately, there are few tools available to evaluate the economic feasibility of these technologies in high-tech greenhouses, in different climates, and with different crops. Thus, it is imperative to develop tools to evaluate the feasibility of emerging technologies in various greenhouse settings. One approach is to use advanced modelling techniques, such as transient system simulation software (TRNSYS), to simulate and optimize greenhouse performance under different scenarios. Such models can provide insights into the potential energy savings

and economic benefits of new technologies, as well as help growers make informed decisions about investments in greenhouse infrastructure. Additionally, there is a need for greater collaboration and knowledge-sharing among researchers, current and future growers, and industry partners, to ensure that newer generations of growers are familiar with not just the theoretical economic feasibility and environmental sustainability of emerging technologies, but also the practical aspect of their maintenance and operation.

2. Student's Actions or activities

My work involves the development of a high-fidelity greenhouse energy model integrating crop growth, greenhouse climate, and HVAC (Heating, ventilation, and air conditioning) technology sub-models to optimize energy savings and crop productivity. The model is designed in the software suite TRNSYS which uses time sequence functions and algebraic and first-order differential equations to produce and configure energy/mass balance, steady-state thermodynamic, and transient thermodynamic sub-models which simulate the thermal behaviour of buildings over time. This model is intended to predict the performance of other crops and cooling technologies, to serve as a decision support tool for protected cropping in warm climates. Some components such as ventilation, photosynthesis, and surface temperatures are simplified based on measured data. The simulation results indicate that the model exhibits a satisfactory level of performance and is appropriate for predicting climate and crop outcomes for greenhouses.

Statistical modelling approaches such as elastic net regression are also applied to phenological, physiological and sensor datasets collected from climate-controlled greenhouses to validate each component of the model. To promote education in the operation of greenhouse technologies, several sensor datasets were also introduced to lectures and tutorials for a protected cropping course, 'Greenhouse and Control Systems', with 100 students throughout April and May 2023. The manipulation of sensor data through machine learning is intended to offer insights into science-based methodologies of high-tech greenhouse optimization.

3. Implications/Results

Several parameters were examined, including chiller energy usage, chiller supply and return water temperatures, water pump activity, tracer gas concentration, outside wind speed, and outside solar radiation. The provided datasets allowed derivation of parameters such as water flow rate, ventilation rate, and normalized or adjusted energy usage which are important optimization targets from an industry perspective. Such sensor datasets were also demonstrated to unearth complex interactions between greenhouse design and cooling behavior. For instance, students assessed the effect of orientation of greenhouse openings upon temperature, identified mis-calibrated energy meters based on model performance metrics, and investigated the effect of various climate parameters upon yield using decision support tools. Ultimately, by relating such sensor datasets and analysis to greenhouse interactions with statistical modelling, students gain the foundational knowledge to manage and work in protected cropping settings alongside emerging technologies.

4. Challenges and perspectives

Given the interdisciplinary and evolving nature of protected cropping, educating growers can be both costly and challenging. Investigating greenhouses via statistical modelling can allow smoother visualization of complex interactions between crops, climates, and technologies within a relatively short period. Given the complexity of the topic and the amount of data to be analyzed, time constraints are major factors which otherwise limit a student's ability to fully understand these concepts. However, the effective use of greenhouse technologies and statistics requires certain prerequisite knowledge, especially concerning the interpretation of statistical results and metrics alongside data processing fundamentals. It is imperative that the material is simplified in a manner that is understandable regardless of their educational background, otherwise modelling provides visual aids but does not facilitate learning.

5. How do your Actions/activities relate to the ISS general theme?

The visualization of greenhouse structures and systems through a high-fidelity model and statistical modelling supports growers and agricultural students in understanding the optimization and function of various greenhouse components. Additionally, developers of emerging cooling technologies can interact with the model to explore different design options, configurations, and systems suiting their needs, promoting the identification of efficient and cost-effective technologies. Ultimately, the combination of high-fidelity greenhouse modelling and statistical modelling supports informed decision-making leading to better crop yields and quality and improving the barrier of entry to high-tech protected cropping for young growers.

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Group F

Group theme

Nutrition

Presenters:

Azzahra Putri Santi, IPB University
Happiness Japhet Mwapina, Sokoine University of Agriculture
Amanda Janmaweera, University of Peradeniya
Li-Ya Chu, National Chung Hsing University

Chairperson:

Mwangi Kamita, Tokyo University of Agriculture
Nozomi Nakajima, Tokyo University of Agriculture

Strengthening Mindset and Skill for Pregnant Women in Efforts to Reduce Stunting Through the Program Milestones

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Keywords: catfish, love method, microgreens, milestone, pregnant, stunting

1. Problem statement

Stunting is a condition chronic growth failure caused by nutritional deficiencies during the critical period of growth, which encompasses the first 1,000 days of life from pregnancy to the age of 2 years (World Health Organization). Child stunting has both immediate and long-term effects. These include higher rates of illness and death, impaired child development and learning abilities, increased vulnerability to diseases in adulthood, and decreased productivity and economic potential (Stewart et al., 2013).

The number of stunting cases in Indonesia has reached 23.8% or 7.3 million children under five, according to the Ministry of Health of the Republic of Indonesia (2021). However, stunting cases in Indonesia in 2021 are still far from the target set by WHO, which is no more than 20%. According to Irmaida et al. (2021), Bogor Regency is one of the districts in West Java that is included in the stunting intervention priority. In 2021 the prevalence of stunting in Bogor Regency will reach 9.89 percent (Information Management and Documentation Official for the Bogor Regency Government, 2022). So far, the handling of stunting cases in Ciaruteun Udik Village has only been in the form of counseling to pregnant women, giving vitamins and biscuits as complementary foods for breast milk (MP-ASI) for toddlers aged 2-5 years. This makes the knowledge and skills of pregnant women in handling stunting low.

Therefore, pregnant women need to increase their knowledge and attitudes related to fulfilling nutrition and skills related to providing easily accessible and affordable sources of high-quality protein. Thus, this knowledge and attitude can strengthen the capacity of pregnant women in fulfilling nutrition during pregnancy as an effort to prevent the birth of stunted babies. In addition, there are also many false myths that are spread in society, such as pregnant women who are prohibited from eating fish and other seafood because it makes milk sour. In fact, fish is a good source of protein and minerals. It is also rich in omega-3 fatty acids, which are necessary for the development of the baby's brain and vision (Dighriri, et al., 2022).

2. Student's Actions or activities

The Milestone Program is held from June 1 to September 28, 2022 in Ciaruteun Udik Village, Cibungbulang District, Bogor Regency. The Milestones targeted 23 people out of 60 pregnant women in Ciaruteun Udik Village. The stages of implementing the Milestone program are as follows: **First**, program socialization. **Second**, strengthening the knowledge and attitudes

of pregnant women regarding the causes and stunting prevention, and balanced nutrition through LOVE (Learning Optimal Via Educator) method. The LOVE method is an educational and debriefing method regarding stunting, which is equipped with the 3B method in Indonesian language, namely Bertanya (asking), Berpendapat (argue), and Bertindak (act) to build partner engagement and goals in obtaining further information related to stunting. **Third,** training on skills in cultivating microgreens and cultivating catfish in buckets consists of making catfish cultivation media, practicing catfish cultivation, cultivating microgreens, and training in processing highly nutritious food from catfish and microgreens. The selection of catfish cultivation training in buckets and microgreens cultivation is based on Nuha and Utami's research (2020); catfish is a good alternative source of protein and contains 40% of the intake of vitamin B12 needed by the body to support children's nutrition.

3. Implications/Results

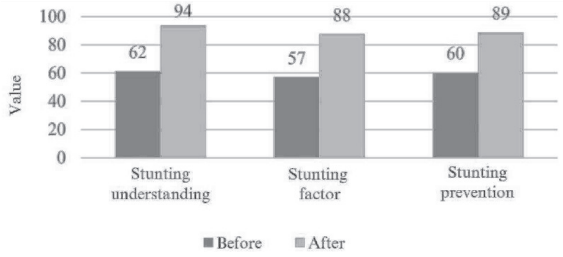

Figure 1.

Figure 1 shows the effect of LOVE method implementation. Before the implementation of the LOVE method. Their knowledge about the causes of stunting increased by 41.97%, and their knowledge about stunting prevention increased by 32.58%.

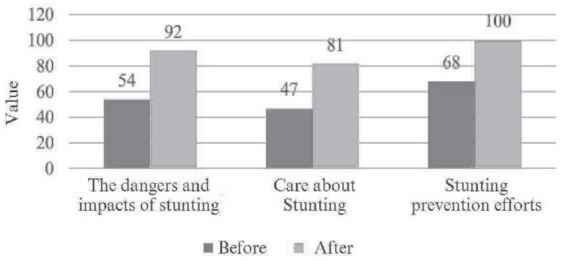

Figure 2.

Figure 2 shows the impact of the LOVE method changes on the partners' and targets' attitudes towards stunting, such as awareness of the dangers and effects of stunting, concern for stunting, and efforts to prevent stunting.

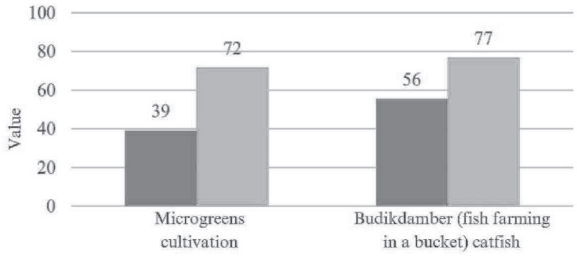

Figure 3.

Figure 3 shows the change in knowledge about catfish farming and microgreens. There was a 45.83% change in the knowledge category of microgreens cultivation, and in the category of catfish cultivation in buckets, there was an increase of 21%.

4. Challenges and perspectives

One of the challenges our team faces is changing the beliefs of pregnant women about protein intake during pregnancy. The general belief that eating fish during pregnancy will cause sour milk is common among pregnant women in the program implementation areas.

However, through an ongoing education and extension initiative called the LOVE Method (Learning Optimal Via Educator), attitudes of mothers are slowly starting to change.

Milestones can become a sustainable stunting prevention program in other regions through the pentahelix collaboration by involving the active role of local youth. This program can be replicated and implemented in other villages.

5. How do your Actions/activities relate to the ISS general theme?

One essential aspect of this is addressing stunting, a common problem among children in developing countries. Milestones, a program focused on mindset and skill strengthening for pregnant women, can help reduce stunting rates. The program emphasizes the importance of proper nutrition, hygiene, and healthcare during pregnancy to ensure that the baby develops healthily. With the help of the youth' s innovative ideas and initiatives, programs like Milestones can continue to evolve and address the global challenge of stunting, ultimately improving the health and well-being of future generations.

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My grateful appreciation goes to Dr. Ujang Suwarna, S.Hut, M.Sc.F.Trop who served as a mentor throughout the preparation of this program. This work would not have been possible without the contributions of my teammates, Hasna Sri Aprilianti, Censa Amelia Febriyanti, Gallant Son Moslem, and Rifqi Hafidz Ash-Shiddiq.

Influence of Food Security on Dietary Intake among Toddlers in Kigoma Municipality

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Keywords: Food Security, Dietary intake, Toddlers

1. Problem statement

Food security is defined as the availability, accessibility, and affordability of nutritious food that meets the dietary needs and preferences of individuals (FAO, 1996). Food insecurity affects the health and well-being of individuals, particularly vulnerable populations including toddlers. Toddlers refer to children between age of one and three years old who are in the process of learning to walk and talk. These are typically active and curious and they often engage in the exploratory behaviour as they learn about the world around them. Holloway et al. (2019) reported that access to sufficient and diverse food in Kigoma is limited by poverty, inadequate infrastructure, and lack of access to markets and food production resources resulting into poor dietary intake among toddlers and finally malnutrition. As it is defined, malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization. Kigoma is among the Tanzanian regions with noted high prevalence of malnutrition (37.9%) above the national level (MoHCDGEC *et al.*, 2016). The 2022 Tanzania Demographic Health Survey and malaria indicator survey (TDHS-MIS) data shows that, Tanzania has made significant progress in reducing child malnutrition however; the level is still unacceptably high. The same survey reported that, only 19% of children aged 6-23 months met the minimum dietary diversity requirement (MoH *et al.*, 2022). Evidence by Gibson (2019) revealed that food insecurity is associated with poor dietary intake among young children. Black *et al.* (2013) reported that children from food-insecure households are more likely to consume a diet low in essential nutrients for healthy growth and development such as vitamin A, iron, and zinc. Additionally, food insecurity can lead to a higher risk of obesity among young children, as they may consume more energy-dense, nutrient-poor foods just to meet their hunger needs (Gibson, 2019). Although other studies have explored the relationship between food security and nutrition outcomes in children, there is limited research on food security and dietary intake among toddlers in this context. Hence, there was a need to assess the influence of food security on dietary intake among toddlers which was the aim of this study.

2. Student's Actions or activities

The study comprised of a need assessment survey which was conducted to generate knowledge on food security situation and dietary intake among toddlers. This helped to identify gaps that can help to design context specific interventions to solve malnutrition among toddlers.

It involved data collection among 100 randomly selected mothers/caregivers with toddlers between 1-3 years old while excluding toddlers with known chronic health condition or developmental delays from Bangwe Ward in Kigoma Municipality. Data were collected using a structured questionnaire which were administered through face to face interviews to obtain information on demographic characteristics, dietary intake of the children and food security which were assessed using House Hold Food Insecurity Access Scale (HFIAS). The collected data were analysed using SPSS software version 20 where both descriptive and inferential statistics obtained.

3. Implications/Results

According to the Household Food Insecurity Access Scale (HFIAS) from Food and Nutrition Technical Assistance (FANTA), hundred households with toddlers were interviewed whereby; only 1% were food secured, 21% were mild food insecure, 76% were moderate food insecure and 1% were severe food insecure. The tables below represents households' food security and number of meals consumed by toddlers.

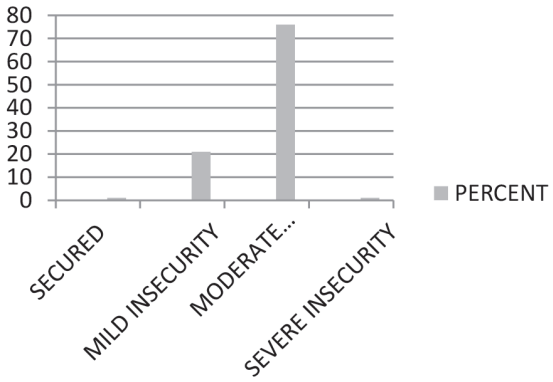

Fig 1. Households food security

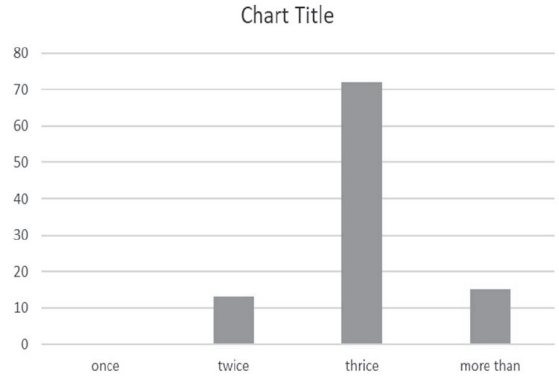

Fig 2. Number of meals eaten by toddlers

As the large percent of many households fall under mild and moderate food insecure, it influenced child feeding practice results that shown 13% were fed on two meals, 15% fed on more than three meals and 72% of toddlers were fed 3 times a day which is similar to adults or family meal pattern. The most commonly fed food during breakfast was porridge (79%). Majority (80%) of children were fed on ugali and vegetables during lunch time and during dinner. 54% of children were fed on rice with stew followed by those who were fed on ugali and vegetables (30%). On the other hand, half of the toddlers were reported to be provided with milk as their refreshment however, this is not commonly done. These findings imply that children were mostly fed on the family meals with regards to types of food and the frequency of feeding. It also seems that children are commonly given plant based foods as compared to animal source foods due to low incomes status among their households. Vegetables consumption on the other hand seems to be low as it is fed just once in a day to a small proportion of the children while fruits are not consumed enough by children. These imply that children are not getting nutritious foods for their growth and development. Moreover, although these households are located in fishing sites, children are not fed much on sea foods creating a need to find out the reasons behind such practices.

Generally, this study provides information to policy makers and practitioners to design

interventions in order to improve food security and dietary intake among toddlers as one of the solutions for addressing the reported high rates of malnutrition in Kigoma Municipality. Likewise, the study poses opportunities for further researches on food security particularly on dietary intake among toddlers.

4. Challenges and perspectives

The challenge in doing this study and in promoting actions to address the problem are literacy rate and general reception of the community members towards the assessment of food security in their households, limited time to do interventions due to the University schedules as well as llimited funding. Hence, suggesting the special projects to be given more time and enough funds to be allocated for research by the loan board.

5. How do your Actions/activities relate to the ISS general theme?

The study highlights the importance of food security in promoting healthy eating habits in young children. This is especially important in the context of achieving sustainability, proper food utilization and promoting crop production diversification for increasing dietary diversity as well.

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I convey my appreciation to the Sokoine University of Agriculture for their nomination. My sincere appreciation also goes to my beloved advisor Dr. Safiness Msollo who provided me with enough support to make this proposal done in accordance to the guidelines. Lastly i would like to thank my beloved mother for her love and fund support. Thank you all.

Assessing the Requirements for Establishing a Sustainable Food Bank in an Underprivileged School in Sri Lanka

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Academic Advisor: Prof. S.S. Kodithuwakkum

Keywords: Food insecurity, Donations, Food Bank, Underprivileged Schools, Management

1. Problem statement

Sri Lanka is amidst an acute economic crisis, with worsening food insecurity forecasted between October 2022 and February 2023. According to the UNICEF Sri Lanka Humanitarian Situation Report 2022, an estimated 6.2 million people (28 per cent of the total population in the country) are moderately acute food insecure, while 66,000 people are severely acute food insecure. The report further states that two in five households (41.8 per cent) spend more than 75 per cent of their expenditures on purchasing food, leaving little to spend on health and education. Thus, a considerable drop in school attendance has been observed within the very few months that government schools reopened after the pandemic. Some schools have started providing lunch to students. However, some underprivileged schools still need help establishing a school-based food bank program due to insufficient funds and external assistance. Therefore, the project aims to initiate a food bank based in an underprivileged school, proposing an initiative to connect beneficiaries and donors and sustain them.

2. Student's Actions or activities

Approached the planning director of the Zonal Department of Education Office, Kandy, to identify Type 2/Type 3 and Special Education Schools as the target group and assessed their food insecurity level through interviews with principals of 3 shortlisted schools to determine the target beneficiary school. Conducted in-depth interviews with the identified school authority to estimate the beneficiary's weekly lunch requirement. Identified Potential donors based on desk research, approached them and discussed with them to assess their capacity and willingness to contribute. Launched the FOODPAL initiative (negotiating with donors to meet the beneficiary's estimated food requirement) to connect the target group and potential donors.

3. Implications/Results

Table 1: The results of the interviews conducted with the three shortlisted schools. As per the results, Senkadagala Deaf and Blind School was selected as the most vulnerable target group since it did not have permanent food donors.

School	No. of students	Does the school have any permanent food donors?	If yes, How many?	Is the school looking for potential food donors?
Kappetipola School	85	Yes	1	Yes, Supply is not enough.
Madduma Bandara School	56	Yes	1	Yes, Supply is not enough.
Senkadagala Deaf and blind school	77	None	–	Yes, No donors.

Table 2: The estimated food requirement in Senkadagala Deaf and Blind School.

No. of students in the school	77
Target meal and No. of days	Lunch, Five weekdays

Table 3: The summary of responses from donors after the approaching and negotiating process, classified by donor category. Temple of tooth relic, a renowned religious institute in Kandy, signed up and started providing lunch once every week, covering 1/5th of the estimated weekly requirement.

Donor Category	No. of potential donors approached.	Agreed to partner up	Interested, but the decision pending	Interested, but no capacity at the moment	Proposal denied
Hotel Industry	17	0	8	6	3
Community Service Groups	4		0	4	0
Religious Institutes	9	1	2	6	0
Conglomerates	2	0	1	0	1
Supermarkets	2	0	1	0	1

4. Challenges and perspectives

While negotiating, some identified potential donors did not need to partner with the FOODPAL initiative since it is still a publicly unknown movement. Also, several donors demanded specific deliverables (Ex: Entity promotion), which could not be implementable because the initiative was in its inception stage. Furthermore, some donors were reluctant to disclose some of their information, making it hard to assess their potential. At the same time, it was challenging for me to carry out the work of the initiative and academics simultaneously, prompting the need for volunteers.

Considering the results, there is a need to adopt a much broader donor-hunting approach to fulfil the target group's requirement, which also demands expanding the organizational capacity of the initiative. Therefore, I plan to launch a social media campaign to enhance awareness about the FOODPAL initiative and its brand image among industry partners. Subsequently, the FOODPAL can partner up with an existing university student society to draw volunteers, and the student society will benefit from becoming a part of a popular local movement in return. Furthermore, the ownership and the operations of the FOODPAL

initiative can be fully transferred to them, ensuring its long-term sustainability even without the founder's involvement.

5. How do your Actions/activities relate to the I.S.S. general theme?

Although sharing has been a part of Sri Lankan culture and youth-based community service groups have led many food donation projects, no specific system regulates those initiatives or their sustainability. A fundamental objective of the project is to provide a standard set of recommendations to them and, therefore, positively impact the youth's contribution towards sustainable local agriculture and food consumption. Furthermore, the project will achieve sustainability by introducing a standard model connecting excess food and places with food requirements while focusing on regional food security, health and reducing food-related waste.

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The Analysis of Consumer Purchase Intention and Sensory Acceptance for Plant-Based Meat: The Example of NCHU Students

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Keywords: Plant-based meat, Purchase intention, Acceptance, Sensory evaluation

1. Problem statement

Due to the increasing trend of environmental sustainability and health consciousness, the demand for plant-based meat (PBM) has been received much attention. Particularly in Taiwan, the rate of food self-sufficiency is relatively low. Further, the supply of meat and eggs have been under shortage and unstable condition in recent years, which becomes a hidden concern for food security. The PBM could possibly become one of the solutions to improve food security by improving the diversity of protein source. However, whether the PBM has potential preference and market demand in Taiwan should be further investigated.

2. Student's Actions or activities

Previous research showed that consumers' repeated purchases could decrease by 75% after the first eating experience of PBM (Cuffey, et al., 2022), which means that there is a challenge for buying PBM. Many studies have focused on Europe and the U.S. but not the market in Asia. According to previous studies (Van Loo, et al., 2020), younger people with higher education are the most likely to purchase PBM. Thus, in order to better understand Asian consumer intentions and willingness-to-pay for PBM, I conducted a sensory evaluation and survey at National Chung Hsing University students. The sensory evaluation and survey were completed on March 23, 2023. The sensory evaluation survey had a total of 113 participants, and each participant were provided a 100 NTD (i.e., new Taiwan dollar) 7-11 gift card as incentive for participation in the evaluation.

3. Implications/Results

The results in Table 1 show that respondents have willingness-to-pay (WTP) a 7.24% price premium (about $5.07 NTD) above $70 NTD to buy PBM dumplings. In addition, Figure 1 shows that health benefits are the primary reason for changing dietary habits (about 60% of participants voted), which exhibits a significant outcome that these participants are willing to pay more for PBM dumplings. In contrast, only 38% of participants are willing to change their dietary habits for environmental sustainability reasons, and 11% for animal-friendly reasons. This suggests that the variable of health benefits is a significant factor in attracting young

consumers to purchase PBM dumplings than the variable of environmental friendliness. Furthermore, the results of the Two-Stage Least Squares (2SLS) model in Figure 2 show that the WTP of PBM has positively influenced by the acceptance of PBM, while the acceptance of PBM was positively influenced by the flavor and texture. Interestingly, the sensory factor of flavor has greater influence than texture on the acceptance of PBM. In other words, the acceptance of PBM for younger consumers is more influenced by flavor, while many PBM manufacturers mainly focus on the development of texture. It is suggested that an emphasis toward flavor development may further enhance consumer acceptance of PBM products in the future. Overall, NCHU students are willing to accept PBM dumplings, and most of them are willing to pay a price premium for the PBM products. Although NCHU students belong to the younger generation in Taiwan, these results provide a potential market opportunity for PBM dumplings. More importantly, PBM products can be one of the solutions to improve food security in Taiwan.

Table 1. Consumer WTP price premium for PBM dumplings

Group	Participants	Average WTP (NTD)	Percentage %*
PBM Dumpling 1	58	4.55	6.50
PBM Dumpling 2	55	5.58	7.97
Total/Average	113	5.02	7.24

* Percentage indicates that consumers are willing to pay how much percent more from the base price of 70 NTD.

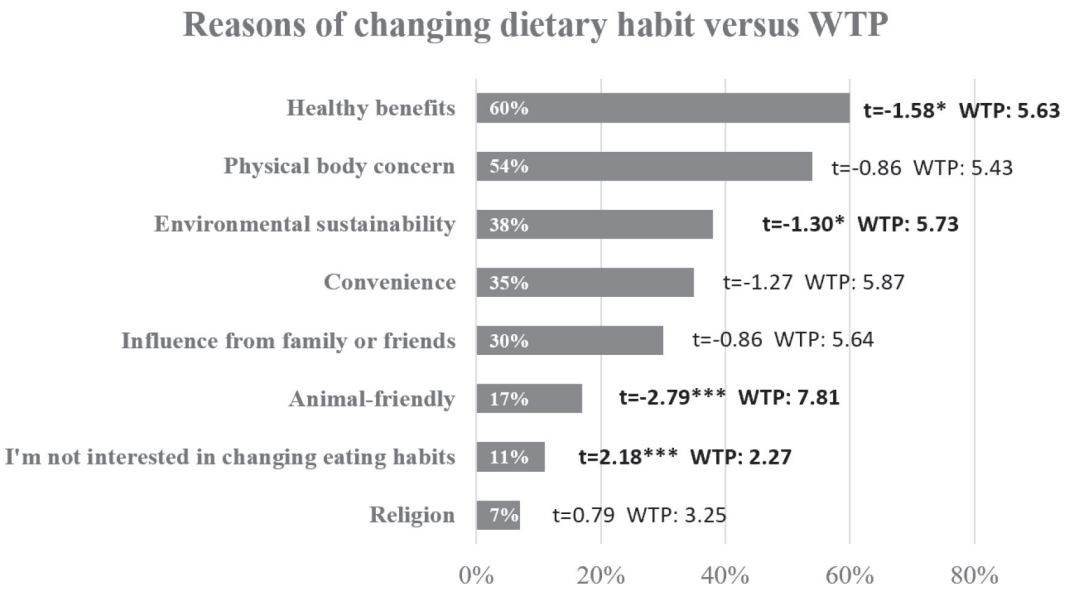

Figure 1. Reasons of changing dietary habit for NCHU students.

Figure 2. The 2SLS Regression Test for Flavor, Texture, Acceptance and WTP for PBM dumplings.

4. Challenges and perspectives

In Taiwan, most of PBM ingredients, such as soybeans and peas, are imported from other countries. Although this study confirms that the PBM can be a potential solution for improving food security, without using domestic-produced soybeans and peas would be still an issue for food security. The government has been promoting domestic soybean cultivation but the production is still insufficient. Finding other suitable local crops as raw materials should be a future research direction to effectively reduce carbon emissions and improve food security.

5. How do your Actions/activities relate to the ISS general theme?

This study enhances students' attention on their food diet, while more young generation understand what is PBM products around our food culture. It involves the student participation in NCHU, intending to promote a diverse and sustainable diet trend through the influence of the younger generation and enhance the stability of our food economy.

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Group G

Group theme

Food 2

Presenters:

Chante Ann Hardaway, Michigan State University
James Michael Stuart Rakotomalala, Tokyo University of Agriculture
Job Nyarimba Ombiro, Jomo Kenyatta University of Agriculture and Technology
Anudari Ayanga, Mongolian University of Life Sciences

Chairperson:

Lioba Chelangat, Jomo Kenyatta University of Agriculture and Technologoy
Rikuto Kasuya, Tokyo University of Agriculture

Food Distributions Impact on Food Availability and University Communities

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Academic Advisor: Dr. Laurie Thorp and Jorhie Beadle

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Keywords: food justice, undergraduates, culturally relevant foods

1. Problem statement

On Michigan State University's campus, many students and student parents struggle with access to fresh produce and culturally appropriate foods. In the case of international students, they are not only attending school full-time, they are also raising a family far from their home country. This problem isn't unique to Michigan State, food insecurity is a problem across many college campuses. According to a study done over the past decade by Frontiers in Public Health, research shows that 41% of American college students faced food insecurity and 73% of students at Historically Black Colleges and Universities faced food insecurity (Hafedorn-Hatfield et. al., 2022). Another study shows that within graduate student populations, 40.3% faced high/marginal food insecurity (Coffino et al., 2021). Forming partnerships with campus farms may be one viable option for combatting food insecurity on college campuses. Together with the Student Organic Farm at Michigan State we are working to address this problem by growing culturally desired and nutrient rich produce on the same campus where our food-insecure students live.

2. Student's Actions or activities

During this past fall semester, I had the opportunity to collaborate with the Student Organic Farm (SOF) to provide fresh, organically grown vegetables to 50 families affiliated with the MSU Student Parent Resource Center. Our team of Residential Initiative on the Study of the Environment (RISE) students met weekly to help load, transport and distribute over 500 lbs. of produce each Friday at the Family Housing Community Center. The produce was set up in a marketplace style, which allowed people to get as much or as little of anything they wanted. RISE students decorated canvas bags to carry the produce, which not only helped keep this food distribution environmentally sound but brought joy both the RISE students and the families. It was important that this was an act of support, not charity, so making this feel like a marketplace was very important. Having culturally appropriate foods and distribution style all added to making sure there was dignified food access. I was fortunate to provide produce to students from over 15 countries including Zimbabwe, Kyrgyzstan, South Africa, China and Ukraine. This experience also introduced me to a more global sense of community.

3. Implications/Results

We offered food distribution of fresh produce from the Student Organic Farm on 9/23, 9/30, 10/7, 10/14, and 10/28 from 1-3pm at Family Housing Community Center on the Michigan State campus. A variety of produce was included as shown in Table 1. Each week there was different produce provided, but usually totaling 400-500lbs.

From the high demand, as evidenced by the fast depletion of donations, we can see that Michigan State as an institution needs to continue to think about hunger and food access among its students and student families living on campus. There is a clear need to expand this food assistance, especially to include protein. We can also see that there is a need for funds so this initiative can increase staff and the types and amounts of food provided. The Student Organic Farm will need to set aside land to continue to grow crops specifically for this food distribution. This project could be adopted by other colleges and universities looking for creative solutions to the food insecurity of its students. MSU is a land grant university and much of the produce for this came from organic and sustainable agriculture research plots that supplement SOF produce. Though at MSU we used the SOF, food donation produce from university land is scalable from small community gardens in family housing areas to large plots of land.

Table 1. Food Distributed Per Week

Week	Produce Provided	Total Pounds	Participants
Week 1 (9/23)	Turnips, Watermelon, Sweet Corn	500lbs	50 families
Week 2 (9/30)	Turnips, Watermelon, Sweet Corn, Leeks	500 lbs	50 families
Week 3 (10/7)	Turnips, Apples, Eggplant, Carrots, Leeks, Squash	500 lbs	50 families
Week 4 (10/14)	Turnips, Sweet Corn, Watermelon, Squash	400 lbs	35 families
Week 5 (10/28)	Turnips, Spinach, Carrots, Squash, Sweet Potato	400 lbs	45 families

4. Challenges and perspectives

One of the biggest challenges was the coordination between the Student Parent Resource Center, Student Organic Farm and Residential Study on the Study of The Environment. Most of the volunteers involved are also full-time students, so there was a lot to get done while also making sure students could go to classes, jobs, and study sessions. We would also like to deepen our understanding of the culturally appropriate foods for the population we partner with. This will require further research and conversations with the families we serve and advance crop planning with the SOF. Shifting from a “charity” model of food distribution to a participatory model will require time and commitment to building relationships with the families and the Student Parent Resource Center.

5. How do your Actions/activities relate to the ISS general theme?

A large part of our food distribution was to help combat the food insecurity within the

graduate student/international student population. This connects directly to our focus of food access and food insecurity. By providing free fresh produce, we were able to provide so people not only had food available to them, but it was food they were familiar with and families knew how to prepare. All of this work pushes towards meeting Sustainable Development Goal (SDG) #2 and #17. This produce used was also from the Student Organic Farm that wasn't being used for anything else. By giving it a new use, this is working towards SDG #12 and #11. By using produce that would've been composted or thrown away it is becoming useful to people who might not have access to fresh produce, this project reaches across the Sustainable Development Goals to help better our future.

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My deepest gratitude goes to my advisors Dr. Laurie Thorp and Jorhie Beadle, who guided me through the construction of this abstract. I'd also like to thank the classmates who helped me: Emma Johnson and Zander Collins.

A Social Craft Hub Towards the Improvement of Food Security in Madagascar: Case from Vakinankaratra Region

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Keywords: Craft hub, youth, Madagascar, food security, social cooperative

1. Problem statement

In Madagascar, the primary sector accounts for an average of 27% of GDP, and agriculture employs 80% of households. Also, the average annual income of small farmers (up to 1.5 ha) is only 653,000 MGA, or about $185. Madagascar is among the 20 countries with the highest malnutrition rates in the world, with 8,250,000 (33% of the population) suffering from malnutrition. About 12.5 million people out of 27.5 million do not eat three meals a day and do not benefit from 2,100 kcal per day, as 111,231 children are in a situation of severe acute malnutrition, especially in Vakinankaratra. However, Madagascar could be the greenery of the Indian Ocean and eastern Africa in terms of its agricultural potential. Each region has its own agricultural potential. For example, the Vakinankaratra region is the apple supply basin of Madagascar, accounting for around 25,000 metric tons per year produced from 1,800ha of field by 8,000 apple producers in the region (Raheriarivony, 2018). In contrast, observations and analysis made by me show that apple producers remain poor due to a lack of initiative from the government and an unsustainable value chain. In 2018, the yield was about 60kg per tree, which continues to decrease (Raheriarivony, 2018). Then, Raheriarivony (2018) reported that collectors have a stranglehold over the producers, who are obliged to sell their products at an unfair price. Regarding the processing, Raheriarivony (2018) stated that only 10% of the regional harvest is processed, the majority is sold to big markets, and an estimation of 30% to 50% of the loss is due to the problem of access to the market, weather, or disease. Finally, smallholder farmers themselves are struggling to find a market. Thus, the revenue stream of farmers remains limited since they do not have the possibility and adequate skills to process their own products. So, food insecurity is omnipresent, which leads to the rural exodus in search of better life conditions like jobs, health care, and education.

2. Student's Actions or activities

After gaining rich experiences in the apple value chain with my former venture and partnership with an apple juice processor's company, I have created a cooperative society in 2021 that is now focusing on craft hub project. The concept of the project made me selected for

a highly selective fellowship in the sub-Saharan Africa region, the YALI Mandela Washington Fellowship, which consists of strengthening leadership skills and business at Clark Atlanta University. I aim to tackle food insecurity by processing local products and creating a rural-based cooperative that will help our eight individual members and future partners improve their livelihoods, especially their incomes, health, and the local environment. So far, the project has been modernized and improved to seek partnerships.

3. Implications

Since 2019, I have been working on a design thinking of how this craft hub project would work. From 2019 to 2020, I was in the phase of emphasizing, and defining needs and problems. In 2021, I was working on the ideation by challenging assumptions and creating idea. From 2021 onwards, I have been prototyping the process to be used after further improvement during my stay in Japan. To that effect, the opportunity for development exists, and innovation has been developed since 2021. It consists of implementing a social and regional-based cooperative that is promoting the circular economy, nutritive foods (dried apples, juice, flour, cider), a co-op brand for the market, and CSR activities focusing on the SDGs. My eight-members cooperative's team got a 6 ha of land to implement the project at the Vakinankaratra region's hub of agriculture. Also, lobbying and partnerships with stakeholders, like international organizations, and farmers are ongoing to implement a human-centered business. The output is to increase the value addition of fruits in the region of Vakinankaratra.

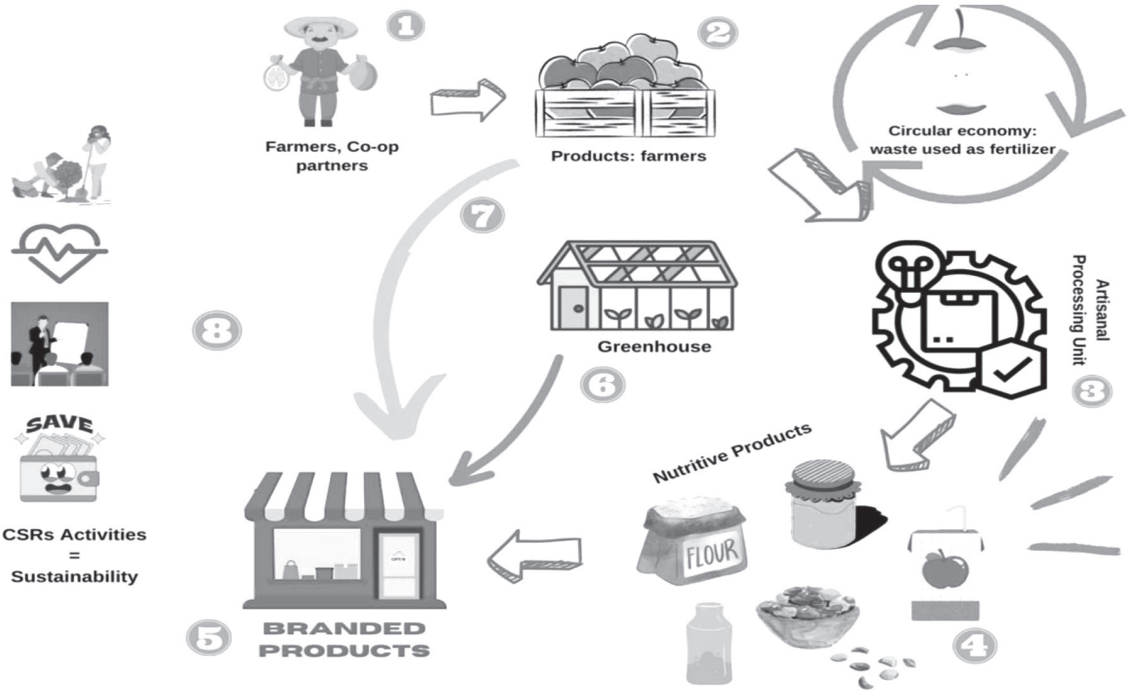

Figure 1: Design thinking prototype of the crafthub

4. Challenges and perspectives

The perspective is to include the local community within the core of the project where they can increase their livelihood, by processing their own products with a tailored support and receiving benefits from our Corporate Social Responsibility (CSR) project. One major challenge is to increase the value addition created from apple production, and the reduction of middlemen. The figure 2 is illustrating the initial situation of 50 farmers in 2018 who worked with my previous business partner, and the expected outcomes that the craft hub will bring.

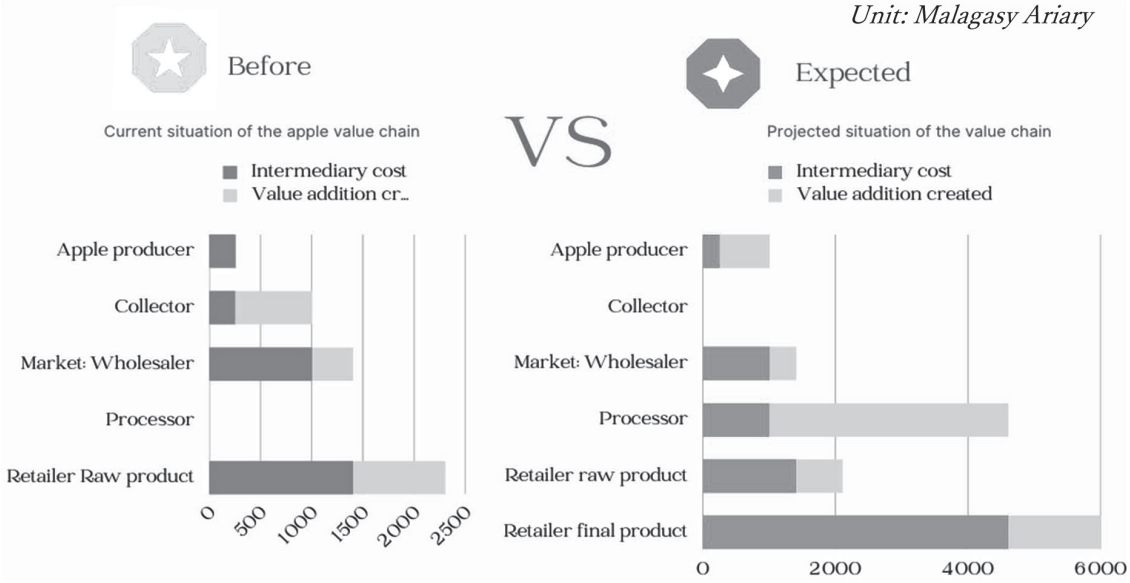

Figure 2: Expected improvement thanks to the craft hub

5. How do your Actions/activities relate to the ISS general theme?

Youth leadership and initiative are the leverage to promote a sustainable food system by associating the experiences of each other to achieve food security through a region-oriented strategy. Also, a transfer of technology and partnerships from and by youth is the key to achieving the SDGs and feeding the global population.

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Development and Quality Characterization of Cape Gooseberries Sauces and Paste

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Keywords: Cape gooseberry, underutilized, quality, sauces, paste

1. Problem statement

Cape gooseberry is the fruit of the plant *Physalis peruviana* L., which belongs to the Solanaceae family and genus Physalis (Olivares-Tenorio *et al.,* 2017). The fruit grows wild as an understory shrub in forest areas, coastal lowlands, and the highlands of Kenya (Wasilwa *et al.,* 2018). They are underutilized fruits in Kenya with little domestication and commercialization despite their potential nutritional and health benefits. Kandagor (2022) reported that farmers in Kenya are also reluctant to take up the fruit due to insufficient awareness of its benefits, limited promotion of the fruit and bias research and development in favour of other commercial fruits.

Recent changes in climate have resulted in drought and irregular patterns of rain, which limit availability of fruits contributing to malnutrition (Ngemakwe *et al.,* 2017). Cape gooseberries (CG) provide a good source of beta carotene, vitamin C, linoleic and oleic fatty acids, fiber, and minerals (Carillo, 2015). CG is a highly perishable fruit posing a challenge in post-harvest handling. This necessitates processing of the fruits into high value-added products and for the purposes of fruit products diversification.

Fruit sauces have high added value and their importance is increasing as they can enhance the functional properties of foods (da Silva *et al*., 2021). On the other hand, fruit paste has a higher fruit content than other types of preserves such as jams, and CG will require a shorter processing time for paste processing due to the higher content of pectin at 0.9% (Petkova *et al*., 2021).

2. Student's actions or activities

The activities were implemented during the academic semester 2021/2022, June to December. The study aimed at developing and assessing the quality characteristics of sauces and paste made from CG. The qualities of sauces and pastes developed were determined in terms of their organoleptic, nutritional properties and microbiological stability with storage. Firstly, the fruits were dehusked and washed, the pulp extracted via the pulper finisher, and a sample analyzed for color as measured by the hunter color difference meter, viscosity using the

Brookfield viscometer, pH by the pH meter, titratable acidity (TA) by titration with 0.1N sodium hydroxide, total soluble solids (TSS) measured using the hand-held refractometer, beta-carotene measured using the UV-Vis spectrophotometer, and vitamin C by dichlorophenol indophenol method.

The CG sauces were processed using the standard procedure used at the Food Science University workshop which briefly involves, heating/concentration of the pulp, gradual addition of sauce ingredients, final brix determination, addition of preservative and packaging. Paste was prepared using the open kettle evaporation method with addition of salt and lemon juice. Addition of 1% food grade color (ponceau) and 10% CG seeds was done to distinguish the sauce samples by appearance and to determine the implications of the seeds in the sauces.

The sauces and paste were analyzed for physical properties- color and viscosity. Chemical properties determined were pH, TA, TSS, vitamin C, beta carotene, proximate composition (moisture, crude ash, crude protein, crude fat, crude fiber and carbohydrates), sugars composition (sucrose, glucose and fructose) was analyzed using high performance liquid chromatography and minerals were analyzed by atomic absorption spectroscopy for iron, calcium, magnesium, manganese and zinc, potassium was determined using flame photometry while phosphorus by UV-Vis spectrophotometer. Sensory evaluation of the products was performed using the 7- point hedonic scale with 15-20 sensory panelists. Microbial properties with storage at 25℃ for days 0, 7,14, 21, and 30 were determined for total plate count and yeasts/molds count using the spread plate method. Results were presented as means ± standard deviation (SD).

3. Implications/Results

Cape gooseberries sauces and paste were found to meet the set Kenyan standards of a pH below 4.6, TSS of the sauces between 18-22% and pastes 24-27%. The viscosity of sauces was the highest at 3033cP. There was fair retention of vitamin C and beta carotene in sauces and paste at 8.2 ± 0.13 mg/100g and 4.06 ± 0.14 mg/100g respectively. The main sugar was found to be glucose in the sauce product with concentration maximum of 29.1 ± 1.38 mg/100g. 10% CG seeds increased the crude protein and crude fat content of the sauces, however, no significant difference was found in crude fiber and carbohydrate concentration. Potassium and calcium were found to be high in the products with 10% seeds and there was an increased concentration of iron. There was overall acceptability of the products in terms of their organoleptic properties; color, taste, aroma, and appearance with a score of above 3.5 on the 7-point hedonic scale. Paste product portrayed good microbial storage stability at 25℃ for 30 days as compared to sauces. The good overall acceptability results obtained in the cape gooseberries sauces and paste samples was an indication of the consumer acceptability of these products at the market level, giving green light that they are viable products and can be up-scaled.

4. Challenges and perspectives

The fruits availability during the study was a challenge as there are few growers of cape

gooseberries in Kenya, attracting a higher price in acquisition. Consumer preference for redness in sauces and paste was unfolded in sensory evaluation, signaling a challenge in promotion of novel products from the fruit. Paste production needed vacuum evaporator since open boiling consumes a lot of power and time to attain the required consistency. There should be more extensive research and awareness creation on cape gooseberries domestication as a means of commercialization.

5. How do your actions/activities relate to the ISS general theme?

Cape gooseberries provide a sustainable solution for fruit availability due to their climate resilience and adaptability to grow and thrive in a wide range of climatic conditions. Utilization of CG for processing of value-added products will leverage on the nutritional properties of the fruit thus contribute to food and nutrition security, and expand its cultivation in Kenya for local consumption, exports and to provide all-year-round raw material for food processing industries. The fruit growers will eventually earn good revenue returns from farming the fruit on large scale basis, and employment opportunities for youth and women will be realized, thus improving the communities livelihoods.

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My sincere gratitude goes to my advisor for guidance and mentorship in the preparation of this abstract. This work was also a success thanks to the Food Science and Technology workshop and laboratory technicians.

Improving the Quality of the Mongolian Horse Breed through Hybridization

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Academic Advisor:Prof. Phd. Enkhmanlai Ganbaatar

Keywords: new breed, nutrition, meat and milk yield

1. Problem statement

Food and agriculture production worldwide are facing unprecedented challenges due to increasing demand for food for a growing population, rising hunger and malnutrition, adverse effects of climate change, overexploitation of natural resources, loss of biodiversity, and food loss and waste. Unfortunately, the same holds true for Mongolia.

Mongolia is a nation with a wide land and a population of 3.4 million and 71.1 million livestock. However, the grazing lands have been overexploited without sufficient recovery periods. As of today, Mongolia has only 4,8 million horses. Mongolian horses (MH) are uniquely adapted to the diverse climates of Mongolia and pass on this quality to their offspring. The Mongolian stallion has a special ability to lead and protect his mares from external attacks and sudden weather changes, and guide them towards locations with ample food and water. The horses are grazed on large vegetated outdoor lands throughout the year, allowing them to find the freshest and most nutritious herbs to eat, resulting in healthier meat. Horse meat has many health benefits. The only drawback to MH breed is their smaller build and lower meat and milk yield compared to foreign breeds.

2. Student's Actions or activities

To enhance the quality of our horse breed, our aim is to establish a new high-yielding line. Extensive research has been conducted to determine the most effective means of breeding our horse herd in a short period of time while simultaneously increasing productivity. It has been determined that artificial insemination and embryo transfer methods utilizing modern biotechnology and scientific findings are the best solution. Specifically, local Mongolian mares will be inseminated with Russian heavy draft (RHD) breed to create a new breed of high-yielding horses through traditional pastoralism methods. This new breed, named "Danagar aduu," is expected to make significant progress over a 16-year period. We are currently 3 years into this project.

3. Implications/Results

Through this project, the expected average live weight of a heterozygous foal is 39-41 kg, compared to the live weight of a Mongolian foal, which is 30-31 kg. A hybrid foal resulting from the crossbreeding of a Russian heavy draft stallion and a Mongolian mare exhibits exceptional

growth, reaching a live weight of 300 kg from the third day of birth to 18 months of age. During the first 6 months of life, the foals gain an average of 0.9-1 kg per day. By the age of 30 months, the live weight reaches 390 kg, with an average daily growth of 430 grams. The estimated average weight of hybrid horses at 30 months is 400-415 kg, the weight equivalent of a full-grown Mongolian horses. Typically, the MH breed is butchered between the ages of 8-12 years, but this rapidly growing new breed can reach butchering age of 2-2.5 years by receiving additional feed to gain fat and strength for 3-4 months in advance. The meat of young horses is more tender and nutritionally beneficial, which will increase the horse meat output in a short time and improve quality, saving effort, labor, and time, while increasing income and speeding up financial turnover. The calculation is based on experimental research conducted on the crossbreeding of a mare from the Ar Baigal region (which has the same origin as Mongolian horses) with a Russian heavy draft stallion. The main objective of this project is to prioritize quality over quantity by crossbreeding the MH breed with the RHD breed to get a superior line of horses with the characteristics of both breeds, including the resilient feature of MH and the large build, high meat, and milk-yielding feature of the RHD breed. Currently, the project has 52 homozygous Mongolian mares, 5 homozygous Mongolian stallions, 40 homozygous MH, 2 homozygous RHD stallions, 2 homozygous RHD mares, 22 heterozygous, 2 homozygous RHD foals in total.

Breed	Age, gender	Live weight	Wither height	Chest circumference	Cannon bone circumference	Meat yield (kg)	Milk yield (per day)
Mongolian (meat yield 52-54%)	Stallion	315-400	120-137	156-122	17-20	189	
	Mare	280-380	117-134	146-165	15-18	175	1,8-4,5
RHD (meat yield 54-62)	Stallion	650-770	147-160	183-208	21,5-25,3	412	
	Mare	530-720	145-159	183-200	20,5-24	363	12-14
Danagar aduu (meat yield 58-60%)	Stallion	482-585	140	186,5	21,5	315	
	Mare	405-550	144	179	19,8	282	8,05-8,4

4. Challenges and perspectives

The challenges faced at the beginning of the project revolved around the lack of experienced personnel and support for assisting RHD horses in adapting to a new environment. By recruiting and employing more individuals with expertise in this field, the team can tap into a broader knowledge base and benefit from their specialized skills. By emphasizing the need for more professionals working in these specialized fields, the project can address these challenges head-on and enhance its chances of success.

5. How do your Actions/activities relate to the ISS general theme?

As the global population steadily grows, the demand for food is also increasing. The only

resolution to this problem is within the field of agriculture. I hope more people in Mongolia will pay attention to solving this issue.

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My deepest gratitude goes to my Father and Grandmother who first started this project and acted as a true mentor during this preparation of this abstract. This work would not have been achieved without the significant participation of my family. Thank you all very much.

Voices from Next Generation

High School Students' Poster Presentations

1 **【Consideration of Qualities Required of Local Food and Agricultural Leaders: Learning from Attempts to Develop Play Leaders for Children】**
Daichi Mio
Senior High School at Sakado, University of Tsukuba

2 **【Verification of the Effectiveness of Plant Enzyme Solution Produced from Vegetable Waste】**
Otoha Serizawa
Senior High School at Sakado, University of Tsukuba

3 **【A Challenge on the Food Education for Children in Rural Areas of Developing Countries】**
Tomoki Miyaura, Shun Kawaguchi, Naruki Matsuda, Kuon Abe
The First High School, Tokyo University of Agriculture

4 **【What is the environmentally-friendly restaurant?】**
Risako Nishikawa, Asuka Ohta, Miu Togawa, Chiharu Une, Chihiro Kaneko, Saku Yamamoto
The First High School, Tokyo University of Agriculture

5 **【What We Can Do to Utilize Marine Plastic】**
Haruhi Kabe, Runa Sekiguchi, Ichiro Suzuki, Mai Ushiki, Rina Takaki, Nanao Kobayashi, Ren Sukizaki, Jumpei Fukuda, Aoi Hyodo, Momoka Nishiyama, Takeru Gunzi, Kurara Katakai
The Second High School, Tokyo University of Agriculture

6 **【The World is Filled with Wasted Food】**
Kihane Yoshida, Haruki Kubo, Mana Kimura, Azuki Kubo
The Second High School, Tokyo University of Agriculture

7 **【Study Abroad as an Option for Every Child in Africa】**
Juri Okita, Sophia Papasava, Ayumi Takahashi, Itsuki Okubo, Yushiro Kijima
The Third High School, Tokyo University of Agriculture

Consideration of Qualities Required of Local Food and Agricultural Leaders: Learning from Attempts to Develop Play Leaders for Children

Daichi Mio

Senior High School at Sakado, University of Tsukuba

In the 21st century, Japan has become increasingly urbanized, modernized, and internationalized, which has led to a lack of respect for food, an increase in lifestyle-related diseases, and a loss of traditional food culture.

In 2005, the Basic Act on Food and Nutrition Education was enacted as a guideline to promote the mental and physical health and vitality of all citizens, especially children. Skills and knowledge related to food and agriculture are fundamental to leading a humane life. Although one-off classes and lectures are given in schools and local communities, it is essential to develop leaders and facilitators who can help people deeply understand the importance of food and agriculture and work to change their life for the better. The purpose of this study is to clarify the qualities and abilities required of leaders and facilitators of food and agriculture education and to propose more effective food and agriculture education programs. In addition to knowledge in specialized fields, it is considered necessary to develop leadership and communication skills that will enable them to reach out to local people, especially youth and children, and encourage them to change their behavior. Through interviews and site visits to play leaders who support children's holiday activities, farmers who conduct food and agriculture education activities, and ARI that fosters rural leadership, the necessary qualities will be identified.

Verification of the Effectiveness of Plant Enzyme Solution Produced from Vegetable Waste

Otoha Serizawa

Senior High School at Sakado, University of Tsukuba

Vegetable scraps discarded in the cooking process have become a problem from the perspective of global environmental protection and effective use of resources. Because vegetable scraps contain a large amount of moisture, they emit a large amount of CO_2 when incinerated. In order to reduce food waste, there have been various ways to utilize vegetable scraps like organic fertilizers. This project aims to produce a plant enzyme solution from vegetable scraps from local school lunch centers in order to contribute to a resource-recycling society. Plant enzyme solution is an artificially developed organic fertilizer. In our project, the vegetable scraps were fermented with sugar and yeast, and the solution was extracted. Using komatsuna (Japanese mustard spinach), we will dilute the produced plant enzyme solution and test its effect on germination and growth by feeding it to plants. Using this plant enzyme solution as a medium, germination experiments will be conducted in an incubator to measure the effect of the plant enzyme solution on the process of growth of germinated seeds. If the liquid fertilizer produced is effective and the vegetable scraps after the solution is extracted can be used as compost in natural farming fields, waste will be reduced and a cycle of resource recycling will be formed within the community.

A Challenge on the Food Education for Children in Rural Areas of Developing Countries

Tomoki Miyaura, Shun Kawaguchi, Naruki Matsuda, Kuon Abe

The First High School, Tokyo University of Agriculture

A healthy and happy life is closely related to what and how we eat. Eating is supported by dental hygiene. In developing countries, a lack of education on nutrition has led to a prevalence of oral health issues, particularly among children in the primary dentition stage. Merely increasing the number of dentists is not a viable solution in rural areas. Therefore, to address the oral health issues, we focus on implementing oral care programs to promote children's oral health. These programs include encouraging the adoption of traditional sweets that have been consumed for generations instead of processed sugary confections. We suggest utilizing local agricultural products that contain nutritional supplements for children. Additionally, to improve living conditions, we propose a program incorporates early childhood education on oral care based on preventive dentistry practices, similar to what is currently practiced for infants in Japan. These programs should be implemented in educational institutions such as nurseries. By pursuing this approach, our objective is to contribute to SDG 3, which aims to ensure health and well-being for all. We strive to achieve healthy oral hygiene and a nutritious diet to support the improvement of livelihoods and local industry in the future.

What is the environmentally-friendly restaurant?

Risako Nishikawa, Asuka Ohta, Miu Togawa
Chiharu Une, Chihiro Kaneko, Saku Yamamoto
The First High School, Tokyo University of Agriculture

Since 1920, White Castle opened, fast food restaurants have spread around the world, and they are loved with their accessibility by many people. But there are some negative aspects such as being bad for the environment and unhealthy. So how about incorporating local production for local consumption into fast foods?

The reason why fast foods are cheap is their raw materials are cheap. They are mass-produced in multiple factories across the country and delivered to each restaurant in a cooked state. Waste is generated at this time. If the restaurant couldn't use all of them before the expiration date, they have to throw them away. It is also related to the fact that fast food is bad for you. In order to extend the shelf life, many additives are included in the ingredients.

The solution to this problem is local food. The system which connect farmers and the restaurants in each region reduces environmental burden and cost of carrying food. This way, customers can get fresh and safe food as they know where the raw materials come from. In addition, each region's menu will be unique.

Fast and Local Food restaurant keeps the advantage of fast food restaurants but also makes them more eco-friendly.

What We Can Do to Utilize Marine Plastic

Haruhi Kabe, Runa Sekiguchi, Ichiro Suzuki, Mai Ushiki, Rina Takaki
Nanao Kobayashi, Ren Sukizaki, Jumpei Fukuda, Aoi Hyodo
Momoka Nishiyama, Takeru Gunzi, Kurara Katakai
The Second High School, Tokyo University of Agriculture

The spread of plastic production marked a major turning point in advancing a variety of industries worldwide. Plastic products have contributed a great economic advantage to our lives and have created new jobs as well. However, the creation of the products can have a significant impact on the health of various species and can cause environmental issues such as marine plastic pollution. We firmly believe that marine plastic pollution should be tackled to decrease the harmful effect on the environment.

Our presentation will provide step-by-step approaches to the problem of marine plastic and connect to The Sustainable Development Goal (SDG)— "Conserve and sustainably use the oceans, seas and marine resources" (Goal 14).

To begin with, it describes facts about marine plastic pollution and its ill effects based on statistical data. In this section, it discusses a surprising truth: the reason why mass plastic debris is accumulating in the ocean.

Subsequently, It explores a few unique solutions in terms of the arts, science, and social movements utilizing marine debris.

Finally, it delves into detail about in-depth practical solutions for the problem. It deals with the importance of these solutions to conserve natural species and maintain biodiversity in the ecosystem.

The World is Filled with Wasted Food.

Kihane Yoshida, Haruki Kubo, Mana Kimura, Azuki Kubo

The Second High School, Tokyo University of Agriculture

Eating is an essential part of life. However, we human beings are now facing some problems with eating. They are called satiation and hunger. 2.7 billion-tons amount of foods are produced in 2022, it means that everyone can eat enough. However many people are suffering from hunger around the world. To think of this issue, we want to get a tip to solve satiation problem at first, and help hunger problem's reduction.

The amount of abandoned food is over 5.2 millions in Japan in 2022. It's caused by people's actions like tending to peoples' preference or discard by grocery stores. To deal with this, Japanese government made a law which aims to reduce food waste, only to make little effect. On the other hand, French government makes its restaurants join food bank. In 2015, it collected 36,000 tons foods, and the amount of collected food increased by 9.2 millions meals in two years.

We must think about this problem more seriously because satiation never stop increasing.

For example, companies should carry out food bank activities in familiar places such as convenience stores to avoid food loss. Let's try to participate in these activities!

Study Abroad as an Option for Every Child in Africa

Juri Okita, Sophia Papasava, Ayumi Takahashi
Itsuki Okubo, Yushiro Kijima
The Third High School, Tokyo University of Agriculture

We are going to talk about providing the opportunity of studying abroad for children in Africa. Africa is known for education issues such as many children dropping out of school or even not having enough money to afford an education. However, these problems are slowly moving toward a solution. But the number of students who study abroad is still very low. This should be solved because we know we can learn so much from studying abroad through our experience of language training in Australia. To produce more and more African students who study abroad, first it is necessary to strengthen the system of compulsory education of Africa. Secondly, the 4th issue of SDGs which is "provide high quality education for everyone" should be solved early to raise the education standards in Africa. We believe that these two solutions will be helpful so that the children in Africa can make a choice to study abroad in their field of study when they are students.

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

Since 2020, the COVID-19 pandemic has significantly restricted international travel, prompting us to adopt a new approach for the "International Students Summit on Food, Agriculture, and Environment (ISS)." We utilized online tools and encouraged remote communication to overcome these challenges. However, we also acknowledged the enduring importance of direct face-to-face interaction among students. Therefore, we are delighted that this year's summit successfully resumed full-scale in-person student exchanges.

It would be wonderful if students could share their activities and ideas and discover new perspectives that they cannot attain from their original ground. We hope that the awareness and relationships gained through the ISS will contribute to a new path of global agricultural and environmental innovation in achieving a sustainable society.

Our grateful thanks go to all those who have helped us put together the 22nd 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, various advisors and all Tokyo NODAI student groups who tirelessly have dedicated to preparing the 22nd ISS,

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

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