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

Youth actions and innovations towards climate change adaptation and mitigation to promote sustainable agriculture in their communities.

September 20 - 22, 2022

HYBRID

2022 TOKYO

Organized by
Tokyo University of Agriculture（Tokyo NODAI）

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

Youth actions and innovations towards climate change adaptation and mitigation to promote sustainable agriculture in their communities.

September 20 - 22, 2022, Online

Statement

The rapid global spread of the unprecedented COVID-19 pandemic since 2020 has affected 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 that involve our common commitments to reducing to the minimum all emissions of greenhouse gases, and adjusting our lives to the actual or expected future climate. 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. The system of food production and consumption is without a doubt closely related to the condition of the natural environment, including the climate, which patterns and problems reflect regional characteristics. It is thus important to understand how innovation can be at the service of humankind towards climate change adaptation and mitigation for a sustainable agriculture.

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 21st ISS will take place on September 20-22, 2022 around the theme "*Youth actions and innovations towards climate change adaptation and mitigation to promote sustainable agriculture in their communities*", which was adopted at the 20th ISS. Due to the pandemic situation, the event will basically be held online for the second consecutive year. We expect the participating students to share the activities they have undertaken at their university 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.

- Two oral presentations will be accommodated for each participating university (exceptionally six for each of our African partners) in the following sessions.
  - **Session 1**: Students' Actions in the field of **agriculture**
  - **Session 2:** Students' Actions in the field of **environment**
  - **Session 3:** Students' Actions in the field of **food**
  - **Session 4:** Students' Actions in the field of **education**
  - **Session 5:** Students' Actions in the field of **nutrition**
- Submitted abstracts will be reviewed by ISS Committee to evaluate if the presentation is within the scope of the ISS theme.
- Each partner university is required to appoint a faculty advisor to support the presenter. The advisors are welcome to attend ISS online.
- Although this year's ISS is online, each partner university is encouraged to report the summary of the selection process of the presenter (to show his/her excellence).

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

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To the audience of the 21st International Students Summit

The ULR links for the Live Discussion are available on the ISS portal site: https://www.isstokyonodai2022.com/

The presentations will be in on-demand format and only the discussion part will be conducted in live format. The presentation videos of all presenters are available on ISS portal site.

It is highly recommended watching the presentation videos before assisting to the Live Discussions.

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All the chairpersons are students representing Tokyo University of Agriculture

The 21st ISS Participating Universities

① University of Peradeniya
② Chapingo Autonomous University
③ IPB University
④ The University of British Columbia
⑤ Western Sydney University
⑥ Thammasat University
⑦ La Molina National Agrarian University
⑧ Chaudhary Charan Singh Haryana Agricultural University
⑨ UniLaSalle
⑩ Agriculture and Forestry University, Nepal
⑪ Yezin Agricultural University
⑫ National Chung Hsing University
⑬ University of the Philippines Los Banos
⑭ Sokoine University of Agriculture

⑮ Jomo Kenyatta University of Agriculture and Technology
⑯ Mongolian University of Life Sciences
⑰ Beijing Forestry University
⑱ University of São Paulo
⑲ University of East Sarajevo
⑳ Vietnam National University of Agriculture
㉑ University of Applied Sciences Weihenstephan-Triesdorf
㉒ Universiti Putra Malaysia
㉓ Michigan State University
㉔ Wageningen University and Research
㉕ University of the Highlands and Islands
㉖ Tokyo University of Agriculture

Program

*Please note that there may be many sessions occurring simultaneously

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

Sep. 20, Tuesday 9:00 AM (Japan time)

【Achieving Food Security through the Strategic Framework 'CRISIS' – Coming together, Research, Innovation, Sensitization, Implementation and Support】
Shimani Umesha Attygalle, *University of Peradeniya*
https://youtu.be/0NJ5KERPNpA

【Analysis of replication proteins of the Maize chlorotic mottle virus in the yeast (*Saccharomyces cerevisiae*) replication system.】
Libia Fernanda Gómez-Trejo, *Chapingo Autonomous University*
https://youtu.be/PR5RFyfpsWg

【Cobio: A Slow-Release Hydrogel Fertilizer from Organic Waste for Floriculture as Youth Innovations in Sustainable Agriculture】
Rio Kevin Marcello Alwi, *IPB University*
https://youtu.be/Gk0-xb5hTUY

【The Challenges of Mountain Agriculture】
Madeline Lee Stuart, *The University of British Columbia*
https://youtu.be/i7q-uy4yJSs

Group B: Students' Actions in the Field of "Food"

Sep. 20, Tuesday 9:00 AM (Japan time)

【Characterisation of capsaicinoids from capsicums, chillies and the greenhouse horticultural waste of these crops】
Mursleen Yasin, *Western Sydney University*
https://youtu.be/uGUSMDnvPdw

【Using Starter Culture Technology for Improving Safety and Quality of Thua-Nao Kab (A Traditional Fermented Food in Thailand)】
Pinsawan Saisin, *Thammasat University*
https://youtu.be/LbluZKyP2tM

【New and Safe Processed Foods in Cambodia】
Sorm Sokly, *Tokyo University of Agriculture*
https://youtu.be/HogHrM0h0LM

Group C: Students' Actions in the Field of "Environment"

Sep. 20, Tuesday 10:30 AM (Japan time)

【Development of cultivation technology using plant growth-promoting bacteria for sustainable agricultural production】

Haruka Yamaguchi, *Tokyo University of Agriculture*

https://youtu.be/0gC-962EgNQ

【Identification of Root Emitted Volatile Organic Compounds (VOCs) in Response to Phosphorous Deficiency in Tomato Plants】

Olumuyiwa Akintola Elliott, *Western Sydney University*

https://youtu.be/CtPL3B1JhRw

【The implication in water quality within the Inland Bay of Lake Titicaca in relation to tourism immobility during the SARS-CoV-2 2019 pandemic】

Daniel, Antonio, Caballero, *La Molina National Agrarian University*

https://youtu.be/20jubDgXvBA

【Changing climate and herbicide resistant weeds to sustainable agriculture】

Chetan Singh, *Chaudhary Charan Singh Haryana Agricultural University*

https://youtu.be/dbTrXDAOxz0

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【Conserving Tank-based agriculture systems by establishing community-based climate-smart villages in Monaragala district of Sri Lanka.】

Saranga Dilhan Konara, *University of Peradeniya*

https://youtu.be/wbqlGxCF8_k

【What is the capacity, role, and potential contribution of the youth to reduce carbon footprint and how this, as a collective action by the youth, can support sustainable development in France?】

Eléonore Catherine Alice Hamez, *UniLaSalle*

https://youtu.be/rlzvLXKvK7k

【Climate Change, Nutri-Sensitive Agriculture and Youth Action to Eradicate Nutritional Vulnerabilities】

Bhavya Sandhu, *Chaudhary Charan Singh Haryana Agricultural University*

https://youtu.be/QrV2ojc2V78

【Local Youth Actions on Global Problems】

Suraj Gaihre, *Agriculture and Forestry University, Nepal*

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Group E: Students' Actions in the Field of "Education"

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【Effects of Different Packaging Materials on Postharvest Quality of Clorox-treated Tomatoes under Two Storage Temperatures】

Hnin Wut Yee Soe, *Yezin Agricultural University*

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【Sustainable Meat--- Taiwanese Peoples' Attitude Toward Insect Food and Its Development】

Sing-Shan Wu, *National Chung Hsing University*

https://youtu.be/tdMuiwz9rnA

【Urban Agriculture developed with college students in the city of Lima】

Jorge Victor Grandez, *La Molina National Agrarian University*

https://youtu.be/5OVBa2l6xhQ

Group F: Students' Actions in the Field of "Agriculture"

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【Youth Involvement in Climate Adaptation: Moving Towards Sustainable and Food-Secure Future】

Cleana Shaine, Pulido, Salonga, *University of the Philippines Los Banos*

https://youtu.be/0_Rh0_mpWsE

【Deficit irrigation strategy for vegetable production in a water scarce environment】

Richard Evarest Laizer, *Sokoine University of Agriculture*

https://youtu.be/kVieg_wYAsM

【The Influence of Climate Change on Third and Fourth Trophic Levels Insects】

Chung-Han Cheng, *National Chung Hsing University*

https://youtu.be/usnZjZu2UtA

【Improving the Quality of Environment by Adding Value to Coconut Waste】

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

https://youtu.be/obCT2oLvUiU

【MANIS (Lime Aroma Mask): Utilization of Limonene in Lime Peel to Become A Biodegradable Nanofiber Mask】

Brayen Ariel, *IPB University*

https://youtu.be/jDZiJd96fbY

Group G: Students' Actions in the Field of "Food"

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【Varietal Variations in the Characters of Mungbean (*Vigna radiata* (L.) Wilczek)】
Phyo Pa Pa Kyaw, *Yezin Agricultural University*
https://youtu.be/X2D_K7HQevY

【Reduction of Greenhouse Gas Emissions through Food Waste Recycling】
Maryiano Keziah Anyango Awino, *Jomo Kenyatta University of Agriculture and Technology*
https://youtu.be/XH1slXcuJ1o

【Bio-fertilizer production for sustainable Agriculture in Adaptation and Mitigation of Climate Change.】
Tito, Nicholaus, Suzuguye, *Sokoine University of Agriculture*
https://youtu.be/tPT82iWV8b8

【Youth embark on providing knowledge in receiving the appropriate amount of nutrition.】
Anudari Ayanga, *Mongolian University of Life Sciences*
https://youtu.be/oNlvvAsdCJk

【Renewal of small-sized urban sites for carbon neutrality − research on climate positive design】
Xiaoshu Lin, *Beijing Forestry University*
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Group H: Students' Actions in the Field of "Environment"

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【Climate change and food security: the case of the fall armyworm *Spodoptera frugiperda*】
Pedro Vitor Matos Camargo, *University of São Paulo*
https://youtu.be/kPoXzc7pr_E

【Potential of urban tree diversity in carbon stock enhancement and climate change mitigation】
Gladness, Edward Kishe, *Sokoine University of Agriculture*
https://youtu.be/CYPxTp4jsXE

【Bioplastic made from banana peels】
Maïwenn Clech, *UniLaSalle*
https://youtu.be/Sxe7r6Fh6A0

【Activity of youth in afforestation in Bosnia and Herzegovina】
Sreten Milutinovic, *University of East Sarajevo*
https://youtu.be/OlYXkFrQfRA

【Greenhouse gas emission from agriculture: An outlook toward Net Zero emission in Vietnam】
Le Thi Dieu Linh, *Vietnam National University of Agriculture*
https://youtu.be/cioxA6haB2I

Group I: Students' Actions in the Field of "Nutrition"

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【Effects of Climate Smart Agriculture on Household Food Security among Small Scale Farmers in Kisumu West Sub-County】

Livingstone Onyango Ajwang, *Jomo Kenyatta University of Agriculture and Technology*

https://youtu.be/KMqBdGxpebA

【Young farmers actions and innovations towards Climate Change adaptation and mitigation in dairy production in Middle Frankonia / Germany】

Matthias, Schneider, *University of Applied Sciences Weihenstephan-Triesdorf*

https://youtu.be/T45BlwQoNlw

【Food Sustainability and Climate Change: Youth Involvement in Building Resilient Food System】

Winfrida Jilala Mihambo, *Sokoine University of Agriculture*

https://youtu.be/79amSfBEliE

【Developing guidelines to use *Azolla microphylla* for manure nutrient sequestration】

Derrick Keith Thompson, *Thammasat University*

https://youtu.be/MD1OwNNSmrY

Group J: Students' Actions in the Field of "Education"

Sep. 20, Tuesday 16:00 PM (Japan time)

【Development of *In Vitro* Protocol for Mass Propagation of *Christia vespertilionis*】

Ummu Qatrunnada Liyana Kamaruddin, *Universiti Putra Malaysia*

https://youtu.be/4elnNgZPW4w

【No Need for Weeds: Herbicide Use in Michigan's Commodity Crops】

Hope Christina Thome, *Michigan State University*

https://youtu.be/xW7ntoRe-9o

【MugKwentuhan Tayo (Let's Tell Stories)! A Podcast for Agricultural Awareness: A Project Initiated by AIESEC in UPLB】

Mariela Beatriz Responde Obciana, *University of the Philippines Los Banos*

https://youtu.be/F1d1u_OfK3o

【Youth and Emission Trading: An Integrated Approach towards Climate Change and Sustainable Farming】

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

https://youtu.be/IkORilzGV0k

【Youth Readiness in Adaptation of Digital Technologies in Addressing Climatic Changes to Promote Sustainable Agriculture】

Anziran Ibrahim Msoke, *Sokoine University of Agriculture*

https://youtu.be/6VQ8COR0vil

Group K: Students' Actions in the Field of "Agriculture"

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【Influence of climate change on farmer-herder conflict complexities】
Martha Deogratias Hilary, *Sokoine University of Agriculture*
https://youtu.be/YhWWl3sQRrc

【Empowering Vietnam Youth Engagement in Climate Change Mitigation through "Green Youth Labs" Project】
Thao Thu Le, *Vietnam National University of Agriculture*
https://youtu.be/RPQqONNB4-0

【Evaluation of *Tithonia diversifolia* as a Nutrient Source in a Hydroponic System for Sustainable Vegetable Production】
Joseph Wafula Wanjala, *Jomo Kenyatta University of Agriculture and Technology*
https://youtu.be/u0oZ0akGl_4

【Uptake of residential energy efficiency measures and renewable energy: Do spatial factors matter?】
Nienke van Twillert, *Wageningen University and Research*
https://youtu.be/KteJPYKcM4o

【Assessment of low-cost hydroponic farming in rural communities for adaptation of climate change】
Antonio Perez Fuentes, *Tokyo University of Agriculture*
https://youtu.be/3Q1CExHvofg

Group L: Students' Actions in the Field of "Environment"

Sep. 21, Wednesday 17:30 PM (Japan time)

【Is there a difference in carbon stock between conifer and broadleaved tree species?】
Tristan, Edward Wesley, Burrow, *University of the Highlands and Islands*
https://youtu.be/51NUwbNwdP4

【Assessment of Climate Change Adaptation Activities in Local Community (A case study of Manahari Rural Municipality, Nepal)】
Barsha Lama, *Agriculture and Forestry University, Nepal*
https://youtu.be/4_aCkA8Uluo

【Promotion of Sustainable Agriculture in Smallholder Farmers by curbing Climate Change through Integrated Pest Management (IPM)】
Faith Wariara Mwiruri, *Jomo Kenyatta University of Agriculture and Technology*
https://youtu.be/jfyayWyH12Q

【Exploration of Potential Bacteria Consortium for Biofertilizer Microorganism-based Formulation】
Novitasari, Istiani, *Tokyo University of Agriculture*
https://youtu.be/nr2b3VRrXyY

Voices from Next Generation

High School Students' Presentations

1 **【Food self-sufficiency】**
Haruna Aoki, Manaka Sakai, Ririko Fukumasa
The First High School, Tokyo University of Agriculture
https://youtu.be/11dLqNb2OKQ

2 **【What we can do now to prevent the extinction of living things】**
Shogo Sekiguchi, Kazuya Tsuruta, Kanaru Shimizu, Haruto Kitajima, Soshu Ikeda
The Second High School, Tokyo University of Agriculture
https://youtu.be/7BawWGlznz4

3 **【Ecotourism ～ Why don't we go on travel while taking environment into consideration? ～】**
Kurumi Horie, Noa Sato, Takeru Ogino, Saika Mimura, Kotaro Takano
The Second High School, Tokyo University of Agriculture
https://youtu.be/pBXRQlbQBJM

4 **【Our Enthusiasm for Global Forest Conservation】**
Kiko Masaki, Misaki Yoshino, Mahiro Akuzawa, Mao Ono, Tomoaki Uchino, Hayato Kubo, Noa Umezawa
The Third High School, Tokyo University of Agriculture
https://youtu.be/qiXHJpx_lOk

5 **【Utilization of used body warmers as fertilizer: compared to iron nails】**
Kanori Nagakura
Senior High School at Sakado, University of Tsukuba (1)
https://youtu.be/jiy5MsZi_0w

6 **【Chronological Changes in weed vegetation on our school campus: compared to a survey 7 years ago】**
Keita Sekiguchi
Senior High School at Sakado, University of Tsukuba (2)
https://youtu.be/XlbfBsjOk2g

Message from Elementary School Students

【We are the students of Toka Elementary School!】
Toka Elementary School, Tokyo University of Agriculture
https://youtu.be/CyZlzkL-ARE

Group A

Group theme

Agriculture

Presenters:

Shimani Umesha Attygalle, University of Peradeniya
Libia Fernanda Gómez-Trejo, Chapingo Autonomous University
Rio Kevin Marcello Alwi, IPB University
Madeline Lee Stuart, The University of British Columbia

Chairperson:

Ramos Mozelle Millenas, Tokyo University of Agriculture

General Chairperson:

Issa Abrahaman Kachenje, Tokyo University of Agriculture

Achieving Food Security through the Strategic Framework '*CRISIS*' – *C*oming together, *R*esearch, *I*nnovation, *S*ensitization, *I*mplementation and *S*upport

Shimani Umesha Attygalle

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Keywords: food security, climate-resilient crops, crop-livestock integration, youth, strategic framework

1. Problem statement

Climate change is among the most significant reasons that have caused food insecurity in Sri Lanka (IPS, 2018). The World Food Programme (2017) has identified climate change as an emerging concern for the food security in Sri Lanka. Various research has extensively studied the climate change patterns over the past years and their impact on agricultural productivity (Marambe, et al., 2015). Accordingly, increased temperature, changes in rainfall patterns, and enhanced carbon dioxide levels would have direct effects on agriculture, while soil erosion, invasive species, alteration of water sources and declining arable lands, etc., owing to climate change, would cause indirect effects (ADB, 2020). Decreasing agricultural production has resulted in hunger, undernourishment, malnutrition (Esham, Jacobs, Rosairo, & Siddighi, 2017) and a lack of food sovereignty (Gunaratne, Firdaus, & Rathnasooriya, 2021).

2. Actions or activities.

The main objective of the action plan was to address food insecurity through a climate-resilient agriculture system. Related actions were performed under three main stages: (i) development of the framework, (ii) identification of the most suitable means, and (iii) Implementation of the project. Out of these three stages, (i) and (ii) have been completed, and (iii) is ongoing.

'*CRISIS*' is the strategic framework developed to reduce the disconnect between several sections of the prevailing agricultural systems. It stands for **C**oming together, **R**esearch, **I**nnovation, **S**ensitization, **I**mplementation, and **S**upervision. *Coming together* was uniting towards a common goal by setting an apex body and bringing together the potential and interested youth. The *Research* phase was focused in collecting information relevant to the specified avenues of climate-resilient agriculture and conducting such research wherever necessary. *Innovations* capable of achieving the ultimate objectives were an integral part of the process. *Sensitization* of the farmer community and encouraging them to adopt suitable means were accomplished with the help of agricultural extension services. *Implementation* of the

specified avenues, followed by *Supervision*, helped identifying the required improvements.

The Updated Nationally Determined Contributions (NDCs) submitted by Sri Lanka according to requirements of the Paris Agreement was referred to when identifying the most suitable means for mitigating and adapting to climate change through *'CRISIS'*. The mitigation NDCs related to crops include reducing post-harvest losses and increasing crop productivity whereas the adaptation NDCs include approaches such as mainstreaming climate change considerations into agriculture and introducing varieties that are resistant to biotic and abiotic stresses, etc. (ME, 2021). After careful consideration of the NDCs, two pathways were selected to implement the framework *CRISIS*; (a) promoting the cultivation of climate-resilient crop varieties - as an enabling factor to develop resilience of the entire agriculture system towards climate change, improve crop productivity, and support post-harvest management, and (b) crop-livestock integration - as a factor to be mainstreamed into the local agricultural system with the ability to mitigate GHG emissions through several mechanisms such as accumulation of soil organic carbon.

The '*Coming together*' phase and a part of the '*Research*' phase of the project were conducted simultaneously. Invitations were sent to potential youth organizations and individuals to collaborate in these efforts. Compilation of related research findings and further investigations on those were also given priority during this stage of the program. Gathering data regarding the research work done on developing climate-resilient crop varieties was successfully completed with the help of young undergraduates and researchers. The leading agricultural institutions of the country were contacted to obtain the required secondary data. The collected data were arranged into a well-classified database that can be accessed and used efficiently. Further discussions were carried out with young climate enthusiasts to find means of expediting the implementation of the program.

These actions were followed by activities targeted at knowledge dissemination and raising awareness. Public institutions and farmer organizations were also engaged in this process. Initially, the project was implemented in a small scale targeting specified pilot areas, with a view to expand the study later. There is also a need to identify proper evaluation mechanisms to assess the key performance indicators to be used during the implementation phase.

3. Implications/Results

Dissemination of information on research outcomes related to climate change, mitigating climate change, and climate adaptation has helped improve awareness among farmer communities and encouraged them to adapt innovative and sustainable farming technologies. It also created an effective platform for networking with young researchers, activists, and agricultural research institutions. The strategy did add more value to the related research activities by increasing their utility in the real world. Innovative ideas, collective efforts, and inclination toward sustainability of the youth helped drive this initiative.

4. Challenges

Accurate prediction of the climate changes was important in selecting crop varieties for

cultivation. The currently available technologies within the farmer ecosystems are inadequate; hence, upgraded technologies should be integrated into the agricultural systems to implement this initiative successfully. The capacity to embrace the specified avenues is limited in some instances due to extensive labour requirements. Restoring the traditional labour exchange patterns such as "*Aththam*" may help overcome this constraint. The climate-resilient crop varieties sometimes did not deliver the same yield and properties of the normal crops and hence, had affected the agriculture-based supply chains. Therefore, further planning and restructuring are required to introduce adaptive mechanisms involving the country's entire food system. Considering the current situation of Sri Lanka, several new challenges have also emerged in relation to providing infrastructure, supplying inputs, diminishing social capital, etc. Sound planning and selecting approaches that optimize the available resources are required to overcome them.

5. Relevance to the ISS Theme

CRISIS is a strategic framework that can achieve food security through climate change adaptation and mitigation. The ultimate objective of this strategy is to improve resilience among the farmer communities and stabilize their income while ensuring an uninterrupted food supply. The major role players of *CRISIS* are youth, and their efforts and creativity power the model. Networking with youth organizations and student groups would support the knowledge dissemination process based on the outcomes of the study. This initiative would lead to sustainability by encouraging climate-resilient agriculture and solving food insecurity issues in Sri Lanka.

6. Acknowledgement

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Analysis of replication proteins of the Maize chlorotic mottle virus in the yeast (*Saccharomyces cerevisiae*) replication system.

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Keywords: MCMV, yeast, viral replication proteins

1. Problem statement

The MCMV has gain importance in recent years because of its role in the Maize Lethal Necrosis Disease, a synergistic disease of maize that needs of the presence of the MCMV together with one or more species of the Potyviridae family, such as the Sugarcane mosaic virus (Redinbaugh & Stewart, 2018). This disease has caused big losses around the world, but it has been especially significant in the east of Sub-Saharan Africa. Recent filed surveys indicate that the disease prevails in Ethiopia, Kenya, Uganda, Tanzania and Rwanda (Boddupalli et al., 2020). All together have had average annual losses of 291.2- 339.3 in the period from 2009-2013. The expected losses for the for 2016-2020 were of 365 million dollars per year and for 2021-2025 and it is estimated that they are going to be of 417.8 million dollars (Pratt et al., 2017). In the context of the climate change, it has also been predicted that it is going to expand to other areas, since there will be more places that are going to have suitable conditions for the spread of the disease (Isabirye & Rwomushana, 2016). This may also imply the spread in other parts of the world. To study this disease and the synergistic relation between these viruses it is important to study the functions of the viral proteins. Regarding this, some discoveries related with proteins from the MCMV has been made, however, further research needs to be done. It has been reported that both p50 and p111 are proteins related to the viral replication (Scheets, 2016).

2. Actions

To investigate these proteins more in detail I did a replication system in yeast. It has already been demonstrated that yeast is capable of replicating the genomic RNA as well as subgenomic RNA1 and subgenomic RNA2 of the MCMV (C. A. Juárez-Macuil and H. Garcia-Ruiz, personal communication, 4 May, 2022). In order to have a deeper understanding of the proteins related to the viral replication, different yeast families were transformed with plasmids that included parts of the viral genome. This yeast samples were harvested, proteins were

extracted from and analyzed by Western Blot to see if it was possible to detect p50 and p111. This required understanding of the experimental procedure and a deep theorical knowledge motivated by the desire of making progress in finding a solution for this disease. Along the performance of the experiments I had to develop my critical and scientific thinking in order to face different obstacles and give suitable solutions that help me to get results.

3. Results

According to the results p50 was detected in all the genotypes that included a plasmid with the gene to express the protein (Figure 1). In the case of p111, it was detected when the yeast had a plasmid with both p50 and p111 together (family I). As expected, it is important to mention that p50 was also detected in this same family (Figure 2).

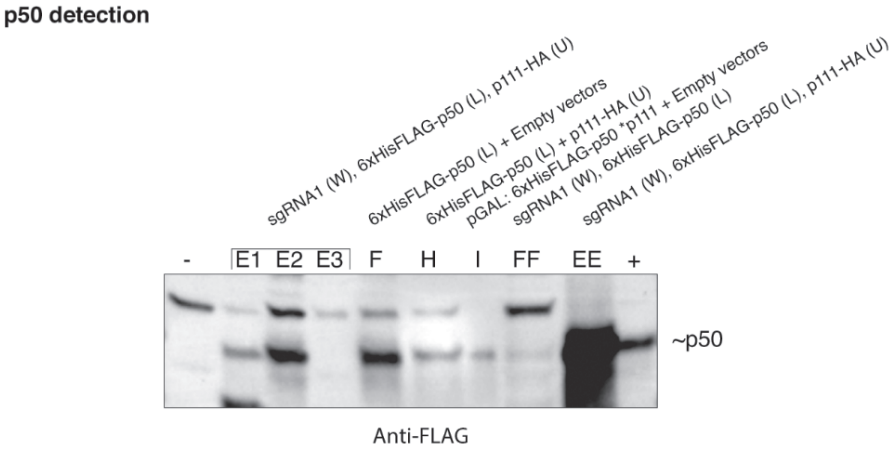

Figure 1. Detection of protein p50 with Anti-FLAG. This protein was detected in all the families that had a plasmid with p50, except for E3. However, p50 was detected in families with the same plasmids as E3: E1, E2 and EE.

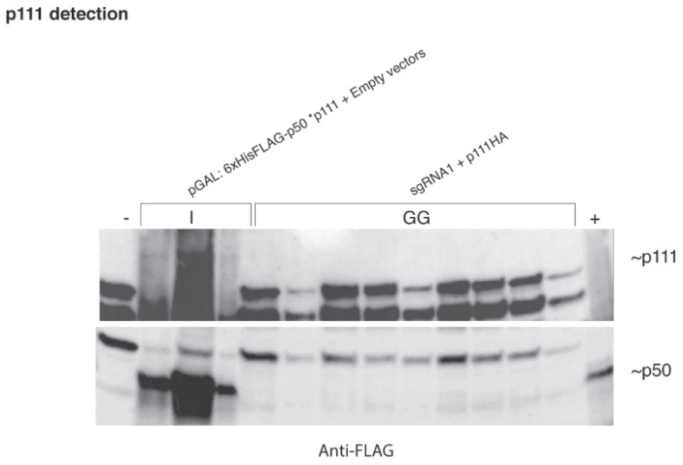

Figure 2. Detection of protein p111 with Anti-FLAG. This protein was detected in family I but not in family GG. p50 was detected in family I as expected.

4. Challenges and perspectives

A lot of progress has been made in developing a functional replication system for the MCMV to study the replication proteins of the virus; since both p111 and p50 have been detected. The detection of p111 alone or with a plasmid to replicate sgRNA1 is not conclusive and further research needs to be done in order to detect p111 in other combinations of plasmids. Regarding the importance of climate change mitigation, further research in this topic is essential. Climate change may cause adequate conditions for the disease development in new places. This is why the understanding of the molecular function of the virus is important to identify a solution for the disease. By developing a system in yeast that simplifies the study of the virus a lot of success can arise in the understanding of the molecular functions. With the results that were obtained it was demonstrated that *Saccharomyces cerevisiae* is a great option to continue with the study of this virus at a deeper level. This set of experiments represent a small yet essential step in order to development resistant plants to face this disease. This will help guarantee food security in the middle of the climate change crisis in all places where maize is cultivated.

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Cobio: A Slow-Release Hydrogel Fertilizer from Organic Waste for Floriculture as Youth Innovations in Sustainable Agriculture

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Keywords: floriculture, hydrogel, innovation, mycorrhizal, organic waste

1. Problem Statement

As a developing country, Indonesia faces a significant dilemma regarding organic waste management. Organic waste disposal in landfills has created various environmental damages, such as greenhouse gas emissions and leachate (Shukor et al., 2018). On the other hand, organic waste could be utilized as a fertilizer to improve the quality of soil and plants (Fauziah et al., 2018). This is a potential given that floriculture is still facing a problem of various diseases due to unfulfilled nutrients. Meanwhile, the existing continuous use of inorganic fertilizers contributes to climate change and groundwater pollution because they dissolve quickly and contain salts that can burn plants. These relatively fast-release inorganic fertilizers in liquid and powder can easily be washed away and are not absorbed by plants.

Organic wastes such as banana weevils, tofu dregs, rice water, and palm liquid waste are abundant in the community and can be processed into organic fertilizers. Indonesia has been marketing several organic fertilizers, for instance, Mikrohara GA and Micro-Hydro Plus. However, these organic fertilizers are impractical and of low quality. By observing the issues of the existing organic fertilizers and considering potential resources, organic-waste-based fertilizer in hydrogel form can be a better solution for nature. Hydrogels are polymers capable of absorbing and releasing water. These polymers could provide more benefits, such as increasing fertilizer efficiency and retention, stimulating better nutrient absorption, supplying nutrients sustainably, and reducing the frequency of fertilizer use (Rabat et al., 2016). These hydrogel organic-waste-based fertilizers are also enriched with mycorrhizal to optimize the absorption of soil nutrients. Mycorrhizal inoculation can increase plants' vegetative growth and the number of flowers and inflorescence (Noor et al., 2019). This slow-release fertilizer will reduce the frequency of fertilizer use, an attempt to mitigate climate change and make sustainable agriculture.

2. Student's Activities

The author develops an innovative breakthrough product, called Cobio (Consortium Biofertilizer), a slow-release hydrogel fertilizer based on organic waste, microbes, and mycorrhizal for floriculture with five functional benefits, namely (1) fertilizing the soil; (2) expanding nutrient absorption areas; (3) maintaining plant health; (4) stimulating flower growth; and (5) being a slow-release fertilizer. Cobio's first production was in Bogor, Indonesia, on June 1st, 2021. The production scheme consists of pre-production (preparation of tools and

raw materials), production, and post-production (marketing and sales). Cobio is offered in two sizes, 500 g sold for IDR 12,000 and 1,000 g sold for IDR 20,000. Cobio contains macro and micronutrients that are beneficial for the growth of floriculture. Palm liquid waste contains a large element C for microbial growth. Macronutrients of N, P, K, S, and Mg are obtained from banana weevils, rice water, and tofu dregs. In addition, these wastes also contain micro-elements, namely Fe. Cobio nutrients meet the optimum conditions of the necessary nutrients as recommended by Sirin (2011), who states the most optimal nutrient concentration for floriculture is N (0.015%), P (0.003%), K (0.023%), S (0.002%), Fe (0.008%), and Mg (0.003%). The ingredients in Cobio have also fulfilled Regulation of Indonesian Ministry of Agriculture No. 70 in 2011 on organic soil destruction and arbuscular endomycorrhiza. Cobio as youth innovation would encourage Indonesian society to support and use hydrogel organic fertilizer through planned and customized strategies for reducing climate change.

In the 2021 pandemic era, Cobio operated on both online and offline platforms. In online platforms such as social media (Instagram, Facebook, and WhatsApp), Cobio digitizes information to spread awareness among members of society in Indonesia and worldwide about the importance of slow-release hydrogel fertilizer from organic waste and the environmental impacts in the long term, primarily through floriculture communities. In addition, Cobio uses e-commerce to increase sales through free shipping programs. To increase Cobio's awareness rate, promotion is carried out through creative content such as **#CobioFunfact**, discussing general information about organic hydrogel fertilizer, **#CobioQuiz**, presenting short quizzes to broaden horizons about organic fertilizer, **#CobioChallenge**, prompting challenges to increase public awareness in a fun and educational way. While on offline platforms, Cobio reaches the local group in Dramaga Subdistrict, Bogor, to introduce a new product and get direct feedback, especially about organic fertilizer. Lastly, evaluation is carried out through consumer surveys to consider future product development. These strategies will be the basis of a sustainability plan to make a change in the future.

3. Implications/Results

The commercialization of Cobio is carried out from July 11th to October 9th, 2021, with a total of 1,263 packages sold. Product sales have reached 13 provinces in Indonesia, and most consumers are between 31-40 years old. Promotion is carried out through e-commerce with free shipping fees, seasonal discounts, ads, and consumer satisfaction surveys. Sfenrianto et al. (2018) reported that Indonesian e-commerce positively affects consumer confidence in supporting purchasing decisions. Offline promotion is by word of mouth between communities and consumers. Both promotion channels generate positive feedback from the educative content and testimonials uploaded on social media. WhatsApp Business achieved the largest sales figures based on the channels, reaching 918 packages. The consumer satisfaction survey shows that 64 out of 100 consumers expressed "very satisfied" with Cobio.

Cobio was registered for Patent as part of Intellectual Property Rights on August 20th, 2021, and it was approved on February 22nd, 2022, with Patent no. P00202106523. This Patent has significant social, economic, and environmental implications. The participatory partnerships justify the positive changes regarding the social impact of Cobio with various stakeholders who produce related waste and process it to embody the potential of organic waste that has not been utilized optimally into functional entrepreneurial products. Other youth also participate by spreading information and using organic fertilizer to influence the surrounding environment to implement similar actions.

Cobio also creates new business opportunities based on organic waste. These activities will encourage consumers to use organic products to maintain and promote sustainable agriculture. Cobio is a sustainable business having prosperous prospects as supported by consumer satisfaction surveys. Cobio also contributes positively to achieving Sustainable Development Goals 8, 12, and 13. Cobio's sustainability for the foreseeable future is reviewed from short, medium, and long-term strategies to final business development with IoT support, innovation in various aspects of business, and export to multiple continents to develop other waste-based products. This product generates mutually exclusive benefits for all stakeholders (community, governments, universities, research centers, and other agencies) and ensures student engagement to encourage the agricultural sector with advanced action.

4. Challenges and Perspectives

The lack of an active floriculture community in social media is one of the challenges for Cobio. As mitigation, the author creates a Cobio community to increase networking and organic fertilizer users for environmental sustainability ahead. On the other hand, only a small amount of organic fertilizer circulates in the community. It requires further introduction to prove Cobio as an organic fertilizer that significantly impacts plants.

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

Cobio is a product of youth innovation in the form of hydrogel organic fertilizer, which reduces the use of inorganic fertilizers in overcoming climate change and ensuring agricultural sustainability. Documenting these resources to promote more sustainable agriculture systems by using underutilized organic matter is necessary.

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The Challenges of Mountain Agriculture

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Keywords: Mountain Agriculture, TEK, Traditional Food Systems

1. Problem statement

Covering around 27% of the world's land surface, and supporting around 15 percent of the world's population, mountainous regions are an important zone to consider when discussing agricultural resources, especially in regard to the impacts of climate change (Romeo et al. 2020; Payne et al., 2020). It has been found that high-elevation environments experience more rapid changes in temperature due to climate change than environments at lower elevations (Mountain Research Initiative EDW Working Group, 2015). Increasing temperatures can impact crops by altering the timing of leaf development, flowering, and harvest (Korres et al., 2016). It can also result in a decreased vernalization period, shorter seed formation periods and overall lower crop yields. Furthermore, climate change may alter mountain landscapes by changing freeze and thaw times, increasing tree lines up to higher elevations, altering precipitation rates, and increasing the risk of severe wildfires (Korres et al., 2016). Looking ahead to how climate change may impact different mountainous regions is essential in ensuring continued food security and food sovereignty for the 1.1 billion people living in mountain communities.

The goal of this paper is to investigate how high elevations may be impacted by climate change, and analyze how traditional agriculture systems could adapt to or mitigate climate change impacts, including the use of traditional cultivars. This impact is assessed through two case studies: one on Hawai'i Island, and one in the Traditional Territories of the Squamish & Lil'wat Nations. Hawai'i Island provides a tropical location to analyze mountain agriculture, while the Traditional Territories of the Squamish & Lil'wat Nations are in a temperate zone.

2. Student's Actions or activities

I lived in the ahupua'a of Kealakekua, on Hawai'i Island, and in Whistler and Brackendale on the Traditional Territory of the Squamish and Lil'wat Nations, in British Columbia. I met with community representatives to learn more about the traditional food systems in these regions. Additionally, in Kealakekua, I worked as a farmhand and was able to observe the practices being used. I also looked through scholarly literature to see how different methods may assist in mitigating climate change impacts.

3. Implications/Results

Revitalizing traditional agricultural systems and reintegrating the use of indigenous

cultivars can help to mitigate the impacts of climate change felt by rural mountain communities. On Hawai'i Island, climate change has led to increased instances of drought, sea-level rise, coastal erosion, flooding, storm intensification, rising temperatures, climate-sensitive disease proliferation and ocean acidification (University of Hawai'i at Mānoa Sea Grant College Program et al., 2014).

Traditionally, there were more than 300 different Hawaiian varieties of kalo, each selectively cultivated over generations to suit different conditions and serve different purposes (Vaughan, 2018; Fujikane, 2021). Unfortunately, currently, only around 70 cultivars of Hawaiian Kalo are still known to remain (Cho et al., 2007). Reintegrating these local cultivars into their'ili will cause there to be less of a need for inputs, as the crops are specifically suited to their environment. It will also allow for greater food security in this area, as Hawaiian farmers will be able to produce enough local food to create substantial meals, rather than focusing on producing exports like sugar cane and pineapple. Furthermore, the circular water system as seen in the moku/ahupua'a land division system can help to conserve water use, thus lessening some of the water-related impacts felt by climate change.

In the Traditional Territories of the Squamish and Lil'wat Nations, climate change has led to more intense and frequent storms, altered salmon spawning cycles, increased melting rates of glaciers and snow, increasingly severe wildfires, and increased extreme temperature events, such as was seen during the historic"heat dome"in 2021. Traditional methods used, such as shade management, controlled burnings, and raising conventional livestock can help to offset the impacts of climate change.

As seen in both case studies, the traditional agricultural knowledge, and furthermore ecological knowledge, of indigenous groups living in mountainous regions has been created over thousands of years to be well suited to their local region. Integrating these methods under the guidance of local peoples can help to increase climate resiliency, food security, and food sovereignty.

I found it promising that many people I spoke with during my studies were also passionate about this topic. The other farmhands I worked with in Hawai'i were also very interested in local cultivars. Similarly, in Whistler, it was most gratifying to experience interest in the study by many young people. As a student, I feel that I was able to easily connect with other youths in my area and discuss our concerns with our food system. These experiences provide hope that, through community engagement, many of the issues regarding food security will be addressed, as the approach includes the challenges and solutions of the affected people.

These results can be used to assess the benefits of encouraging local traditional food systems in these communities in mitigating negative climate change impacts.

4. Challenges and perspectives

Although there is scholarly literature published on the traditional food systems of people living in mountainous regions, including that of Hawai'i Island and Whistler, little citizen research is available. Thus, my work will add the citizen perception that is often lacking in scholarly peer-reviewed literature.

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

By analyzing these two different regions, I hope to gain a better understanding of what challenges a community may face in the future due to climate change, and what ways these impacts may be mitigated through the use of traditional agricultural systems.

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Group B

Group theme

Food

Presenters:

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Characterisation of capsaicinoids from capsicums, chillies and the greenhouse horticultural waste of these crops

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Keywords: Capsaicinoids, protected cropping, biomass waste, *Capsicum*, value-addition

1. Problem statement

The increase in world population and adverse climate change has put a strain on agriculture production. Protected cropping is one of the key solutions towards sustainable food production (Rabbi et al., 2019). Capsicum crops grown under cover tend to produce better quality and prolonged (up to 6 months) yield (Australian Bureau of Statistics, 2008). Increased food production led to more food and agricultural waste and glasshouse production is more energy and capital investment (Lin et al., 2022). In 2018, global food waste was reported to be 1.6 billion tons causing a loss of US $1 trillion economically (Dahiya et al., 2018), US $900 billion socially and US $700 billion environmentally (FAO, 2021). Moreover, Australia loses $20 billion per year through food waste. Moreover, the conventional waste disposal methods (dumping in landfills etc) have environmental and ecological impacts (Babla et al., 2022). Therefore, the focus has now shifted towards green and sustainable processes because of the limited disposal sites and large costs on waste transportation (Chakraborty & Mohan, 2019). It is important to reduce the waste from capsicum production in protected cropping which can be done by using plant waste (leaves, stem and low-quality fruits) to extract capsaicinoids and value addition of these crops. A cheap, easy to use and standard extraction technique should be developed for growers.

Capsicums and chillies are rich sources of capsaicinoids, the secondary metabolites responsible for pungency of these fruits. Capsaicinoids are alkaloids with various physiological, pharmacological and antimicrobial characteristics. Capsaicinoids have been reported for their beneficial effects on gastrointestinal tract, respiratory system, cardiovascular system (Othman et al., 2011), arthritis (Deal et al., 1991), osteoarthritis (Kosuwon et al., 2010), diabetes and obesity via TRPV1 (transient receptor potential vanilloid channel 1) (Panchal et al., 2018).

2. Student's Actions or activities

To minimise waste impact from protected cropping on the environment the project aims to valorise waste biomass for extraction of capsaicinoids. Crop was grown under hydroponic technology in a high-tech greenhouse facility from March 2021 to October 2021. In the experiment 3 varieties of capsicum (Royston, Groote, Owen) and 2 varieties of chilli (Jet,

Caysan) were used. Plants were provided with dissolved fertilisers and fertigation was done at three different electrical conductivity (EC) levels i.e., low (EC 1.8 dS m^{-1}), control (EC 2.8 dS m^{-1}) and high (EC 3.8 dS m^{-1}). The second part of the study focuses on the characterization of capsaicinoids from capsicum and chilli plants (fruits and biowaste), and the effect of different EC treatments on its concentration. A standard solvent extraction protocol will be developed by testing different factors of time, solvent percentage, solute to solvent ratio and temperature.

3. Implications/Results

The UPLC analysis of Jet chilli initial trial showed the presence of capsaicin and dihydrocapsaicin at 3-minute retention time which is similar to Barbero et al. (2016). The effect of different nutrient treatments has been observed on yield, fresh and dry weight of plant, moisture percentage, and physiochemical properties of capsicum fruits. Overall, Royston variety had higher yield with T1 treatment. If the project is successful, isolation of capsaicinoids from waste biomass of protecting cropping will help in development of nutraceutical or pharmaceutical products at lower costs. It will lead to better food waste management, reduced economic and environmental impact and source of secondary income for growers. The extraction of these pungent compounds can benefit formulation research in future where these molecules can be encapsuled to reduce their pungent taste upon consumption. The project involves research by another PhD student on greenhouse modelling in warm climates. It aims to improve the economic viability of protected cropping due to reduction in the initial cost of the greenhouses (with locally available technology) and reduction in operating cost (energy and water use efficiency).

4. Challenges and perspectives

Outcomes of this project will promote potential collaborations with nutraceuticals and pharmaceuticals industries to develop useful products. The successful standardization of extraction techniques will help capsicum and chilli growers to earn extra income from valorization of crop waste and low-quality fruits. The research work can be expanded via presentations in conferences and to growers directly. The standardized technique can be promoted to stakeholder through farmer's market, local campaigns, on farm tours, print and social media. The work has been affected by Covid-19 challenges (lockdown and restricted access to the facilities). It might be challenging to get access to remote farming regions and contact growers because of their busy schedules.

The importance of waste disposal is introduced to the younger generation as a part of school curriculum or extracurricular activities (Waste, 2022). Australian government has laid out National Food Waste Strategy, Roadmap and the National Waste Policy Action Plan for reducing food waste to halve by 2030

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

The project is related to agriculture and food science sub themes. The study focuses on sustainability of food production by observing the best treatment combination which will allow

growers to have better fruit and capsaicinoids yield during off season production. Extraction of capsaicinoids from food and horticultural waste aims to reuse and recycle the waste materials and efficient utilization of resources.

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Using Starter Culture Technology for Improving Safety and Quality of Thua-Nao Kab (A Traditional Fermented Food in Thailand)

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Assistant Prof. Dr. Awanwee Petchkongkaew

Keywords: Climate change, Traditional fermented soybean, Safety

1. Problem statement

Thailand is ranked ninth on the list of the top 10 countries most affected by climate change in German watch's Global Climate Risk Index 2021. (Eckstein et al., 2021). Soybean cultivation in Thailand take place during summer and the rainy season. The northern part is the most important soybean cultivation accounting for 85% of the country's cultivable area. (Office of Agricultural Economics, 2021). At present, farmers have been affected by climate change through a decreased soybean germination rate, damaged and low-quality; therefore, northern farmers process soybean to increase agricultural value. They bring boiled soybeans to ferment. Then make thin round sheets and put them under the sunlight. These products are called thua-nao kab which people like to use as a condiment to eat with food, but climate change also affects fermentation of soybeans with the growth of pathogens or more microorganisms which causes more spread of infection. These problems result in pathogenic contamination and make food spoilage easily. For example, Thai researcher can detected the pathogens such as Bacillus cereus (Ekachai et al., 2011) in thua-nao kab from local methods. To troubleshoot these problems, we improve the method. We use starter culture to ferment soybean.

2. Student's Actions or activities

First, we will use the isolated bacterium *Baciilus subtillis* strain 38, which was isolated from samples of soybeans in northern Thailand and can produce protease enzyme, and. metabolic products that can inhibit pathogens (Chukeatirote et al, 2011).

Second, we improve the process to make product safe from pathogens. We use stainless steel tanks to ferment soybeans. We use drum-drier instead of leaves to make circular disk and drying under the sunlight was replaced by putting it in hot air oven.

Finally, we make product easier for consumers to use them and have long shelf life. Usually, people sell in sheet and then consumers roast and grind it by themselves. So, we grind it into powder forms because the dry powder has a low water activity (Aw); thus, products can be stored longer. Also, we change the package from normal plastic bag to biodegradable paper sachet to protect from light and oxygen deterioration. These new paper sachet are easier to decompose than plastic bags and do not create pollution that causes climate change as well.

3. Implications/Results

We presented an idea to our classmates. They are interested in this product and agreed that production methods should be changed to be safer and cleaner. They suggest that the product should add some nutrients such as protein because fermented soybeans use protease enzymes to digest protein which resulting in less protein in thua-nao kab. In addition, we collected data about consumer's attention in this product by used a Google form. The result is people who interested in the idea of this product are 79.1% and don't interested are 26.9%. Including, majority of the people agree about the idea of turning package into biodegradable sachet.

In society, I expect people can apply this process to make food safety. In economic, these products can increase the agricultural value. The farmers who grow soybeans have more income. In the environmental, changing the packaging from plastic to paper can reduces the greenhouse gas emissions.

Youths and adults can offer ideas on how to improve these product and where we need to improve. They can share this idea with people in their community and motivation is developing local food to be safe and to mitigate the effects of climate change.

4. Challenges and perspectives

My problem is continued improving this project's idea. So, I will use this idea as a questionnaire for consumers in each age group to collect data about which parts should I improve to reach the food safety standard, solving problems for farmers and promote my idea too. The product that I developed is a traditional food of the northern that is not well known to all people. So, I thought the promotion would be give some suggestion before collecting the survey data.

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

This idea was invented to improve local northern Thailand fermented ingredient product that can prolong the shelf-life. It can mitigate the effects of microorganism from climate change problem and increase income for farmers who grow the soybean and inspire new idea to others people to develop fermented products and preservation process.

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New and Safe Processed Foods in Cambodia

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Keywords: processed food, heat treatment, food sanitation

1. Problem statement

In Cambodia, agriculture accounts for 22.38% of the country's gross domestic product (GDP) (RGC/NSDP, 2019). People involved in agriculture mostly live in the local areas. In the local area, there is a limited storage and transport system for agricultural products and a lack of processing facilities and knowledge capacity (ADB, 2021). Because of this, a lot of agricultural products don't reach the consumer and are abandoned. For instance, cashew is one of the industrial crops in Cambodia but only the cashew nuts are commercialized, and the rest of the cashew fruits (cashew apple) become waste. Papaya is also an important agricultural product and an existing resource that is easy to grow and maintain. People grow papaya as their livelihood, they consume it, and they sell it fresh in wet markets (MAFF/GDA, 2010). People usually consume mature papayas and eat young papayas as vegetables, but not often for processing. However, the amount of processed food produced from local agricultural products is limited, and only 10% of the agricultural products are processed (Eurocham, 2018). Agricultural products are processed by the homemade method, and most of them are commonly sold at wet markets. Majority of Cambodian people do their shopping at the wet market. Food poisoning and food-related diseases frequently occur due to these home-made products. Muramatsu et al. (2020a, 2020b) reported that the homemade pickles sold at wet markets in Cambodia were highly contaminated with microbes, including the bacteria that cause food poisoning. A heating process that sterilizes food products is effective in reducing the microbial content. So, to improve food safety or sanitation, the heat treatment process (sterilization and/or pasteurization) is added to the production processes in this study. Therefore, to solve those problems, the effective use of agricultural products and the development of processed foods with guaranteed safety and quality are needed in local areas in Cambodia.

2. Student's Actions or activities

In order to solve those challenges and reduce the agricultural product loss, for example, the unused agricultural products (cashew apples) and the imperfect agricultural products (young papaya), we propose a suitable processed food with food safety. To reuse the unused agricultural products, we propose making jam. The jam is a gelled ready-to-eat product and has

many uses, for example, bread, milk-product, sweets, and so on. The jam is easy to make without the need for any special devices and skills. The jam also can be kept at room temperature. The cashew apples can be obtained for free in Cambodia. For a new use of imperfect agricultural products, we propose two processed foods: dried food and pickles. Dried foods and pickles are kinds of the existing preserved food in Cambodia. However, the dried young papaya and pickled young papaya are new processed foods in this study. We added heat treatment into the production processes for jam, dried young papaya, and pickled young papaya to ensure the products are safe to consume. The pickles were packed in a glass bottle, which is easy to pasteurize and enhances product value, quality, and safety. Glass bottles are readily accessible in Cambodia at a reasonable price and can be reused. Fresh young papayas are also reasonably priced and easy to find in Cambodia. Dried young papaya is one of the preserved foods to keep at room temperature and is comparatively easy to make.

Cashew Apple Jam

The jam raw materials were cashew apple, sugar, low-methoxyl pectin, and citric acid. These materials were mixed, dissolved, condensed, and prepared to 50° Brix sugar content while heating to approximately 80℃ . The jam heated to 80℃ was filled in a glass bottle. We called this sample a hot-pack jam. The hot-pack jam was reheated at 90℃ for 20 min in a sterilization process. After 20 min, the jam was kept at room temperature for cooling with sterilization. We called the sample with the sterilization procedure a reheated jam. These jams were used to evaluate the acceptability in Cambodia.

Dried Young Papaya

The hot air-drying characteristics of two types of young papaya, raw or fresh papaya and blanched young papaya were measured at three temperatures (30-70℃), three air velocities (1-3 m/s), and a relative humidity of 40 %. Usually, dried young papayas are rehydrated to some degree before eating. The water absorption characteristics of the dried young papaya and the dried blanched young papaya that were dried after blanching were investigated at three temperatures (20-40℃).

Pickled Young Papaya

Two kinds of pickled young papaya were made to develop a new, safe processed food that effectively utilizes agricultural products. These two types of pickles were used to evaluate the acceptability in Cambodia and other Asian countries.

3. Implications/Results

New and safe processed foods (jam, dried food, and pickle) are proposed. The cashew apple jams were acceptable and had the possibility of becoming new processed foods in Cambodia. We obtained the important basic information needed to optimize drying processes and design dryers. The pickles received mostly favorable evaluations from Cambodian and Asian panelists based on the overall evaluation scores (over 3.0). Both pickles were potentially

acceptable as new processed foods in Cambodia and in other Asian countries. Because these processed foods are simple, the local producers and manufacturers can also adopt them easily. The consumer receives a safe processed food product. The value-added to the unused and effective use of agricultural products and also the final processed products increased. The job opportunities and the farm village women's empowerment are promoted. The income of the local farmers and the Cambodia nation increased.

4. Challenges and perspectives

Cambodia is facing some constraints, such as knowledge capacity of food processing and food hygiene, processing technology, and processing facilities. If a small food processing plant is built in a rural area and people receive education about food processing, food sanitation, and so on, these activities also lead to the development of the rural area.

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

To make processed food, we need a material (agricultural products). To get a material, we need to manage the agricultural land adequately. Managing the agricultural land adequately leads to environmental preservation including the climate, the development of rural areas, and a sustainable society. Also, the development of processed foods leads to the development of rural areas and sustainable society.

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Group C

Group theme

Environment

Presenters:

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Chairperson:

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Development of cultivation technology using plant growth-promoting bacteria for sustainable agricultural production

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Keywords: PGPB, inoculation, sustainable agriculture, environmental burden

1. Problem statement

In recent years, there have been many discussions about the environmental impact of agriculture as a factor linked to climate change. One of these is the excessive or inappropriate use of chemical fertilizers. It has been pointed out that these practices have the potential to have various negative impacts on the environment. For example, soil fertility is reduced, soil physical properties degrade, and crop quality declines. Other issues discussed include eutrophication of rivers, lakes, and inland seas, accumulation of toxic substances in food and drinking water, and possible depletion of the ozone layer due to increased denitrification (Kosino,1978). In addition to environmental pollution, chemical fertilizers consume large amounts of fossil fuels and mineral resources, emitting greenhouse gases, and in regions without natural resources, they are forced to rely on imports for materials, making their supply uncertain. Japan also relies 100% on imports of phosphate ore, the material for phosphoric acid. In order to solve these problems, especially in the agriculture sector, the establishment of alternative fertilization practices or cultivation technologies to chemical fertilizers have become a pressing issue worldwide. The use of soil microorganisms is currently attracting attention. In recent decades, research on rhizosphere microorganisms and symbiotic bacteria has been conducted, and plant growth-promoting bacteria (PGPB) with several physiological functions that contribute to the promotion of plant growth have attracted attention.

Our laboratory was the first in the world to show that nitrogen-fixing bacteria symbiotically coexist in yams (Takada et al., 2019). Subsequently, research on symbiotic bacteria was conducted, and in a study by Ouyabe *et al.* in 2020, plant growth-promoting bacteria isolated from yam (*Dioscorea* spp.), tropical tuber crop (Takada et al., 2019) were inoculated into rice plants, and their growth-promoting effect was observed.

2. Students' actions or activities

Based on these previous studies, I'm conducting two experiments aimed to establish the PGPB inoculation method.

Site: Miyako subtropical training and research farm

Term: May 2022-Dcember 2022

Material: Kinandang Patong (rice), A-19 (water yam)

Bacterial strains: S-12 (*Rhizobium* sp.), S-8, S-163, S-187,1614 (*Enterobacter* sp.).

Experiment1: Rice inoculated with PGPB under different concentrations and fertilizer conditions

Objective: to survey the difference in rice growth under the different treatments; PGPB concentration and the amount of fertilizer. The treatments are as follows:

T01: control (no inoculation), cattle manure 100%, **T02**: control, cattle manure 50%,

T03: control, cattle manure 0%

T11: PGPB inoculation (OD 0.8), cattle manure, **T12**: PGPB (OD 0.8), cattle manure 50%,

T13: PGPB (OD 2.5), cattle manure 0%

T21: PGPB (OD 2.5), cattle manure 100%, **T22**: PGPB (OD 2.5), cattle manure 50%,

T23: PGPB (OD 2.5), cattle manure 0%

Experiment2: Mixed cropping rice and yam

Objective: to survey whether mixed cropping with rice and yam give a positive effect on the growth of rice such as PGPB inoculation. The treatments are as follows:

R1: control (rice only), cattle manure 100%, **R2**: control, cattle manure 50%,

R3: control, cattle manure 0%

RY1: mixed cropping (rice & yam), cattle manure 100%,

RY2: mixed cropping, cattle manure 50%, **RY3**: mixed copping, cattle manure 0%

Y1: control (yam only), cattle manure 100%, **Y2**: control, cattle manure 50%,

Y3: control, cattle manure 0%

3. Implications/Results

In the future, we will realize PGPB inoculation technology using organic fertilizers for rice, apply it to actual production sites, and expand the range of possible applications so that it can also be used for other crops. Ultimately, we will continue our research with the goal of developing a sustainable fertilizer management technology based on PGPB inoculation as a next-generation technology for promoting organic agriculture and reducing chemical fertilizer use. If this technology can be realized, it will not only reduce the environmental burden of soil, water, and air pollution caused by chemical fertilizers, but also serve as a catalyst for increased productivity in regions where chemical fertilizers are difficult to obtain and use, thereby reducing hunger and increasing income, and ultimately contributing to poverty alleviation.

4. Challenges and perspectives

A future challenge for research is to provide a stable growth-promoting effect of PGPB under field conditions. To achieve this, we need to study what kind of growth environment is necessary and what kind of inoculation conditions are required. For example, we need to conduct cultivation experiments one by one to verify the following items: fertilizer application conditions, inoculation methods such as soil spreading and dip inoculation, number of inoculations, appropriate inoculation period for the target crop, the concentration of inoculum,

selection of appropriate strains for inoculation, and changes in the bacterial flora due to inoculation.

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

Establishing an inoculation method for PGPB and promoting it as an alternative to chemical fertilizers would mitigate or solve environmental pollution caused by chemical fertilizers. We believe that PGPB can contribute to the reduction of greenhouse gas emissions, which is in line with the ISS theme of climate change adaptation.

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Identification of Root Emitted Volatile Organic Compounds (VOCs) in Response to Phosphorous Deficiency in Tomato Plants

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Keywords: Phosphorous Deficiency, Apocarotenoids, Volatile Organic Compounds, HS-SPME-GC/MS

1. Problem statement

Soils are multidimensional and consist of multiple levels of interactions and competition for limited resources. It is known that plants communicate with soil microbiome for accumulation or uptake of essential nutrients. A classic example is the symbiotic relationship between plant roots and Arbuscular Mycorrhizal (AM) fungi for Phosphorous (P) uptake (Yoneyama et al., 2007).

P improves plant productivity as it is present in major plant processes and molecules (Massalha et al., 2017) and given what we know about its use and availability (Hinsinger, 2001; Péret et al., 2011), we would expect that there are signals to deter competing organisms from P resources in the soil. Therefore, Volatile Organic Compounds (VOCs) also known as Volatile Apocarotenoids – VAs are effective means of attracting AM fungi or preventing other competitors. Herein, we examine the VOC profile from tomato roots at varying concentrations of P nutrition over a time series using Headspace, Solid phase Microextraction Gas Chromatography Mass Spectrometry (HS-SPME-GC/MS).

2. Student's Actions or activities

This project will help provide more understanding, discovery of novel and existing VAs that enhance the survivability of tomato plants in low P stress conditions, thereby, improving biomass, root development and yield, enhanced nutrient uptake, and strengthened symbiotic associations with soil microbiome.

We adopted the optimized HS-SPME-GC/MS technique as described by Rivers et al. (2019) which allows for sensitive, reproducible, accurate, and high-throughput detection and quantification of VOCs. Plant roots were analyzed in response to the P concentrations.

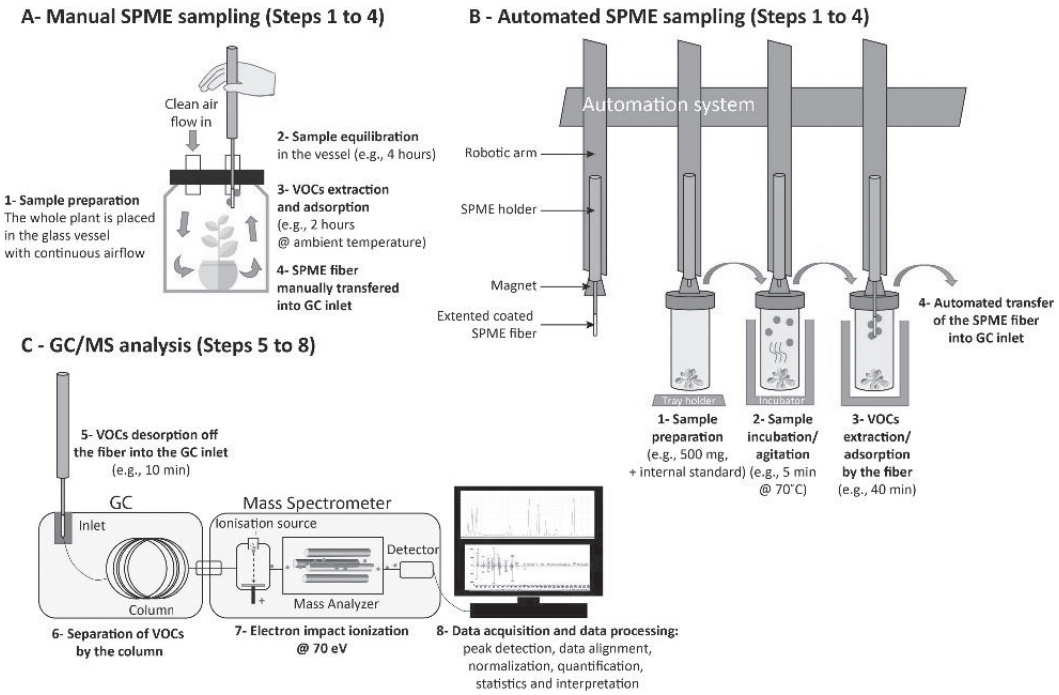

Fig 1: Schematics of the HS-SPME – GC/MS technique adapted from Julie Leroux (2022).

3. Implications/Results

The relative content of each VOCs obtained directly from GC peak areas would appear as percentage composition (Palá-Paúl *et al.*, 2004).

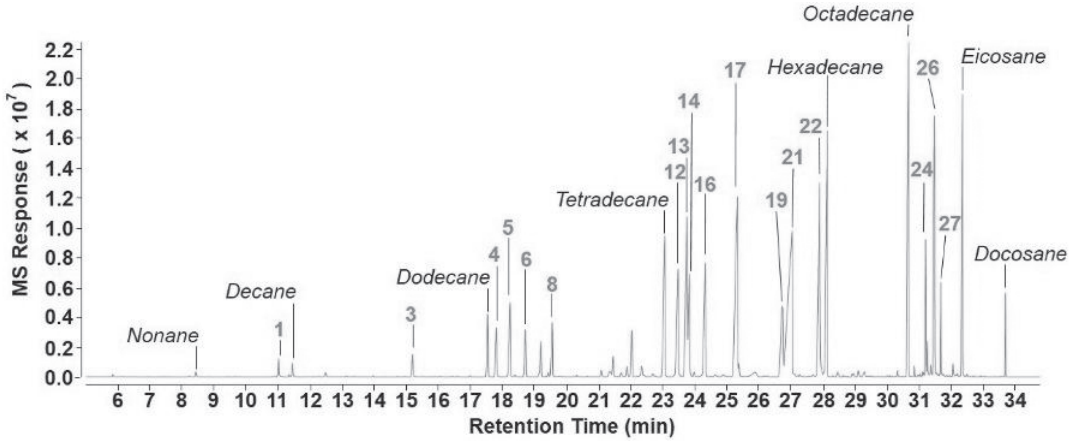

Fig 3: Total ion chromatogram of apocarotenoid standards (numbered in orange) and n-alkanes C9 – C22 (denoted in black).

Agilent MSD ChemStation software (version E.02) and Agilent MassHunter software (version B.50) were used for data acquisition and analysis respectively. Statistical analyses were performed using R. VOC identification is based on mass spectrometry and the NIST/ EPA/NIH Mass Spectral Library (version 2014) for mass spectral matching (≥ 70%

confidence) and peak annotation. Kovats non-isothermal RIs was calculated for all identified peaks using n-alkanes C9- C22 and compared against scientific literature RIs from the NIST, PubChem and Adams Essential Oils databases.

4. Challenges and perspectives

Issues relating to the pandemic, infection, extended lockdown, and delay in the delivery of consumables and also, flooding impacted the research timeline. Moreover, the total automated HS-SPME-GC/MS method run time is 108min per sample.

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

This research is well linked to the general theme of innovation towards climate change adaptation and mitigation especially for the plant environment. An understanding of the happenings in the root zone helps us develop innovative ways for plant adaptation whilst reducing our environmental footprint of fertilizer usage. VOCs are an important part of plant growth and development as they regulate and are involved in key processes that determine their survival (Rivers et al., 2019).

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The implication in water quality within the Inland Bay of Lake Titicaca in relation to tourism immobility during the SARS-CoV-2 2019 pandemic

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Keywords: water quality, Lake Titicaca, SARS-CoV-2 2019, tourism immobility

1. Problem statement

The COVID-19 pandemic has been one of the most shocking events of the 21st century, which has had repercussions around the world (Vasquez-Martinez, 2021). Therefore, tourism has certainly been one of the most affected fields (Gossling et al., 2021; Jaaron et al., 2021); border closures and mobility restrictions aimed at curbing the spread of the virus have reduced tourism activity (Zhong et al., 2021). This had a negative impact on Puno City because the economy of the region is dependent on the tourism sector (Laurente Blanco, 2021). Under this premise, the number of boats to the islands bordering the Inner Bay of Lake Titicaca was greatly reduced, this could lead to an increase in the concentration of BOD (Biochemical oxygen demand) due to the lack of movement by aeration. The aim of the research is to determine the relationship between the immobilization of tourism during the quarantine period due to the COVID-19 and the level of BOD (Biochemical oxygen demand) pollution in the Inner Bay (IB) of Lake Titicaca

2. Student's Actions or activities

2.1. Statistical information

The gathered information of the flow of tourists and boats was requested from the Ministry of Foreign Trade and Tourism (MINCETUR), and the General Directorate of Coast Guard and Coast Guard (DICAPI). Each request was made through the transparency portal of each entity.

The information was organized according to the tourist islands that belong to this ecosystem: Amantani, Taquile and Uros.

2.2. Satellite image processing

We only worked with a section of the satellite images, which corresponds to the study area. For this purpose, we developed an Application Program Interface (API) in the Geographic Information System software called QGIS. Bands 2, 3 and 4 of each satellite image are the ones of interest. It is possible to find the shapefile within the UTM Coordinate System Southern Hemisphere, zone 19S.

Thereafter, we proceeded to link the previously cut bands with the Puccasky™ software, which contains algorithms to determine the parameter BOD (Biochemical oxygen demand). This process was carried out with all the months of the study period.

Table 1. Criteria for image representation.

Type	Value Configuration	Interpolation	Level of accuracy	Method	Groups
Pseudocolor monoband	Incremental (2 - 98%)	Linear	2	Quantile	15

2.3. Identification of BOD concentration

Two classification rules were used on each of the previously processed satellite images.

(i) The first rule gives two ranges of values to the images. These were entered and the Float32 option was chosen as the output data type. Then, we proceeded to use the polygonize tool to remove the values outside the initial classification with the erase part tool. For this purpose, a categorized symbology was applied and DN was chosen in the value option for the resulting vector layer. Thereafter, using the extraction tool, a new raster was extracted, in which the input layer was the previously processed raster and the mask layer was the vectorized product of the polygonization

(ii) The second rule was applied, that is shown in Table 5. Therefore, the same step was repeated with the polygonise tool. Moreover, using the select objects by area tool, we proceeded to invert the selection and delete the selected objects. Finally, a new field was developed and the area in hectares was calculated, under the given rules, with respect to the total area. This second rule is the one that allows us to directly obtain the estimates of the percentage of BOD (Biochemical oxygen demand) concentration area, according to the total area.

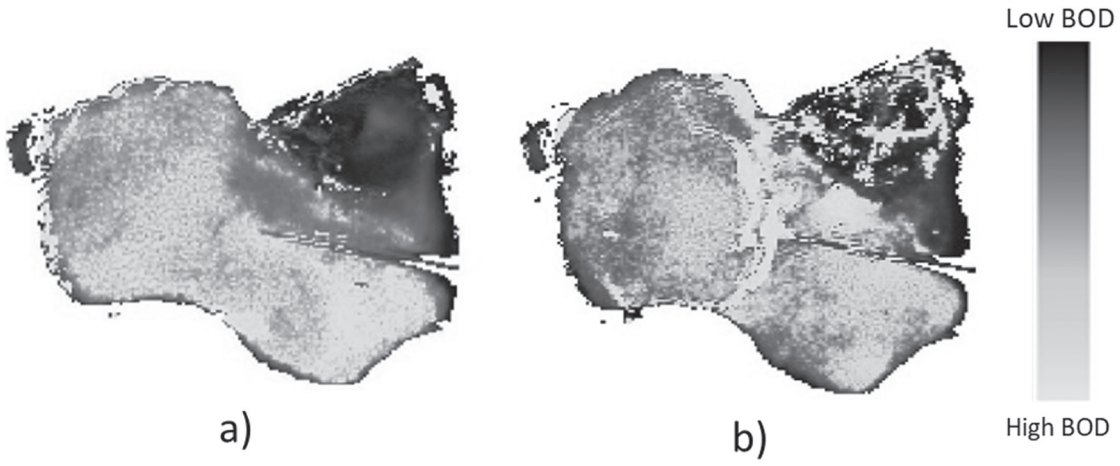
Table 2. Reclassification Rule by Table in QGIS applied to raster images

Rule	Minimum range value	Middle range value	Maximum range value
Rule N° 2	0 - 0.05	0.05 - 0.15	0.15 - 1000

3. Implications/Results

The area of high BOD concentration is distinguished by the intense yellow coloration. In that regard, in the month of December 2020 (a) there is a high BOD concentration distributed almost uniformly. In November 2021 (b), it shows that the high BOD concentration accumulates in a certain area of the BI, in a south to north direction.

The results showed that there is a relationship between the influence of COVID 19 (quarantine), which directly affected tourism, and the level of contamination of the Lake Titicaca BI. This relationship is defined by a coefficient of determination of 0.01.



4. Challenges and perspectives

One of the challenges of this research has been access to information.

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

Is linked to the environment, since with the Landsat 8-9 OLI/TIRS C2 L2 images, it was possible to show the considerable relationship of the polluting effects in the BOD, this due to the commercial behavior coming from tourism in the city, as well as polluting factors derived from social behavior. and government environmental policy factors.

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Changing climate and herbicide resistant weeds to sustainable agriculture

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Keywords: Climate change, Increased herbicide resistance, Youth

1. Problem statement

India's unique demographic advantage of larger proportion of youth in its total population presents a plethora of opportunities to sustain in today's dynamic world. Due to drastically changing climatic conditions and illiteracy Indian farming communities are struggling with the problem of herbicide resistance. This situation has worsened due to inadequate knowledge of dosage, duration and critical stages of input application that leads to soil health erosion, environmental degradation, depleting yield potential and reduced number of viable herbicide options. The estimated loss due to weeds in India is about USD 11 billion (Gharde *et al*., 2018).

2. Student's Actions or activities

To address the problem, I designed a chart which depicts the critical stages, time and dosage of input application for popular local wheat variety. I demonstrated the method of usage of this chart to villagers, affixed some copies at public locations and requested farmers to do their field operations accordingly. I motivated farmers, my classmates and retailers for collective actions and to spread awareness about precision agriculture and timely application of inputs and encouraged farmers to follow the approach of climate smart agriculture in their farm management and planning to make out way of life sustainable. By this, I did my foremost efforts to reduce the over- reliance of farmers on the usage of narrow spectrum herbicide which have similar mode of action that leads to evolution of herbicide resistant weeds and encouraged them to adopt crop diversification and crop rotation that leads to sustainable agriculture.

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 output and boost in soil health and productivity with improved microclimate and soil biodiversity. There was an observable shift from traditional farming system to modern agriculture system, and from chemical weed control practices to integrated weed control. Farmers developed a keen interest in calculated and scientific application of inputs for rationalizing agriculture.

4. Challenges and perspectives

The tolerant weed species, poverty, illiteracy, ignorance and dearth of skill are the major changes in Indian communities. The key challenges due to changing climate are shift in weed flora, as enriched carbon dioxide conditions are expected to favour C3 photosynthetic pathway and can cause increased incidences of weed invasion (Singh *et al.*, 2016). Herbicide resistance reported in Phalaris minor and Rumex dentatus prominent in Rice-Wheat cropping system (RWCS) against Isoproturon and Metsulfuron-methyl (Kaur *et al.*, 2022).

Discussion of this issue on such a significant platform, starved faces and the need to feed the ever-increasing population are the source of motivation to develop flexible integrated management practices which are based on the knowledge of weed biology, ecology and climate.

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

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 devastating effects of climate change by the implementation of effective management practices, collective efforts of youth, cooperation from the farmers and innovators for sustainable development of agriculture and my country as a whole.

I strongly feel that, it is the responsibility of youth especially young agricultural undergraduates, to connect and unify all resources and to use them according to varying climatic conditions for modernizing and sustaining agriculture.

Let's make sure our agriculture is productive and sustainable for the generations to come.

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Group D

Group theme

Nutrition

Presenters:

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Conserving Tank-based agriculture systems by establishing community-based climate-smart villages in Monaragala district of Sri Lanka.

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Keywords: climate-smart village, Monaragala-Sri Lanka, community mobilization, **tank-based agriculture, climate vulnerability**

1. Problem statement

Agriculture sector plays a vital role in the Sri Lankan economy and contributes 7% of the Gross Domestic Production (GDP) and around 2.14 million (25.3% of the workforce) people are employed (Central Bank of Sri Lanka, 2020). The occurrence of extreme events of droughts and floods has been in the rise affecting crop production badly, and Sri Lanka holds the 30th position in the Global Climate Risk Index 2021, which indicates an increasing trend of vulnerability in the agriculture sector. Crop cultivation is predominantly practiced in the dry-zone (< 1750 mm annual rainfall) using water collected in tanks during the major rainy season (October − February) where prolonged droughts could drastically reduce crop production and the country's food security. Monaragala is a leading agriculture-based district in the dry-zone, where the main livelihood of the majority of people is agriculture, has been identified as one of the most vulnerable districts to drought (M. Heenatigala, 2021). Capacity reduction in major and minor tanks due to siltation, pollution, catchment depletion, encroachments, dumping of waste, etc., reduces the availability and the quality of water for irrigation and this is further aggravated due to climate change impacts. Thus, being an agriculture undergraduate, my ambition was to build the capacity of youths and farming communities in Monaragala district on climate-smart technologies and to mobilize them to conserve tank-based irrigation systems and to make more climate-resilient farming communities.

2. Student's Actions or activities

The project intended to establish a climate-smart village through community mobilization with the main emphasis on improving and conserving the capacity of tanks for agriculture. As the first step, Madulla Division in Monaragala District (which is having higher number of major and minor tanks) was selected and a questionnaire survey was conducted from randomly selected 30 farm families in this division to gather information on their knowledge on the reasons for capacity depletion of tanks and major issues, negative environmental impacts and to obtain suggestion to address these problems. After identifying the background knowledge, as the second step, farming communities, specially the youth, will be educated on climate-smart

technologies and practices, and motivated them to implement those climate-smart adaptation and mitigation technologies and practices. Using the trained volunteering youth, this concept, in collaboration with the government extension network, will expand to other divisions of the district. Progress of the implementation of conservation measures to enhance water holding capacity of tanks through the direct engagement of the farming communities will be assessed conducting post-surveys. Through experience gained, a specific goal-oriented youth team is formed and mobilized them to broadened the concept island-wide, also linking related stakeholders with rewarding package for dedicated contributions.

3. Implications/Results

Survey results revealed that with the current economic and food crisis in Sri Lanka, all the participants are motivated to engage in agriculture using advanced technologies. Majority of the youth showed much enthusiasm to establish modern agricultural systems by adopting advanced technologies as business ventures to have a stable and sustainable agriculture-based livelihood, but identify lack of knowledge as a major limitation. All participants highlighted water limitation as the main issue, and the need of acquiring the required knowledge. All mentioned that they have been observing the capacity of the tank is depleting rapidly (Fig 1a), not enough water is available for crop cultivation as in the past, and also water become more polluted.Among the surveyed, 83.3% of farmers use only tank water for irrigation (Fig 1b).

Figure 1.(a). A photograph of a capacity depleting tank in Madulla Division of Monaragala District.

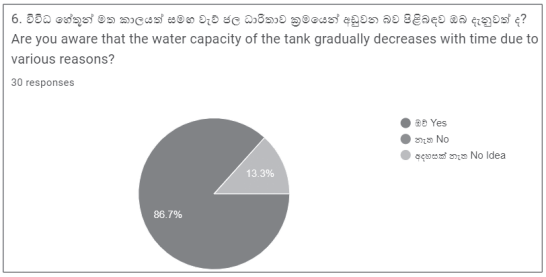

Figure 1.(b). Percentages of the farmers who observed the depletion of the capacity of the tanks in the Madulla Division.

Thus, educating the youth on efficient water-use systems, crop varieties which are having higher water-use efficiencies, soil and water conservation measures, more importantly the tank catchment conservation and enhance water holding capacity of the tank, environmentally-friendly integrated resources management and agronomic practices, etc., are very much essential. Famers are willing to join any related training programs, incorporate new technologies into their farming systems, and to share new knowledge with others to increase the crop productivity and sustainability. Through capacity building, this project will definitely increase the socio-economic well-being of the farming community, while making them more economically stable. As mentioned above, the local youth will be motivated to be the key

drivers of this process through the establishment of an empowered with the specific goal-oriented volunteering youth team for the task.

4. Challenges and perspectives

Changing the misconceptions established through tradition, lack of knowledge, and long-term traditional practices of farmers are challenging tasks. The enthusiastic, motivated, and educated youth and young farmers are selected in the initial steps to disseminate new knowledge to the farming communities. Since there is a reputation for university involvement, addressing the challenge of the lack of trust on any external engagement in agriculture and environment conservation, could be overcome. Therefore, the selected message conveying agents, who are well trusted among the farming communities in collaboration with the university, are used in the third step. As a village is a place where everybody is in mutual respect the new knowledge can pass through the community in a trusted way when the educated youth are used as the key drivers to disseminate related knowledge of climate-smart methods listed above.

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

Effective implementation of conservation of tank-based cascade system and appropriate climate smart technologies through capacity building of farmers and youths will enhance the water availability for crop cultivation and productivity throughout the year. The outcome of this will ensure the establishment of a sustainable agricultural system, food security, and livelihood improvement in these high-risk climate-vulnerable communities while also directly addressing several SDGs.

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What is the capacity, role, and potential contribution of the youth to reduce carbon footprint and how this, as a collective action by the youth, can support sustainable development in France?

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Keywords: sustainable development, carbon footprint, food industry

1. Problem statement

As Édith Boukeu, a Cameroonian journalist, reported: "Respecting our environment means changing our lifestyle habits so that they are linked with sustainable development". Indeed, every day, the food eaten by people all over the world connect many sectors from producing to retail and to sell it.

"There are an estimated 570 million farms worldwide today, and millions of other people work in food-related jobs" (Brooks, Deconinck and Giner, 2019).

Nevertheless, food production is a small aspect of the food system. The agro-food sector provides consumer goods for millions of people. Most people living in extreme poverty are in rural areas where the agro-food sector is the most important activity but not so much developed.

This leads to the environmental footprint. Agriculture stands for 40% of the earth's surface, more than any other human activity.

Finally, three most important challenges on the Earth are feeding a growing population, providing a livelihood for farmers, and protecting the environment (Brooks, Deconinck and Giner, 2019).

At school, those problems are often exposed to make students aware of the world in which we live and the preoccupations for today and the future.

2. Student's Actions or activities

As far as I am concerned, I was taking part in an association this year. It was the Association of Students of my campus; it was a team of 28 members and our role was to coordinate all associations and students' projects on campus. Indeed, I oversaw the sustainable development of the association. Their role was to make students aware about sustainable development on campus and in their associations. As a project, we asked them to nominate one person in charge of sustainable development in the association to make their actions and events

more eco-friendly. We also asked them to do the carbon footprint of their biggest event and we were with them to help us with the calculation.

The UniLaSalle group has also a sustainable development team, with which we worked. The coordinator informed us quite often about events linked with sustainable development on campus: Climate fresk, May in bike, GEIC news, fairtrade fortnight...

Carbon footprint aims to identify and evaluate the quantity of greenhouse gases emitted by an organization over a year, necessary for its operation (ADEME, 2022).

Finally, the Carbon Footprint is a tool that allows us to identify all sources of greenhouse gases emissions responsible for global warming to reduce them. It is an essential tool to contribute to the achievement of the Paris agreements and carbon neutrality, the first lever of which is the reduction of greenhouse gases emissions. The first action is the need to strengthen cooperation with different departments to improve data collection, and to make people aware of the importance of this study.

3. Implications/Results

Table 1. Table representing the carbon footprint of the moving and the food for an event on one week by the Association of Students (ADEME, Agribalyse)

	Moving	**Kg CO_2/km**	**Distance (km)**	**Emissions (kg CO_2)**	**Total (kg Co_2)**
On the week	By car	0,193	245	47,285	48,769 kg CO2
	By bus	0,035	42,4	1,484	
	Food	**Kg CO_2/kg**	**Number of kg**	**Emissions (kg CO_2)**	**Total (kg CO_2)**
1st day	Bread	0,67	52,25	35	249,06
	Cheddar	6,27	11,4	71,5	
	Ham	11,88	12	142,56	
2nd day	Bread	0,67	52,25	35	196,28
	Mozzarella	5,49	7,2	39,528	
	Chicken	7,31	15,2	111,112	
	Ketchup	0,94	1	0,94	
	Orange	0,97	10	9,7	
3rd day	Potatoes	0,47	30	14,1	1907,42
	Salad	0,88	15	13,2	
	Beef	42,73	44	1880,12	
4th day	Pasta	1,72	60	103,2	543,96
	Emmenthal cheese	6,27	20	125,4	
	Tomatoes	0,9	60	54	
	Ham	11,88	22	261,36	
5th day	Rice	2,16	60	129,6	376,52
	Corn	1,24	10	12,4	
	Tomatoes	0,9	60	54	
	Chicken	7,31	22	160,82	
	Mayonnaise	1,97	10	19,7	

Table 1 is the result after an event of one week on campus, considering the carbon footprint of the transports and food, because I do not have the other data. It gives a quite real picture of the actions of students.

4. Challenges and perspectives

Sustainable development is not really understood by everyone, particularly at school, when students would rather have fun than deal with their carbon footprint. Indeed, we did not want to oblished them to do it but the objective was to initiate them. We got support from the school in this process, which was very motivating.

This process can be expanded with the creation of a group of students, who go to see the association one by one, and understand their needs in the process, or the reasons for their non-involvement. The team sustainable development of the school is open to work with them, that could be a good point, to make the process successful.

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

I am aware of the major role of sustainable development for the future, that we must think and act today, in communities and not only alone, from our point of view. Through actions and projects I did, it allows me to develop a way of thinking in favor of sustainable development. Concerning sustainable agriculture, our courses have been dealing with it since the first year, especially in the food-industry, where major changes are appearing, following people's consumption patterns.

Nowadays, in agro-food industries, lots of changes are made to answer political decisions and to improve their environmental and social impact. 77% of French people are also concerned regarding the composition and origin of their purchases (INPES, 2022) such as looking for products without additives. That is why most companies work on clean label products. The advantage is that they can define their own limits. The objective is to show more neutrality, and transparency for consumers.

Agro-food engineers work on different ways of improvements: policies to continuously improve the environmental performance of production sites. It deals with the consumption of water and how to control and reduce it.

Moreover, packaging and overpackaging are a real topic of discussion because it has to be reduced, even if it is very useful for the transportation of food. In this way, industrialists can choose more sustainable sources for their production and packaging.

Policy of optimizing lines by reducing losses and waste is another subject of continuous improvement for companies. The quality manager is also working on the implementation of workplace ethics charters within the industries and imposed on suppliers.

Finally, some of these themes are investigated via our courses at UniLaSalle, in group or with our teachers.

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Climate Change, Nutri-Sensitive Agriculture and Youth Action to Eradicate Nutritional Vulnerabilities

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Keywords: Climate Change, Nutri Sensitive Agriculture, Nutrition, Youth

1. Problem statement

Today climate change poses challenge to world food and nutrition security, and it is guesstimated that agricultural yield in developing countries will shrink by 10-20% in coming decades (Mahapatra *et al,* 2021) and this will adversely affect the health and nutritional status of the people. Changing climate directly or indirectly affects the individual and household food consumption pattern, access to natural resources, availability of affordable and adequate nutritious and safe food, diet diversity, potable water and health care services (Bloem *et al*, 2010). The most vulnerable section of society are women and children, who have to bear the brunt of dwindling resources and are most affected by malnutrition, and the intake of different types of food groups and nutrients is less among them compared to recommended intake (Srivastava and Singh, 2014). Thus it becomes imperative for us as a society to acclimatize with climate change and adopt measures to sustain livelihood and agriculture for ensuring enough food and nutrient availability for people, especially among rural women and children (WHO, 2019). It has been extensively reported that to overcome the effects of climate change on the agriecosystem, biodiversity and food availability and, bring improvements in the quality of life, health and nutritional status of rural people, there is urgent need to bring about positive changes in their behaviour.

2. Student's Actions or activities

These positive changes in their day today knowledge, attitude and practices can be brought through multifaceted approach and implementation of intervention programmes at community and household levels (Wesley *et al,* 2019, Acharya and Das, 2020). Here the action of youth is required that they work with rural women and educate them to improve their knowledge, attitude and practices in dealing with day today life issues. Keeping this in mind since school times I worked with rural women and organized trainings and capacity building programmes in my village to empower rural women with technical knowledge and sensitised them about the impact of climate change on agriculture and food and nutrition security. I gave emphasis on understanding and documenting the traditional knowledge and practices of rural women towards agriculture, food intake, food processing, preservation and storage, child rearing practices, lifestyle practices, etc. Based on this backdrop I prepared a comprehensive

education module for improvement in the quality of life of rural women. I gave special consideration to nutri-sensitive agriculture intervention approach so as to make protective foods like fruits, vegetables, milk and milk products, etc. available to rural families free of cost. During my school days I also prepared and distributed literature to people of my village on importance of balanced diet, fruit processing and preservation, infant and young child feeding practices, importance of water conservation, hygiene and sanitation, importance of ventilation, discouraging use of plastics, etc. I also gave special attention to promote utilisation of coarse nutri cereal, pearl millet and its value added products among rural people, at household level. Being Gender Champion of the College and as a member of the Young Journalism Cell of the University I worked to arrange exposure visits of rural women in agricultural exhibitions, fares and farm visits. Efforts were made through these fares to make available quality seeds and plantings to women for setting up kitchen gardens and for their agricultural farms. The people of my village were apprised about farmer advisory services of the University for receiving weather updates and important farming messages.

3. Implications/Results

The developed literature and farm advisory services were found useful by all (100%) the rural women and their families. In my village most (70%) of them established kitchen gardens and it was observed, over the years, that creating awareness among rural people through lecture, demonstrations, distribution of education material and counselling resulted in improvement in their eating habits (60%) and, amount of intake of different types of locally available nutritious food items and nutrients (Kuwahara and Eum, 2022). Over the last 7 years a significant improvement (50%) in the knowledge of rural women was noted regarding practices of fruit and vegetable production and consumption. The results were highly motivating and all the rural women took keen interest to learn different types of cooking skills for nutrient conservation and improving dietary diversity and that through utilisation of home grown local food sources.

4. Challenges and perspectives

Major challenges observed to mitigate nutritional vulnerabilities among rural women (60-70%) were gender disparity, economic constraints, illiteracy, lack of time, lack of proper information, etc. Most of these constraints can be overcome by mobilizing rural youth for wider participation in nutrisensitive agriculture intervention programmes (Shannon *et al*, 2021) and motivating them to sustain themselves by judicious utilisation of locally available resources.

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

On the basis of work done by me I advocate and believe that propagation and utilization of locally available food resources and their conservation can ensure environment protection and improvement in the health and nutritional status of our communities. I expect that as a result of combined actions of youth, community and governments to progress the demand for nutritious coarse cereals, which are a climate resilient crop, can ensure food and nutrition

security and also assuage hidden hunger (Satyavathi *et al*, 2021). I firmly believe that utilization of farm advisory services and extension services of our organization, by farmers and farm women, can play an important role in mitigating the problems arising out of climate change and in achieving the sustainable development goals. I hope that if we all work together in close association at national and international levels and reinforce the approaches to sentinel our mother earth and environment, then only we can expect to have sustainable food systems and healthy and happy world which is free from all types of miseries.

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Local Youth Actions on Global Problems

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1 Problem statement

Developing countries are more vulnerable to climate change since the majority of the population depends on agriculture and lacks the technical and financial capability to respond to increased variability (ulal et al., 2010). Although young individuals are progressively seen as valuable assets in reacting to climate change, they have been relatively truant within the climate change policies and plans (Narksompong & Limjirakan, 2015). Despite widespread scientific agreement on climate change, societal perceptions may not always match scientific results (Shrestha et al., 2019). So, localized experience and observation-based climate knowledge are crucial to robust the stock of climate change adaptation and mitigation science (Karki et al., 2022). Thus, in addition to the scientific approach, public awareness is essential for addressing climate change issues.

2 Student's Actions or activities

The youth network was formed at the local level that performed varied forms of action or programs to increase awareness, improve skill and bring desirable behavior towards climate change issues. I was program development coordinator of the team for two years. We as a team, performed various programs like:

Climate talk - This activity involved the participation of youth, students, local people and experts as well. It brought together young climate activists where they shared their climate stories with the participants. It enlightened the cause, impacts, facts and solutions that could be done from individual, community and national level.

Green discussion - This activity requires the participation of local people, youth and experts sometimes. The discussion took place on several topics of climate change and sustainable development of the overall sector including agriculture at the local level.

School awareness program - As today's children are tomorrow's youth. We shared about climate change, its causes and its impact to students of various schools located within the district. It was conducted by visiting the schools along with the team members and giving lectures to the students.

Training on solid waste management – Trainees were encouraged to make compost or vermicompost from decomposable material to promote rooftop farming. On the other hand, the

non-decomposable material was collected by the municipality.

Training on a safe method of pesticide and fertilizer application – Demonstrating local people on identifying the hazard level of pesticide based on the label on the bottle. Teaching them the importance of using Personal Protective Equipment (PEP) while spraying the pesticides and the appropriate time, method and type of fertilizer application based on the crop grown.

Pocket is my Dustbin - It was a campaign suitable for the local areas. A commitment was made by all the participants on the different formal program not to throw the waste, especially plastics rather keeping it in the pocket thereby making the pocket a mini dustbin and later disposing of it safely.

Youth involvement in the above-mentioned program was achieved by forming a branch unit of a popular national youth network named Nepalese Youth for Climate Action (NYCA). Coordination with local governmental bodies, local educational and religious institutions, and NGOs further strengthened the people's participation based on a voluntary basis. All the members of the team were so active in the above-mentioned program because they can get several opportunities of training, visit, awards and certificates from the central team of NYCA. The source of funding for conducting the program were the central unit of NYCA and corresponding collaborating institutions like local government, school and college, NGOs, INGOs etc.

3 Implications/Results

Intensive and frequent climate change related programs in the local area bring behavioral changes in the local people. The multiplier effect of awareness was seen in the local area in which one aware person affects the behavior of other people and makes them aware too. Ultimately it led to a society with a positive attitude towards a safe and clean environment. A study conducted by Poudel et al. (2018) in Dang district found that out of 120 respondents, 83.3% (100 respondents) were aware about climate change where our activities are being carried out. Among them, 32.5% of farmers heard climate change frequently while 50.83% heard occasionally. Neighbour/friends is the major source of information (47%) about climate change followed by mass media (45%) and teachers (8%).

4 Challenges and perspectives

As the above-mentioned program doesn't result in the immediate economic benefits to the local people, a kind of hesitation on such a program was shown by the older people having restrictive mindset. Inadequate source of funding for the smooth operation of the program was a limiting factor. Coordination with other agencies was for each and every program conducted which was sometimes difficult to initiate. Proper monitoring and evaluation were a serious challenge due to inadequate funding and incentive to the team members. The repetition of similar kinds of messages to local peoples sometimes lead to the ignorance of the program from the participant's side.

Adequate funding source, as well as supportive role from local government would result

in a more impactful program. Expansion of the youth network all over Nepal would be beneficial to replicate an effective program. Linking the climate related program directly with the immediate economic benefit to the participant would lead to the effective and efficient program on a sustainable basis.

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

All the performed activities are directly related to the ISS general theme of "Youth actions and Innovations towards Climate Change adaptation and Mitigation to Promote Sustainable Agriculture in their Communities". The team is composed of active youth and able to innovate the different programs suitable to the local area. The basic theme of the team conducting such programs at the local level is "Act Locally, Think Globally". Each program had the objective of creating awareness among the local people and as a whole to bring desirable behavioral changes which are the prerequisites for the adoption of climate smart technologies. Exclusively aware citizens with the ability to adopt climate smart technologies aid in achieving both the mitigation and adaptation goal.

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Group E

Group theme

Education

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Sing-Shan Wu, National Chung Hsing University

Jorge Victor Grandez, La Molina National Agrarian University

Chairperson:

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Tran Thi Ha Chau, Tokyo University of Agriculture

Effects of Different Packaging Materials on Postharvest Quality of Clorox-treated Tomatoes under Two Storage Temperatures

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Keywords: Packing materials, tomato storage, temperature

1. Problem statement

In Myanmar, tomato is one of the most profitable crops for the growers and the total sown area was 113771 ha with an average yield of 11.64 mt/ha in 2015 (Myanmar Agriculture Service, 2016). Being a perishable crop, tomato rapidly deteriorates after ripening and a large portion of the valuable products are lost after harvest. Tomato provides loss figures of 25% or 28-42% worldwide (Zaldivar, 1991) and a loss of 20-50% has been reported for fresh tomatoes in tropical countries (Pila, Gol & Rao, 2010). High postharvest losses, 30-40%, also occurred in Myanmar due to weakness in use of suitable postharvest handling practices and treatments (Hla, 2005). These losses bring low return to growers, processors and traders and country also suffers in terms of foreign exchange earnings (Kader, 1992). Therefore, this study was conducted to find out the ways in order to minimize tomato postharvest losses to some extent by using sanitizer, packaging materials and low temperature storage.

2. Student's Actions or activities

The effects of different packaging materials and storage conditions on the quality and shelf-life of harvested tomato fruits were investigated at the Department of Horticulture, Yezin Agricultural University from 7 February to 18 March, 2019. Factorial arrangement in RCB design was used with 3 replications. The tested tomato variety was Kyauk Pyar harvested at maturity stage 3, turning (more green than red in colour). Factor A was two storage temperatures: ambient (28-32℃) and cold (15℃) and Factor B was different packaging materials: perforated plastic bag, unperforated plastic bag, perforated plastic bag + Clorox, unperforated plastic bag + Clorox, Clorox without any packaging material and control. Before packaging, Clorox treatment was prepared by soaking tomato fruits in 200 ppm Clorox solution for 10 minutes.

The data on fruit weight loss (%), fruit skin colour development (score), firmness (score), visual quality rating (VQR) (score), total soluble solids (Brix %), fruit pH and titratable acidity (%) were collected at three-day intervals throughout the storage period and the shelf-life (days) was determined at the end of storage period based on visual appearance of tomato fruits.

3. Implications/Results

Table 1. Skin colour, firmness, soluble solids, fruit pH and weight loss of tomatoes as affected by storage temperatures and packaging materials after 15 days of storage

Treatments	Skin colour (score)	Firmness (score)	Soluble solids (Brix%)	Fruit pH	Weight loss (%)
Ambient	5.48	1.76	3.39	4.21	11.82
Cold	5.28	2.39	3.92	3.94	5.64
$LSD_{0.05}$	0.28	0.16	0.27	0.19	2.43
Perforated	5.58	2.04	4.02	4.15	8.65
Unperforated	4.57	2.58	3.52	4.03	5.99
Perforated+Clorox	5.85	1.84	3.88	4.14	8.28
Unperforated+Clorox	4.45	2.62	3.63	4.15	5.65
Clorox	5.95	1.60	3.72	4.11	11.88
Control	5.88	1.75	3.17	3.89	11.93
$LSD_{0.05}$	0.48	0.28	0.47	0.33	4.21

Table 2. The interaction effect of two storage temperatures and different packaging materials on shelf-life of tomato fruits in this study

Treatments	Shelf-life* (days)		Mean
	Ambient	Cold	
Perforated	11 ef	21 abc	16 B
Unperforated	19 bcd	24 ab	22 A
Perforated+ Clorox	14 def	18 cd	16 B
Unperforated+ Clorox	19 bcd	25 a	22 A
Clorox	14 def	16 cde	15 BC
Control	9 f	15 de	12 C
Mean	14 B	20 A	

* In a row (or a column), means followed by a common letter are not significant different based on LSD at 5% level.

The results of this experiment were shown in table 1 and 2. In this experiment, significantly lower weight loss (5.64%) and longer shelf-life (20 days) were observed in cold-stored tomatoes which showed firmer fruit skin and slower rate of colour development than those under ambient condition (11.82% and 14 days duration). However, cold-stored tomatoes had lower total soluble solids and titratable acidity than those under ambient condition. Among the packaging materials, both Clorox-treated and non-treated fruits in unperforated plastic bag exhibited significantly lower weight loss (5.65% and 5.99%) at 15 days after storage and can be stored longer (22 days each) than control (12 days). The interaction effect was observed in shelf-life showing better response of non-treated fruits packed in perforated plastic bags under cold storage than ambient condition. Therefore, to achieve maximum shelf-life and minimum weight loss for tomato fruits, cv. Kyauk Phyar, the fruits should be stored in cold room at 15℃ and unperforated plastic bag should be used under both conditions, cold and ambient. Moreover,

perforated plastic bags should also be used in cold-stored tomatoes.

By applying the results of this research, the postharvest losses of tomato fruits can be reduced to a certain extent then, all the stakeholders along the value chain can get more income, because of getting longer shelf-life and maintaining fruit quality. Consequently, this may improve their socio-economic status and standard of living.

4. Challenges and perspectives

We had some difficulties such as insufficient research fund, inadequate laboratory equipment for collecting data and controlling temperature of cold room in the time of electricity break-down. It will be better to have some experience in handling laboratory equipment to measure qualitative parameters of tomato fruits and some knowledge on advanced technology used in developed countries.

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

By minimizing postharvest losses, tomato production can be increased from the existing growing area without using any more acres of land, labor and capital to extend tomato growing area. As a result, emission of greenhouse gases from cultivation practices which is the major cause of climate change today can be reduced and it can promote sustainable agriculture thereby creating our environment much healthier.

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Sustainable Meat--- Taiwanese Peoples' Attitude Toward Insect Food and Its Development

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Keywords: Alternative protein, Insect food, Affect-Behavior-Cognition model

1. Problem statement

The Food and Agriculture Organization of the United Nations (FAO) predicts that the global population will reach 9 billion in 2050. Governments of various countries will need to reform agricultural land-use policies and re-examine the people's long-standing food sources and eating habits to cope with the problem of food insufficiency in the future (Van Huis et al., 2013). In terms of eating habits, expected until 2030 consumption of meat in developing countries rises by about 7 percent, approximately equal to 27 kilograms per capita per year (Msangi, Rosegrant, & Pandya-Lorch, 2012). The increase in meat demand makes people spend more land, water, and energy to increase meat production. And this will exacerbate environmental destruction (Verneau et al., 2016).

Alternative protein sources such as clean meat, algae, vegetable fungi, and insects are options to decrease the negative environmental impacts of conventional stock farming. FAO (2013) mentions the policy to manage insects as an alternative protein source and the policy has been implemented in Asian, European, and American countries for a long time (Van Huis et al., 2013) and some insects are traditionally used as food in many cultures to provide various sources of nutrition and this is called "Insect food."

Oonincx, Finke, & Feed (2021) mentioned that insect food can provide a high protein source, they are rich in iron, magnesium, and zinc elements. These benefits might help solve the problem of insufficient protein and trace element intake for many people. In addition, eating insects can also protect the environment by keeping other livestock replaced by insects which can reduce greenhouse gas releases and spend less water and land to produce protein-rich food. Further, the feed conversion ratio (FCR) of insects is even higher than that livestock (Van Huis et al., 2013).

According to estimates, there are 1,900 edible insect species consumed by about 2 billion people in the world whose daily diet includes insects. The most eaten insects are in the orders of Coleoptera, followed by Lepidoptera, Hymenoptera, Orthoptera, and Hemiptera (Chen, Feng, & Chen, 2009). Even though a lot of nutrients, benefits, and options are available from insect food, the types and vendors of insect food in Taiwan are not fully documented.

2. Student's actions or activities

In order to enhance our understanding of people's attitude toward edible insects in Taiwan, we conducts a quantitative case study to investigate the attitude toward insect food. The results of the study were used to understand the affect, behavior, and cognition of insect food. In the "Affect-Behavior-Cognition model" (ABC model) of behavioral theory to establish a research framework (Verneau et al., 2016). The dependent variables include "afect toward insect food," "behavior toward insect food," and "cognition of insect food," and the independent variables are "Gender," "Age," "Vegetarian," and, "The most commonly eaten meat." Data are analyzed to determine the relationship between personal attributes and Affect-Behavior-Cognition of edible insect.

Here are some preliminrary observations. One are gender of male, people like eat mutton or seafood have better attitude on edible insect. The other one is affect, behavior and cognition of edible will effect each other.

Based on the above-mentioned observations, we can know female is one group that can't accept edible, and people like other kinds of meat have more negative attitude toward edible insect. How to solve the problem the research conducted by Shelomi & technology (2015) indicates that that acceptance of insect food is related to consumers' cultural and psychological cognition in the study area. Therefore if we want to change general public's attitudes towards deible insects, maybe we can teach people how to cook it or make public more familiar with edible insect.

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

The results of this study will provide a preliminary understanding of the affect, behaviors, and cognition knowledge about edible insects in Taichung's youth population. It will help to establish a foundation for the future promotion of edible insects.

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Urban Agriculture developed with college students in the city of Lima

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Academic Advisor: Mg. Sc. Andrés Casas

Keywords: Urban agriculture, organic vegetable production, poverty, environmental education's school

1. Problem statement

In recent decades, the planet is experiencing an ecological, environmental and social crisis due to the irresponsible actions of humans. In the excessive use of natural resources and biodiversity services to satisfy their social and economic needs. (López, 2021) Since 1972 to face these problems in the world, there have been government conferences that debate these types of issues. However, until now, the objectives set and established to solve climate change have not been fulfilled. That's why the transition scenario presents unpredictability and uncertainty. (Navarro, 2015)

Lima, the capital of Peru, is not exempt from these problems. In the last five decades, it has been affected by environmental degradation, depletion of natural resources, and inadequate water supply. These problems are often more exposed to poor households. (MINAM, 2006). In neighboring districts, people struggle daily to satisfy their essential needs. Also, try to meet their nutritional requirements. Of that, 25.5% live below the poverty level. (INIE, 2021; World Bank Group, 2021).

2. Student's Actions or activities

Educational vegetable gardens are physical spaces in the school where a wide variety of vegetables are grown organically, intended to contribute to the daily diet of students). In this context, community gardens are an alternative to improve people's health and diversify their diet. In 2019, I and others university students were allowed to set up a vegetable garden at a school in Ate district (district of Lima). We developed capacities in 11 weeks for the students related to the installation and management of organic gardens for recreational and food production purposes.

Our goal was to produce vegetables for consumption by students and school teachers to raise environmental awareness and civic responsibility towards nature. As López (2021) recommended, we established the educational sessions of the organic garden on development according to the purposes, objectives, and contents of education. Every week, the sessions were related to environmental problems and sustainable agriculture.

Table 1 Session and activities at E.I. "Juan Andrés Vivanco Amorin"

Session	**Description and activities of the session**
1. Introduction to a school garden	Importance of garden and vegetables. Identification of the elements of organic gardens.
2 Land preparation I	Reconnaissance and cleaning of the field
3. Land preparation II	Weeding and land clearing
4. Land preparation III	Demarcation and distribution of furrows. Compost incorporation
5. Sowing	Explanation of sowing, types, density, spacing, direct and indirect sowing
6. Cultivation farm-work I	Importance in the care and management of the garden. Irrigation management for vegetables
7. Cultivation farm-work II	Thinning, rooting & reseeding
8. Pest Control I	Identification of main pests in vegetables
9. Pest Control II	Identification of pests present in the field, manual collection
10. Aromatic plants	Identification and recognition of aromatic plants
11. Harvest	Identification of criteria for harvest. Vegetable harvest

3. Implications/Results

In the garden, we planted different vegetables to demonstrate an urban agriculture system. We targeted to teach/empower 30 students and two teachers at an educational institute in the district of Ate. Students were taught about organic agriculture using ecologically sound inputs.

Comments and student perceptions:

Canchari, T. (7th-grade student, 13) mentions *I liked harvesting my lettuce and being able to eat it at home. With my parents, I tried to make gardens in my house with the practices that the university students taught me. I hope to have the same results.*

Davila, L. (School teacher, 32) declared as *a teacher: I learned another way to encourage my students (organic garden). Since the beginning of the sessions, I have seen new perspectives from my students regarding climate change and growing fresh food.*

4. Challenges and perspectives

Skills developed:

Galantini, G. (University student, 20) declared: *"I learned about the management of organic gardens, how to transmit my acquired knowledge to the students. I saw the students were very enthusiastic, whichever motivated me to seek more information to clarify their doubts"*

Urbano, M. (University student, 25) declared: "*It allowed me to consolidate my knowledge and continue developing my ability to transmit and share with a group of students younger than me. I was able to meet and work with new colleagues. Also, we formed a good work team"*

According to the comments on our educational vegetable garden program. Anupama et al. (2008) mention that students feel great satisfaction in producing their food, reporting positive changes in their social skills and responsible environmental behavior.

Table 2. Vegetables produced at E.I. "Juan Andrés Vivanco Amorin"

Vegetables produced			
Vegetables	**Kg.**	**Aromatics**	**Kg.**
Radish	4	Black mint	2
Turnip	5.5	Rue	1
Lettuce	8	Fennel	3.5
Pak choi	6.3	Coriander	3
Spinach	7	Basil	4.5
Zucchini	6	Cilantro	4

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

We encouraged students to be in charge of promoting urban agriculture and producing vegetables in organic gardens as a new food production alternative. Also, the students gained new competencies and skills in leadership, teamwork and social responsibility.

Cities where there is an increase in the population as well as the demand for vegetables, it is considered an opportunity that university students can implement these types of projects. Also reinforce food security and involve early age people in healthy eating and clean agricultural production.

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Group F

Group theme

Agriculture

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Chung-Han Cheng, National Chung Hsing University
Irene Akinyi, Jomo Kenyatta University of Agriculture and Technology
Brayen Ariel, IPB University

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Youth Involvement in Climate Adaptation: Moving Towards Sustainable and Food-Secure Future

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Keywords: climate-smart, hackathon, microfarm, youth, food security

1. Problem statement

Climate change continuously changes food systems and jeopardizes the food security of millions of people. From the data released by the Economist Intelligence Unit (2021), the Philippines ranked 64th among 113 countries with a Global Food Security Index Score of 60.0 out of 100. Included in the index is the natural resources and resilience factor, in which the Philippines scored only 43.6, measuring the climate adaptation capacity of the country and its risk and susceptibility to climate change impacts. Moreover, the increase in population growth drives the demand for food, and problems concerning food sufficiency and food security must be addressed to sustainably feed the next generations. Despite the integral role of agriculture in the country's growth, the sector is still lagging behind the development that will boost its productivity and efficiency.

In the Philippines, the average age of farmers is between 57 to 59 and the majority of the youth seek opportunities with high benefits and salary, trading this over agriculture. This trend was validated by the study of NEDA (2019), revealing a decrease in agricultural employment due to young and educated workers migrating to other sectors, which leads to ageing farming system. Youth's lack of agricultural awareness largely contributes to this challenge and hence, increasing the country's agricultural adaptation and improving its growth strategies through educating youth regarding the processes that drive the country's food security are of maximum importance.

2. Student's Actions or activities

Kids Who Farm jumpstarted the Hyperlokal Food Network, an urban community Microfarm Program that involves youth in addressing food security and insufficiency issues. Kids Who Farm conducted a technology transfer on the basics of urban agriculture by capacitating the youth on Kratky hydroponics, protective farming, aquaponics, and containerized vegetable gardening using an experiential or hands-on learning approach. In establishing the Microfarm set-up, Kids Who Farm provided the youth with the necessary inputs and materials to build and maintain the grow house. Moreover, the program continuously involves orphans in establishing their self-sustaining and productive Seedlings of

Hope; engages Youth Agvocates in managing their own hyperlocal food sources; and creates opportunities for PWDs through the GrowAbility Microfarm Project. Provided that Kids Who Farms' social accounts showcase basic techniques in Kratky hydroponics, it influences other young individuals outside the reach of the microfarm project to build their own DIY grow house that increases their local food access. With the wide reach of technology, sharing such information would also be of great help in encouraging collaborative action among agricultural organizations because undoubtedly, not only has the program encouraged youth participation in agriculture but it also sparked creativity within them by making farming fun and easy.

Impact Hub Manila, on the other hand, hosted Impact Hackathon, a 2-day virtual event that exposes youth to the entrepreneurial workspace by providing them with the opportunity to attend innovation workshops, mentorships, peer learning, and talks by various industry experts. Youth groups were given an experienced mentor who guided them in developing their feasible and climate-smart solutions that address issues in areas of climate change, agriculture, education, health, and smart cities, which will be judged and funded by the organization to kick off the actualization of the innovative projects.

3. Implications/Results

In 2019, Kids Who Farm has trained 843 young individuals, assisted 2 communities, conducted 18 trainings, and partnered with 20 organizations including the Department of Education in Zamboanga City. As of writing, Kids Who Farm has already mobilized 180 youth volunteers, trained over 6,000 individuals with regard to urban agriculture, and established a total of 38 community and school microfarms. Through the microfarm program, partner community members including the youth were able to grow and maintain their all-year-round source of vegetables using sustainable and low-cost agriculture technologies, thereby increasing the availability of fresh, safe, and nutritious foods, improving economic development, and minimizing food expenses. As the program expanded with the increase in youth involvement in sustainably managing natural resources and human footprint, it paved the way for the creation of agro-enterprises in the communities, which generated new streams of revenue through selling the production surplus within the community.

Furthermore, the Impact Hackathon have engaged the youth to be part of the solution by providing them with the opportunity and platform to develop innovative digital solutions that will help local farmers transition to precision and climate-smart farming. Some of the projects that youth have developed include iFertigateNa, a smart platform integrating remote sensing technologies that help farmers shift toward precision agriculture; Alipugpug Tech Solutions, an environment-friendly and automated vertical farming system built from bamboo; and Lakapati, a web-based platform that increases small-scale farms' efficiency. As of writing, the Impact Hackathon has supported 224 completed youth projects anchored to the UN's Sustainable Development Goals and increased the youth's confidence to start their own impactful and climate-smart businesses by pairing them with experienced professionals and increasing their access to corporate organizations, thereby increasing youth's agricultural awareness and social responsibility.

4. Challenges and perspectives

Trying to establish such a movement has been a struggle primarily because of the lack of awareness and disinterest of youth in agriculture, making it difficult for them to be trained, convinced, and engaged. Kids Who Farm's approach to making farming fun and easy also encouraged the youth to partner with the organization, along with their friends, and be part of the solution. The program instills in the youth the value of household production in minimizing the impacts of climate change and contributing toward food sufficiency. With the impact that Kids Who Farm created so far, the organization plans to scale up its reach and projects in the region by involving more youth in the program and expanding to other cities outside the area. Kids Who Farm also aims to ensure inclusive growth by including more sectors and partnering with different NGOs outside the Philippines. Meanwhile, the lack of confidence and access to markets, financial support, and networks hindered the youth from venturing into agri-related businesses. In the Impact Hackathon, youth are not only encouraged to ideate solutions but also to develop the idea themselves with the help of industry experts and mentors for them to realize the benefits and impacts of their projects on promoting agriculture efficiency and sustainability. The hackathon is conducted annually to widen their talent pool and to empower more impact-driven youth entrepreneur-innovators.

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

Youth involvement in various efforts to address climate change and agriculture-related challenges is the future of sustainability and food security. Youth-centric initiatives like those presented above provide capacity building and create a network for youth to have a consolidated effort in catalyzing climate actions and knowledge sharing. They were provided with the necessary inputs and financial support to actualize the projects and their own climate-smart solutions, which empower them to promote agricultural awareness and to lead in capacitating more young people and communities. With the adaptability and scalability of the urban microfarm program and agri-hackathons, these can be replicated and implemented by other communities to engage and encourage more youth to be involved in climate-resilient and sustainable practices by leveraging technology and low-cost materials that will help serve the world's agriculture sector. Generally, the programs and activities have empowered and educated the youth to take a proactive role and make a significant impact in building a food-secure future.

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Deficit irrigation strategy for vegetable production in a water scarce environment

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Academic Advisor: Prof. N.I Kihupi

Keywords: water scarcity, deficit irrigation, crop water requirement (CWR)

1. Problem statement

Challenges on the agriculture industry of Tanzania include climate change and the resulting droughts, floods, agriculture temperature shocks and a lack of agricultural technology (Mbiha, E. R. and Ashimogo, G. C., 2010). Also, due to population growth, growing stress is placed on water resources, resulting in greater risk of water scarcity for small holder farmers.

With regards to Morogoro municipality, water sources have been drying up as years get by due to climate change. This is as reported that, Ngerengere River used to be perennial in the late 1990s, but today it gets dry during the dry season, and this phenomenon is not only directly linked to decreased rainfall, but also increase in temperature (Fetch, 2019). This has widely discouraged agricultural production thus making it difficult for dwellers to involve themselves in vegetable production.

Due to this problem, there is a need to adopt irrigation practises that minimize use of water at the expense of a little loss of production but overall achieve higher productivity of the crop in question-deficit irrigation.

2. Student's Actions or activities

I started by conducting a research project titled, "Effects of interacting organic and inorganic fertilizer with deficit irrigation on yield and growth of Ethiopian mustard (*brassica carinata*) vegetable in Morogoro municipality. The organic and inorganic fertilizers used were chicken manure (CM) and UREA respectively. The study was conducted at the crop museum farm at Sokoine University of Agriculture, Morogoro, Tanzania. The research duration was from October 2021 to December 2021. The experiment was laid out in a Randomized Complete Block Design (RCBD) with six treatments. Each treatment was replicated three times. The treatments were 50%CWR+ no fertilizer (T1), 50%CWR+0.21 t/ha UREA, 50%CWR + 14t/ha CM (T3), 100% CWR+ no fertilizer (T4), 100% CWR) + 0.21t/ha UREA (T5) and 100% CWR + 14t/ha CM (T6). There was a total of 18 plots with each plot containing 25 seedlings. The plot size was 1.8 m ×1.2 m.

The crop water requirement (CWR) is obtained by calculating the crop evapotranspiration (ETc) whose equation is given by:

ETc = ETo × kc where, kc is the crop coefficient (dimensionless) and ETo is reference

crop evapotranspiration (mm/day).

Morogoro weather data was used to calculate the reference crop evapotranspiration (ETo) during the entire growing period and kc was obtained with regards to Ethiopian mustard vegetable (Table 1).

Table 1. Accumulated ETo, Kc and ETc for Ethiopian mustard vegetable

Stage	ETo (mm/day)	Kc	ETc (mm/day)
Initial stage	3.7	1.15	4.255
Mid-season	3.9	1.04	4.056
Late season	3.7	0.68	2.516

3. Implications/Results

Table 2. Yield of Ethiopian Mustard for the respective treatments

Treatment	Yield (t/ha)	Significant difference
50% CWR*control	1.4	a
100% CWR*control	2.3	ab
50% CWR*urea	4.4	b
100% CWR*urea	4.5	b
50% CWR*chicken manure	4.8	b
100% CWR*chicken manure	9.6	c

The post hoc analysis used was Duncan Multiple Range Test (DMRT).

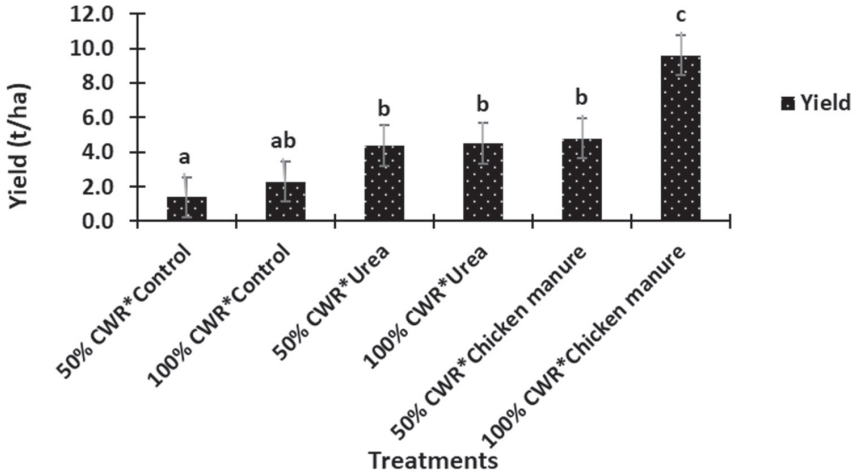

Figure 1: Combined effect of water levels and fertilizer levels on Ethiopian mustard vegetable yield

Results shown in Table 1 implies that with slight loss in yield, the 50% reduction in water

requirement and application of 14t/ha of chicken manure would be the best option for Ethiopian mustard production under water stress conditions. This would also enhance the water productivity which is key to adoption strategies under a changing climate, thus making agriculture more attractive to the youth as reported by RVO (2018) that horticulture subsector could attract youth due to its potential for quick economic returns and its less demand for land compared to staple crops. In addition, use of organic fertilizer will not only cover yield losses due to water stress but also support environmental conservation. However, to ensure effectiveness in implementing deficit irrigation the best system for irrigation is drip system. I collaborated with my fellow youth from Sokoine University of Agriculture to develop a low-cost drip irrigation system whose component parts (emitter and rubber) are made from reused locally available disposable plastic material (pen tip).

4. Challenges and perspectives

These results are from an isolated study conducted in Morogoro municipality. It would add value if the study was extended elsewhere with the aim of collecting more data from similar experimental setup so as to have consistent conclusions. Further, taking in to account the problem of water scarcity, drip irrigation stands out as the most appropriate system for irrigation. However, drip systems are costly and thus are beyond the reach of most small-scale farmers including the youth, many of whom are currently unemployed. Thus, appropriate low-cost drip irrigation systems would play an important role in this respect. Sokoine University of Agriculture has developed such a system that requires upscaling.

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

Deficit irrigation is an adaptation strategy towards water scarcity (an effect of climate change) and hence it promotes sustainable agriculture.

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The Influence of Climate Change on Third and Fourth Trophic Levels Insects

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Keywords: Coccinellidae, parasitoid, competition, biocontrol, population dynamic

1. Problem statement

Climate change causes the changes of physiology, phenology, population dynamics, and life history of plants and insects (Castex, Beniston, Calanca, Fleury, & Moreau, 2018), which correlated to the frequency and intensity of pest outbreaks (Ladányi & Horváth, 2010). Although the impact of climate change on integrated pest management is much discussed, the increasing difficulty of sustainable agriculture management due to the reducing efficiency of biological control when the climate condition favors the agricultural pests is less addressed (Castex et al., 2018).

The zigzag beetle, *Cheilomenes sexmaculata* (Coleoptera: Coccinellidae), is a potential biocontrol agent which has a broad prey range and higher intrinsic advantages than other ladybird beetles (Omkar et al., 2005; Wang, Tan, Guo, & Zhang, 2013). The zigzag beetle is native to Asia and the population is tended to be northward in recent years due to the climate change (Singh & Omkar, 2009). The population is regulated by parasitic wasps, and most of the wasps are widely distributed around the world (Riddick, Cottrell, & Kidd, 2009; Roy, Brown, Frost, & Poland, 2011). Despite their wide distribution, the parasitism rate varies between locations depending on the climate conditions (Ceryngier, Roy, & Poland, 2012). Thus, the research of effects of climate change on these parasitic wasps are required to evaluate the efficiency of *C. sexmaculata* ladybird as a biocontrol agent. In this study, we investigated the interaction between the third (*C. sexmaculata*) and fourth (parasitic wasps) trophic levels insects in the field and analyzed the possible factors that may affect parasitoids' population.

2. Student's Actions or activities

The *C. sexmaculata* and its associated parasitoids were obtained from an organic farm since November, 2021. Larvae of ladybird were collected biweekly, and maintained in the greenhouse (25 ± 2℃, 55 ± 15% RH, photoperiod L24: D0 h). Green peach aphid, *Myzus persicae* (Hemiptera: Aphididae) was provided as food source for the ladybirds until the emergence of parasitoids.

The number of parasitized hosts (total number of hosts with emerged parasitoids / week), parasitism frequency (whether a host is parasitized or not), the abundance of the

parasitoid (average number of emerged and developmental failure parasitoids / host), sex ratio (proportion of males), abundance of ladybird and climate factors were calculated as response or explanatory variables. Some individuals were prepared into dry specimens for the continuous identification. The generalized linear mixed models were used to analyzed the influence of external factors on parasitoids. The data analysis were done with R statistical software (R Core Team, 2022). The data from November 27th, 2021, to May 29th, 2022 was used.

3. Implications/Results

Six species of parasitic wasps were found, and two of them were hyperparasitoids. The pructotrupid *Nothoserphus mirabilis* (N.m), encyrtid *Homalotylus hemipternus* (H.h), and eulophid *Oomyzus scaposus* (O.s) were the most common parasitoids, and pteromalid *Pachyneuron solitarium* was the most abundance hyperparasitoid (fifth trophic level), which parasitized on H.h.

Peaks of parasitism rate of N.m, H.h and O.s were January-March (58.6 ± 14.6%), November-January / April (34.3 ± 15.4% / 44.7 ± 25.0%) and December / March-April (24.7 ± 1.2% / 32.0 ± 5.8%), respectively (Figure 1).

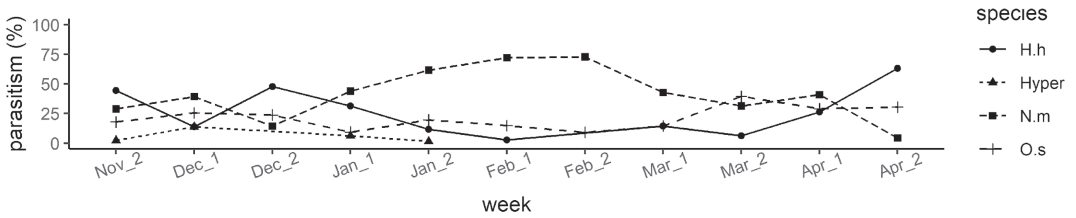

Figure 1. The trend of parasitism rate of each parasitic wasp against different weeks. The number behind of month means the order of collection. The end of the time in this figure is April 29th, 2022.

The abundance of ladybird had significant effect on all response variables of parasitoids except the abundance of N.m per host ($P < 0.05$). Temperature showed the negative effect on the number of hosts parasitized by N.m ($P < 0.001$). In contrast, H.h and O.s were negatively affected by precipitation and RH ($P < 0.05$), whereas H.h was also significantly affected on parasitism frequency and abundance of parasitoids per host ($P < 0.05$). Sex ratio was not affected by any climate factors. Each parasitoid showed the significant negative effect on their competitors in most response variables ($P < 0.05$).

4. Challenges and perspectives

In this study, the solitary parasitoid N.m was the dominant species of zigzag beetles between January to March, which was a cooler period in our field survey. However, it is possible that N.m is most vulnerable to climate change due to its rapid decline in the hotter period. In contrast, the gregarious parasitoids (H.h and O.s) were affected by precipitation and RH, whereas H.h showed more response variables that were significantly affected, indicating

that H.h is possible to be more sensitive to the external environment. Additionally, the interspecific competition also played an important role in regulating the population dynamics.

Generally, parasitoids have lower temperature tolerance than their hosts, which makes the impact of climate change more significant (Chidawanyika, Mudavanhu, & Nyamukondiwa, 2019). This climate condition not only affects parasitoid development but also has an indirect impact through lower trophic level creatures (Hance, van Baaren, Vernon, & Boivin, 2007). In the future, to have better understanding on this issue, research on long term surveillance, broader range of trophic level, and physiology of parasitoids and hosts are required (Chidawanyika et al., 2019).

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

This study estimates the future situation of parasitoids of *C. sexmaculata*, which may help organize sustainable agriculture when using ladybirds as biocontrol agents.

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Improving the Quality of Environment by Adding Value to Coconut Waste

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Keywords: Coconut, Cocopeat, Excessive salts

1. Problem Statement

Environmental pollution is one of the most overlooked issues in Kenya that contributes to the destruction of atmospheric space. Coconut waste significantly contributes to environmental pollution. A coconut plantation is an analogy to an energy crop plantation and a food crop. Its potential is unutilized, allowing for huge capacity gains and improvements to human health, global energy, and climate change outcomes. The coconut tree is not harvested for biomass until the end of its productive life. The coconut pith, husk, palm, shell, and tree trunk are coconut wastes that can all be of value and use to the communities and the people. The coconut husk has high amounts of lignin and cellulose. Coconut shells take approximately six weeks to decompose if broken down into pieces and put in the soil (Jeyaseeli et al., 2010). If non-sustainable alternatives are used to store the coconut waste, it could take more than five years, leaving behind chemical traces. Despite the good characteristics of cocopeat, several factors have been reported to affect the quality of cocopeat. Cocopeat has been reported to have a high C: N ratio of 112:1 (Ilahi et al., 2017). The composition and attributes of cocopeat vary depending on the maturity of the coconut, extraction method and disposal, the period between extraction and use, and environmental factors. Studies show that coco peat has high salt levels, toxic to seeds, general plant life, and soil quality (Bernstein, 1975). The rainwater leaches soli from the coconut wastes into the soil during rainy seasons, and gradually the soil salt content increases. High levels of salt reduce productivity i.e. it could result in dehydration of the plant, yield decline, or even death of the plant. Apart from the soil quality being affected, the air balance is affected during the ion exchange process. The pollution of an environment in a horticultural system is equated to the product of its nutrients concentration and the water drainage quantity. The salt content of the water used and the excess irrigation necessary to cope with heterogeneity in irrigation and water uptake is a great limitation.

2. Student's Activities

Cocopeat was identified and utilized as a propagating media. This is an important practice that was applied to curb challenges such as reduced soil availability apart from reducing environmental pollution. Soilless propagation media are better alternatives to soil use. Of these substrates, cocopeat is cheaper, easily available free from soil microorganisms attack, and reusable thus a better option for farmers. Cocopeat can be reused for up to 5 years, it is very economical. The productivity and output level of cocopeat in propagation was corrected by removing excess salt in the media. Composting and buffering were identified as the methodologies for the removal of the excessive salts in the cocopeat.

3. Implication/Results

The implementation of this program had a cost implication. Development of extension material such as brochures, and recorded online videos required so much time and economic resources. To gain the attention of the farmers, social strategies and promotion tactics were used i.e. in farmers' field days and agricultural fairs. Online platforms, especially YouTube and Facebook attracted many audiences. We also partnered with several agricultural training institutes and stakeholders to ensure both the small-scale and large-scale farmers are made aware of the project finding and environmental conservation initiative. This action highly attracted youths. The processes of improving the cocopeat quality created job and earning opportunities for many young people.

4. Challenges and perspectives

This concept is very important to any economical agricultural firm and environmental policy establishment organization. Every economic-driven farmer should consider this perspective as a propagating and growing chance for new crops including vegetables. This conservation measure is a plan that supplements an increase in production by quality and yield. This concept could be best promoted through farmers' field days, agricultural fairs, and the distribution of extension materials. Partnering with farmers Sacco and agricultural institutes is the best option to ensure that both large small-scale farmers are not discouraged from doing farming because in the coastal areas where soils are of poor quality.

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

Climate change is the most critical challenge to achieving sustainable development in the coming decades. Adapting to these changes is the easiest way to ensure agricultural activities are not limited. This experimental action suggests the best way to utilize coconut waste in production and improve the environmental quality state. The concept of this action is actually to be sustainably driven by utilizing natural fibre in a propagating media. This is an adaptation to the current global changes by the active involvement of the youth and young people. This experiment is a highlight response to achieving the 12th and 13th sustainable development goals.

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MANIS (Lime Aroma Mask): Utilization of Limonene in Lime Peel to Become A Biodegradable Nanofiber Mask

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Keywords: compostable, lime, limonene, nanofiber mask

1. Problem statement

Lime (*Citrus aurantiifolia*) is one of the superior commodities of the Banyuwangi Regency, Indonesia. Nevertheless, massive quantities of lime, particularly peels, are generated annually, posing an environmental problem in many parts of the world (Ademosun, 2022). Interestingly, Covid-19 is obstructed by limonene, one of the most abundant (49.3%) volatile components in *C.aurantifolia* (Gupta et al., 2021). Furthermore, four flavonoids (tangerine, hesperetin, nobiletin, and naringenin) may also inhibit viral infection and replication of the virus. In addition, the Covid-19 pandemic that massively limited people's mobility also caused depression, anxiety, and stress associated with psychological resilience during the Covid-19 outbreak (Oral and Gunlu, 2021). Based on Cigna's global 360° Welfare Score survey report in 2021, there was an increase of 2% in stress to 75% compared to the beginning of 2020.

Moreover, looking up to the current condition, due to increased use of face masks and a shift in customer preference for single-use masks because of hygiene concerns, plastic waste creation increased dramatically during COVID-19 (Patrcio Silva et al., 2020) According to a study by Klemeš et al., 2020, the creation of a mask uses between 10 and 30 Wh of energy and emits 59 g of greenhouse gases (CO_2-eq). The majority of these face mask wastes are made of polypropylene, polyethylene, polyurethane, polystyrene, polycarbonate, or polyacrylonitrile, all of which contribute to the pollution of the environment by adding plastic or microplastics. As a result, several improved waste management technologies have been created, with minor changes in the overall handling of medical waste.

2. Student's Actions or activities

Therefore, responding to several problems above, the author has an idea to create an orange-scented medical mask, further abbreviated as MANIS (Masker Aroma Jeruk NIpiS). This innovation comes as an active biodegradable nanofiber mask injected with limonene compounds as bioactive compounds obtained from the lime peel. Limonene's immunomodulatory, anti-inflammatory, and antiviral activities aid in limiting the severity and progression of Covid-19. I believe that students could do these three things. First, we could manage to collect the lime peel as the main source where limonene is extracted from the big companies as well as small f&b businesses that use lime a lot. As for reference, students could

benefit from *kedai soto* (soup store) or even from the lime seller that is unable to manage their unsold lime.

Secondly, students should establish a beneficial partnership between universities and research institutions concerning the machine or technology to foster the realization of innovation and reduction in cost. Biodegradable masks are among the most current and environmentally friendly alternatives to plastic masks. Compared to traditional plastic, this biodegradable material cuts CO_2 emissions by 30% to 70% (Lackner, 2015). Biodegradable polymers can be made from many sources, including biomass derived from agricultural resources such as polysaccharides (starches, lignocellulose), proteins, lipids, and microorganisms. Furthermore, Nagoor et al. (2021) discovered that limonene can operate as an inhibitor for Covid-19. To this extent, technologies are urgently needed to process these multipurpose innovative medical masks.

Thirdly, students urge to promote an eco-friendly lifestyle amidst this Covid-19 situation by promoting a biodegradable mask as a promising solution to avoiding climate change from being worse. Promotion could be done by firstly setting up a policy starting from a university basis that regulates its students using MANIS. Lastly, students with a background in chemistry, food science, environment, and/or business are needed in establishing a collaboration to set this innovative idea into reality. This could be run through an internal research team recruitment which will be opened at the national university level across Indonesia.

3. Implications/Results

MANIS demonstrated a sustainable strategy by incorporating natural plant fiber into nanofiber mask technology to reduce the amount of plastic waste by face masks. It is a solution to lime peel management and Covid-19 transmission. In line with some of these key goals, it can also contribute positively to achieving Sustainable Development Goals number 3, 9, 12, and 17. Socially, it is expected to enhance up to 30% of people's awareness of the importance of maintaining health protocols amid the post-covid situation. Environmentally, it is estimated to process 50-65% of the amount of lime peel per day and reduce medical mask waste's emergence. Economically, it requires only 4.34% of the normal total cost needed to undergo the process.

Students can contribute by increasing people's awareness of this post-covid issue that affects our climate, which is the increasing mask waste that is hard to degrade naturally. Secondly, students can spread the word to commercialize MANIS as the mask of the future, noting its benefits and sustainability. This role is supported by the fact that students are an important part of our society. The world needs our imaginative ideas to reverse the climate disaster because students and youths are the future.

4. Challenges and perspectives

Collaboration with the mask industry is needed to minimize the costs of realizing this innovation. Limonene is generally considered safe and has no adverse effects when inhaled. Besides, there is enough evidence in the literature to support the use of such biodegradable

masks in preventing and destroying germs, including the coronavirus (Pandit et al., 2021). Therefore, to benefit the environment and ecosystem, it is necessary to adopt biodegradable alternatives to avoid the invitation of another unknown pandemic shortly and to preserve threats produced by the non-biodegradable disposal of synthetic masks.

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

I believe that students are the future. Unfortunately, currently, we are overwhelmed by the threats of climate change. Covid-19 aftereffects worsen the destruction of the environment and climate through medical waste. Nevertheless, this initiative provides us with feasible ideas of medical masks that will mitigate climate change and promotes the utilization of a sustainable concept of waste management of our food commodities, which perfectly correlated with the holistic perspective raised in the theme of 21st International Students Summit 2022.

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Varietal Variations in the Characters of Mungbean (*Vigna radiata* (L.) Wilczek)

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Keywords: mungbean, characters, phenology, genotypic variation

1. Problem statement

Myanmar mainly depends on agriculture for its economy, meanwhile, recognized as the second most climate-change vulnerable country. Since the climate is significantly vulnerable towards the agriculture sector, it is necessary to take adaptable measures to solve this problem. Although most of our farmers grow rice as a national crop, other crops also need to be considered for alternative income. In this case, mungbean (*Vigna radiata* L. Wilczek) drew my attention as one of the important pulse crops in developing countries due to its desirable characteristics. In Myanmar, the total cultivation area was 1.2 million hectares with an average yield of 1.11 metric tons per hectare and produced about 1.4 million metric tons in 2017-2018 (Department of Planning [DoP], 2018). However, there are still only a few high-yielding mungbean varieties (Yezin 9, Yezin 11, Yezin 14 and Yezin 15), commonly cultivated by Myanmar farmers. It was generally grown in two seasons; monsoon season (May-July) and post-monsoon season after harvest of rice (October-December). Therefore, new potential mungbean varieties were needed to develop in order to mitigate climate change. I decided to conduct this study to investigate the parental line among different varieties from the data of phenotypic and genotypic variations.

2. Student's Actions or activities

To achieve the research objective, a pot experiment was conducted at the Department of Plant Breeding, Physiology and Ecology, Yezin Agricultural University, Myanmar. The experimental materials comprising nineteen genotypes of mungbean (7 introduced from China, 9 local, 3 released varieties) were grown during dry season (December 2019 to February 2020) in a randomized block design with four replications to study varietal differences in duration of phenology stages, and yield and yield components. All of these research activities were done by the help of my fellow students.

3. Implications/Results

Based on intensive care and management, my research was concluded successfully and the results will be very useful for further mungbean breeding programs to orient the climate change. In addition, there may be hope for mungbean growers to determine choice of better

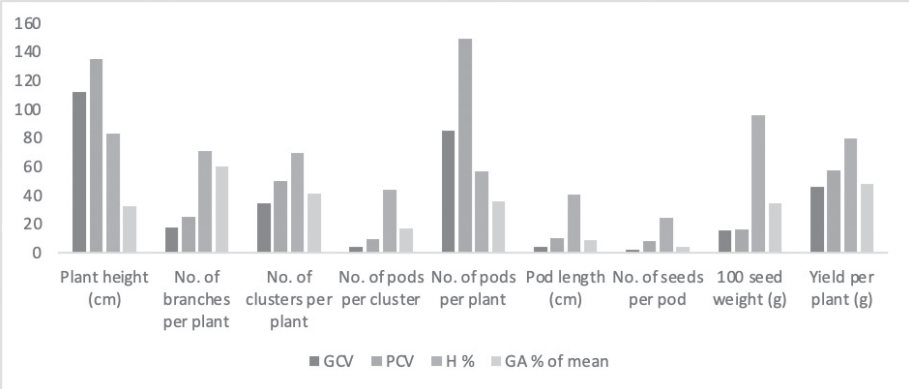
varieties, planting dates, optimum spacing, crop rotation and proper harvesting upon maturity which will be giving them a positive outlook and also increasing the chances of a food secure future. Among the selected genotypes, C-4105 performed the highest yield (11.95 g), followed by A-7635 (9.57 g) and Yezin-9 (8.90 g) in second and third place (Table 1). In terms of genetic parameters (Fig. 1), the greatest PCV value was observed by the number of pods per plant while the largest GCV was noticed in plant height. Regarding the heritability, 100 seed weight is revealed as the most heritable component. However, the supreme number of GA% of mean was recorded in the number of branches per plant.

Table 1. Mean performance for yield and yield components in Mungbean

Genotype	PH (cm)	BPP (no.)	CPP (no.)	PPC (no.)	PPP (no.)	PL (cm)	SPP (no.)	HSW (g)	YPP (g)
A-10266	40.95^{a-d}	1.00^{b}	5.00^{b}	2.98	15.00^{ab}	7.88	8.86	5.10^{d-f}	5.22^{b-d}
A-10271	27.38^{d}	1.25^{ab}	4.25^{b}	2.61	10.00^{ab}	8.80	9.76	6.60^{ab}	6.20^{b-d}
A-10272	31.70^{cd}	1.25^{ab}	4.75^{b}	2.40	10.75^{ab}	8.65	9.96	6.30^{a-c}	5.12^{b-d}
A-10731	42.60^{a-d}	2.00^{ab}	8.25^{ab}	3.32	26.25^{a}	7.08	12.00	3.88^{gh}	5.83^{b-d}
A-10735	37.75^{b-d}	1.00^{b}	5.75^{ab}	3.42	19.25^{ab}	7.53	11.75	4.62^{fg}	8.10^{a-d}
A-4145	36.38^{b-d}	1.25^{ab}	6.00^{ab}	3.64	21.75^{ab}	9.06	10.55	4.67^{fg}	6.88^{b-d}
A-7635	32.02^{cd}	1.25^{ab}	6.25^{ab}	3.00	18.75^{ab}	8.39	10.21	5.35^{c-f}	9.57^{ab}
A-7642	29.07^{d}	1.25^{ab}	6.25^{ab}	2.42	16.00^{ab}	6.12	10.35	3.62^{h}	4.60^{cd}
A-8964	44.55^{a-c}	1.25^{ab}	4.50^{b}	3.08	14.50^{ab}	8.83	11.35	5.38^{c-f}	5.90^{b-d}
C-3020	31.32^{cd}	1.00^{b}	4.75^{b}	3.10	14.75^{ab}	7.75	10.30	5.05^{ef}	6.22^{b-d}
C-3114	35.00^{cd}	1.00^{b}	3.75^{b}	1.75	6.50^{b}	8.85	9.50	6.92^{a}	3.62^{d}
C-3122	32.08^{cd}	1.25^{ab}	4.75^{b}	2.05	10.50^{ab}	7.78	9.14	4.62^{fg}	5.12^{b-d}
C-3210	34.75^{cd}	1.00^{b}	5.00^{b}	3.12	15.75^{ab}	9.51	8.72	5.00^{ef}	6.88^{b-d}
C-4105	50.42^{ab}	2.75^{a}	10.50^{a}	2.02	20.88^{ab}	8.91	11.66	6.03^{a-d}	11.95^{a}
C-4107	37.62^{b-d}	1.00^{b}	5.50^{b}	2.77	14.25^{ab}	8.28	9.91	5.12^{d-f}	8.10^{a-d}
CHENG	42.25^{a-d}	2.50^{ab}	8.00^{ab}	2.91	23.00^{ab}	7.85	10.05	5.42^{c-f}	7.70^{a-d}
Yezin-1	46.30^{a-c}	2.50^{ab}	7.00^{ab}	2.77	19.50^{ab}	9.74	9.90	5.85^{b-e}	7.73^{a-d}
Yezin-14	37.85^{b-d}	1.00^{b}	4.75^{b}	3.06	14.25^{ab}	8.99	10.14	4.80^{fg}	5.60^{b-d}
Yezin-9	53.50^{a}	2.25^{ab}	8.00^{ab}	2.27	17.00^{ab}	9.63	10.02	6.97^{a}	8.90^{a-c}
Mean	**31.08**	**1.46**	**5.95**	**2.77**	**16.24**	**8.40**	**10.22**	**5.33**	**6.80**
$LSD_{0.05}$	15.31	1.69	4.98	-	16.84	-	-	0.96	4.68
F test	**	**	**	ns	**	ns	ns	**	**
CV%	13.53	44.30	32.07	27.48	36.69	25.38	15.68	6.91	26.31

ns = non -significant and ** = significant at 0.05 probability level.
PH = Plant height, BPP = No. of branches/plant, CPP = No. of clusters/ plant, PPC = No. of pods/ cluster, PPP = No. of pods /plant, PL = Pod length, SPP = No. of seeds/ pod, HSW = 100 seed weight and YPP = Yield per plant

As there are many activities needed to accomplish this research, there were several meetings with my fellow students. During the data collection, we discussed the future of the agriculture sector under climate change. One important thing is that most of my fellows are very eager to underpin our future for this industry in their own ways. Along the journey, I inspired their passion and motivation, thereby; I decided to continue my research activities under whatever conditions.



GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation, H% = Heritability (broad sense), GA % of mean = Genetic advance as % of mean

Figure 1. Genetic parameters for yield and yield components in selected Mungbean genotypes

4. Challenges and perspectives

For a youth participating in agriculture, in my opinion, taking a deep consideration on hybridizing climate change adaptable varieties is urgently needed. Biotechnology is already developing in many other countries and it helps to accomplish the goals of the plant breeding program, however, still having many limitations to implement in Myanmar. Therefore, the prerequisite studies like this are certainly crucial to initiate climate change plant breeding programs.

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

As a student studying agriculture and specializing in plant breeding, I am strongly dedicated to empowering all of my knowledge on climate change adaptable varieties development. Believing in "diversity is the strength", I am passionate to have different points of views, comments and suggestions regarding my project. By this submission, I am very excited to share my experience and to get a chance to learn from youths across the world, through listening to their voice and seeing their enthusiasm towards climate change adaptation and mitigation. After all, I anticipate continuing my journey in plant breeding to release mungbean varieties adaptable to climate change and will be able to extend my horizon for the improvement to other crops.

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Reduction of Greenhouse Gas Emissions through Food Waste Recycling

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Keywords: agriculture, climate change adaptation, composting, food waste recycling, greenhouse gas emissions

1. Problem Statement

Food wastage arises along the food supply chain for several reasons. Some of these reasons cut across the globe, while some are locally based and unique per country. In developed countries, food wastage occurs during processing, distribution, and consumption stages (FAO, 2015). However, in low-income countries, food losses occur in the production and post-harvesting phases. These losses are exacerbated by poor infrastructure, insufficient technical-know how on food preservation, and rampant food spoilage among other factors (FAO, 2015). Inadequate mitigating measures, however, at household level by individuals and the government, coupled with a bulging population, has led to high food wastage in Kenya. For instance, Kisumu County, among other 47 counties, is grappling with food waste management issues. It is roughly estimated that the county generates over 500 tonnes of food waste per day. Out of these, the county collects less than a half for waste management which are either disposed of by burning or left to naturally decay in open pits − a practice that is seen in all the counties in Kenya. These methods of disposal, however, have been cited as among contributors of greenhouse gases in the atmosphere besides being a cause of bad odour in cities. As a result, this write-up focuses on recycling of food waste as a means of reducing the emission of greenhouse gases and providing an alternative to food waste management at household level.

2. Student's Actions or activities

Food waste at household level can be implemented by embracing reuse of food before it spoils. But once they spoil, recycling must be encouraged at all costs. Use of anaerobic digestion has been embraced- although on a smaller scale at household level. Food waste management programs, thus, should focus on consumers. For instance, educating vendors and consumers in the market areas, as in the case of Kisumu, on how to pack and use the waste for biogas production, can be a step towards managing food wastage at the point of where foods are sold. At consumption sites, particularly household level, easy-to-use, portable and affordable biogas plants can be installed. The youths can be involved in collecting the food wastes from the

market and trade the same to supplement homemade biogas produced at household level. Besides using biogas as fuel for cooking, this kind of initiative can also open other opportunities that can embrace eco-friendly devices such as evaporative refrigerators that do not use electricity.

3. Implications/Results

This kind of program will ensure that youths have an opportunity to venture into business start-ups that do not require high financial capital but utilize the readily available materials in the form of food wastes. Embracing this program by the youths will also improve environmental cleanliness and reduce pollution in the cities. Also, this kind of initiative has the opportunity of reducing the cost of living to the residents who embrace recycling of food waste for biogas production. Biogas fuel is comparatively cheaper compared to using charcoal, firewood, kerosene, and electricity. Using biogas as a source of fuel and recycling food waste will also reduce emission of greenhouse gases in the long run. Reduction of carbon emission from firewood, and kerosene will have a reduction effect on the cases of respiratory related diseases and ultimately health expenditure among those who embrace the food waste recycling technology for biogas production. Use of evaporative refrigerators will reduce food spoilage of perishable foods. In turn, the ability to preserve food through these initiatives will also help reduce malnutrition levels among households in the county as food wastage will be reduced.

4. Challenges and perspectives

Scaling out this program requires political good will both at the government and community level. Since it sounds unattainable and impractical to implement in the community, a concerted effort from the implementers is required. Also, enormous expertise will be required to come up with affordable, and easy-to-use biogas plants that can suit and fit into housing designs in the cities. If not taken into consideration, it can pose a serious challenge to the food waste recycling initiative. Diverting food from various sources (farms, groceries, restaurants) can also be a laborious exercise if the chain of food waste supply is not well defined.

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

This program's aim is to reduce greenhouse gas emissions that are generated from food waste. This will be done by recycling food waste into compost, which can be used as a natural fertilizer for crops. This will assist in lowering the amount of methane gas produced from food waste decomposing in landfills, as well as the carbon dioxide emissions that come from producing and transporting food. Involving youth in the food waste recycling process will help educate them about the importance of reducing greenhouse gas emissions and preventing food waste. This knowledge can then help reduce GHG emissions and prevent kitchen food waste in their communities. This will help to increase food security, foster productivity and economic efficiency, promote resource and energy conservation, and address climate change.

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Bio-fertilizer production for sustainable Agriculture in Adaptation and Mitigation of Climate Change.

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Keywords: Bio-fertilizer, Agriculture Productivity, climate change, chemical fertilizers, microorganisms

1. Problem statement

In the 2030 Agenda for sustainable development, member states express their commitment to protect the planet from degradation and take urgent actions on climate change and its impacts (UN Department of social affairs, 2015), Raimi *et al.* (2021) reported that poor soil, harsh climatic conditions, including high temperature and drought, the poor economic situation, lack of technological development and insufficient farming practices have significantly affected the crop productivity in Africa. As far as Tanzania is concerned climate change and poor soil are the major factors that affects the agriculture productivity and food security, it has been reported that relative to a no-climate-change baseline and considering domestic agricultural production as the principal channel of impact, food security in Tanzania appears likely to deteriorate as a consequence of climate change. This relative decline comes about through reduction in agricultural production, principally food production, due to increases in temperature and changes in rainfall patterns (Arndt *et al.*, 2012). Organic fertilizers which are made of plant and animal materials, have been used for centuries for improving the plant productivity, however challenges bordering on availability, cost, and management have limited the use of organic fertilizers among the African farmers (Raimi *et al.*, 2017). The chemical fertilizers also have been used by most farmers and according to Raim *et al* (2021) chemical fertilizers are costly, unsuitable and contribute to environmental pollution and soil structure degradation and there are now overuse of the chemical fertilizers which have become increasingly uncontrollable and most times, irreversible, causing significant nutrient loss to African soils.

2. Student's Actions or activities

On developing a major solution to improve agriculture productivity while mitigating and adapting to the climate change the first thing to do is improving soil fertility naturally and avoid soil degradation as well as the use of the poor agricultural techniques that contributes to climate change such as use of chemical fertilizers and organic fertilizers through emphasize and establishment of use of Bio-fertilizer in Agriculture.

Three groups of bio-fertilizers will be produced with a specific microorganism in each group and these are "Nitrogen fixing bacteria, Potassium-phosphorus solubilizing bacteria and the Arbuscular mycorrhizal fungi". I have been making initial preparation and fund seeking on isolation of the microorganisms, selection of effective strains and preparations on making initial field trials towards establishment of biofertilizers as a commercial product to be used in communities to enhance sustainable Agriculture.

3. Implications/Results

Use of bio-fertilizers in agriculture increases the crop productivity showing 20% to 30% increase in yield (Zewide., 2019), these microorganisms promote plant growth by improving the nutrient acquisition and keeps the soil environment rich in all kinds of macro- and micro-nutrients but also improve soil texture, soil fertility which facilitate plant growth and production. Bio-fertilizers also help plants to adapt to various environmental stresses, strengthening roots and also said to produce metabolites that protect plants from pest and disease attacks hence sustainability in Agriculture can be achieved. The production and emphasis on use and implementation of bio-fertilizers in agriculture will reduce the excessive use of chemical fertilizers which contributes to soil pollution and degradation.

BIOFIX (from MEA Ltd – Kenya) and LEGUMEFIX (from Legume Technology Ltd – UK) were the first biofertilizer inoculants/supplements for soybean to be registered in Tanzania in 2015 and till now there are no clear information on whether they are still imported or not. And according to Tanzania Fertilizer Regulatory Authority there are more than two bio-fertilizer registered in 2017, although till now there is not yet enough production of the biofertilizer to be enough to sustain the demand market.

4. Challenges and perspectives

The challenges that lead to failure in accomplishment of this work include absence of financial support to buy reagents and equipment to start the Laboratory isolation of microorganism to be used as biofertilizer also for strain identification and selection of the effective strain through greenhouse performance of the tested strains and alternatively this can be performed by molecular techniques trough sequencing of various strains and identify the effective strain to be used as biofertilizer, all these are hindered by absence of laboratory reagents and equipment to perform the work.

Biofertilizers are profitable to farmers offering necessary nutrients to crops hence increased productivity and reduced requirements for chemical fertilizers hence environmental benefits, there is a growing demand for agricultural goods produced in a sustainable manner; therefore, the use of eco-friendly inputs for food production, such as biofertilizers, will have a significant increase in the coming years.

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

The production and emphasize on use of bio-fertilizer relate to the theme in a way that, using biofertilizer in agriculture will promote the sustainable crop production because these

microorganisms will lead to increased nutrient uptake, plant growth and plant tolerance to abiotic and biotic stress. The biofertilizers being simple and easy to apply will help to overcome use of chemical fertilizers and organic manure which are associated with causing climate change by contributing to soil degradation and global warming through emission of greenhouse gases such as nitrous oxide (N_2O), methane (CH_4) and carbon dioxide (CO_2). Youths will be the main target as workers and as knowledge providers to the community on the benefits of using Bio-fertilizer, using youth as target will also have a very huge impact in future as they will become parents and the knowledge will still be transferred to their generations like the Genetic information.

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Youth embark on providing knowledge in receiving the appropriate amount of nutrition.

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Keywords: Climate change, Greenhouse gas, nutrition.

1 Problem statement

Mongolia is a developing nation with 3.3 million citizens living sparsely over a territory of 1,566,500 square kilometers, in contrast to human population, Mongolia houses more than 70 million livestock. Mongolia's GDP is expected to reach 14.00 billion USD dollars by the end of 2022. With 29,300 tonnes of meat exported annually, despite that Mongolia's Greenhouse Gas (Co2) emission is still steadily increasing, from the latest statistics shown in 2019 carbon emission was 23,070, a 7.05% increase from 2018. While it is undeniable that burning fossil fuels for energy, mining and vehicles are the biggest contributors making up about 50% of the emissions. But methane is a close second at 40%. Additionally, most of the methane emissions is generated by animal's digestive tracts and discharged by the animals as they pass wind or belch, while the rest is emitted from animal manure. Due to the Greenhouse Gas and Climate change, Mongolia has experienced significant climate changes, with warming of over 2° C and declines in rainfall reported between 1940 and 2015. The frequency of droughts, and natural disasters has increased, 76.9% of the land has been desertified, and permafrost has shrunk by 33.7% over the past 50 years. Mongolia's geographic location, extreme weather and fragile ecosystems, coupled with prominent pastoral livestock and rain fed agriculture sectors, make Mongolia's economy, livelihood highly vulnerable to climate change. Climatic shocks and natural disasters have only exacerbated food insecurity in Mongolia, with the depletion of food stocks instigation, a rapid migration out of rural areas and into urban centers. This only made things worse by affecting 35% of the population into extreme poverty. As a consequence of that, economically unstable households often turn to cheaper alternatives with questionable or lacking aspects. These cheaper products often contain additives such as preservative chemicals, trans-fat and hold a questionable origin. Constant consumption of unhealthy foods produces the majority cases of obesity, malnutrition, sickness and cancer. Mongolia currently holds the highest cancer mortality globally. The World Obesity Federation (WOF) concluded that by 2030 Mongolia's obesity rate in children will increase to 19%.

2. Student's Actions or activities

To address the previously stated problem, in 2021 the youth in Mongolia have started a campaign about obtaining an accessible, healthy diet. We have conducted a survey online

involving 7550 secondary school students. The purpose of this study was to determine the nutritional level of Mongolian secondary school students' diet and to determine their daily calorie intake. The survey shows that 49.4% of the students do not calculate the daily calories they consume, while the other 42% are eager to learn how to calculate their daily calorie intake. While the remaining 8.6% do calculate their calorie intake. The sole foundation for a healthy eating future is preventing food related diseases and gaining accurate information about the daily goods we consume. Therefore, our team decided on the idea to start a campaign work aimed for students all around the country. With the assistance of this campaign people will become more knowledgeable about their daily nutritional requirements, and will be able to calculate their calorie intake. In addition to that we highly recommend people to garden at home, this will not only help you to eat healthy but it will help with your finances even by a little.

3. Implications/Results

The result of our work has been steadily showing, in fact myself and my teammate have taken gardening in our lives and are waiting for this year's crops to ripen.

4. Challenges and perspectives

The challenges we have faced during this project was people's lack of knowledge in receiving the appropriate amount of nutrition and changing people's biased opinion on nutrition and calorie intake. Mongolia is a country that has an ongoing history of nomadic lifestyle, Mongolian cuisine consists of two main ingredients- meat and flour. Mongolians rarely use a variety of vegetables in their meals, because certain vegetables are more expensive. As a result, receiving much needed nutrients you can only obtain from specific vegetables or fruits are difficult. From this stems people's biased cognition on food rich in a variety of vegetables. This is why we have started a campaign on providing knowledge on nutrients and recommended home gardening.

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

Climate change has not only affected our country, it has affected all the nations all around the globe, causing food shortage. For this reason we believe the actions we have taken are quite prevalent in all communities around the world.

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Renewal of small-sized urban sites for carbon neutrality – research on climate positive design

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Keywords: climate change, carbon sink, small sized urban sites, climate positive design

Problem statement

As a developing country, China's energy demand and CO_2 emissions will inevitably grow. In the context of world climate issues and China's strategic goal of carbon peak and carbon neutrality, landscape architecture plays a vital role in addressing climate change and enhancing sustainable development (Liu, 2020). At present, most of the studies on carbon sequestration measurement have focused on large-scale levels such as city or urban area, while few studies on carbon sequestration benefits of green space in small-sized urban sites such as park and plaza have been conducted (Wang & Yin, 2021). Against this background, this study aims to investigate climate positive design methods of landscape architecture.

Student's Actions or activities

Sample Site Selection

Four different types of small-sized urban sites in the process of urban renewal in Beijing, plaza, residential area, campus and park, with a size of about 1000 square meters, were selected as sample sites for site research and data collection. The project aims to increase carbon sink through climate positive design.

Calculation of carbon sink capacity of sample sites before and after transformation

We used the Pathfinder app (Pamela, 2019) to measure carbon sequestration and emissions in four sample sites, and to calculate the time to reach climate positive.

Climate positive design with community needs

Through questionnaires, interviews and participatory design, we investigate the needs of local residents, which will be used as a reference in the design. Afterwards, the study, by means of literature review and fieldwork, will carry out the climate positive design of the sites by increasing carbon sink, reducing direct carbon source, and reducing indirect carbon source. Specifically, these include (1) plant selection and application, (2) landscape design with fewer roads and more green spaces, (3) use of materials with high sustainability performance, and (4) sustainable construction and maintenance.

Implications/Results

Analysis of carbon sink capacity of sample sites

By analyzing carbon sequestration and emissions, we identified design priorities for different sites, and achieved a positive climate in 5 years for the park and campus sample sites and 20 years for the residential area and plaza sample sites by design.

Table 1. Carbon sinks in the study sample sites

Sample plot		Green coverage (%)	Total Material Emissions (Embodied Carbon) †	Total Plant Sequestration †	Total Operational Emissions †	Net Impact over 50 years (Metric tons)	Years to positive
Plaza	before	4	63,830	234	31,585	95	∞
	after	14	5,507	18,416	626	-12	20
Residential area	before	49	27,917	14,951	3,466	16	108
	after	49	17,963	62,962	2,160	-43	20
Campus	before	42	63,936	204,422	1,990	-138	20
	after	53	3,361	425,370	4,100	-418	5
Park	before	78	10,639	54,011	548	-43	14
	after	80	3,785	73,901	591	-70	5

† Values are expressed in kg CO_2-eq.

Firstly, considering the high carbon emission generated by paving, construction materials, energy consumption of facilities, manual maintenance, plaza project renewal should choose materials with low carbon emissions, use alternative construction materials to reduce the amount of concrete, minimize manual maintenance by using organic fertilizers and irrigating plants through permeable paving.

Secondly, the green coverage of residential area and campus is moderate, and the increase of carbon sink mainly comes from carbon sequestration by plants, so large evergreen trees and large deciduous shrubs with strong carbon sequestration should be selected, and the quantities of plants as well as the proportion of trees and shrubs should be increased. In addition, the green coverage of the campus is relatively low, and the stone pavement in the site generates high carbon emissions, so the design will convert the unused land and pavement into green space, contributing to increasing carbon sink.

Lastly, the park has a high carbon sink benefit because of its high green coverage and high planting density. However, the moderately managed lawns could be switched to perennial herbaceous plants to improve the carbon sequestration.

Strategies for climate positive design

Based on the research, we propose strategies for climate positive design that are universally applicable. In the design phase, we will design a larger green space, design a natural

plant landscape, and use carbon calculation tools to help design decisions. In the construction phase, we suggest using existing materials and engineering structures for micro-renovation and adopting low-carbon materials. In the maintenance phase, we will reduce manual intervention, use organic fertilizers, adopt water-saving irrigation systems, adopt rough plant management practices, and optimize management processes.

In addition, it is interesting to note that we use a carbon footprint calculator like Pathfinder to obtain data related to carbon emissions and carbon sinks, visualize carbon sinks, and quantitatively analyze carbon sinks for accurate climate positive design.

Challenges and perspectives

The study has some limitations of ignoring material transport carbon sinks, chance in the samples, and crude calculations of plant material carbon sinks. However, the study has good educational implications, and if more landscape architects did positive climate design, we would have a better environment.

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

Environmentally, we address global climate issues by using climate positive design and proposing small urban site renewal strategies for carbon neutrality. Educationally, we encourage residents to engage in carbon reduction initiatives through participatory design, activating community dynamics and raising residents' low-carbon awareness.

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Group H

Group theme

Environment

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Climate change and food security: the case of the fall armyworm *Spodoptera frugiperda*

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Keywords: insect resistance management, invasive insect pest, agricultural landscapes

1. Problem statement

Brazil is an agricultural country responsible for feeding more than 800 million people around the world (Contini & Aragão, 2021). The effects caused by climate change are one of the major challenges that are being currently faced in agribusiness worldwide. As an essential activity for the balance of society agriculture is highly dependent on climatic factors, being strongly affected by changes in the climate. Thus, these climate changes that have been influencing agriculture can threaten food production and food security both in Brazil and in the world.

The rising of global temperature is one of the known effects of these changes. Besides influencing plant metabolism, the increasing of temperature tends to affect the behavior of insect pests in agri-ecosystems. An increase of only one Celsius degree, some insect pests can cause 10 to 25% more damage in the plant (Deutsch et al., 2018), resulting in higher losses in the productivity. One of the insect pests that can have its behavior affected by these climate changes is the fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae).

This insect pest is native to tropical and subtropical regions of the Americas and recently invaded many countries of Africa, Asia and Oceania in 2016, 2018 and 2021 respectively. The larvae of *S. frugiperda* are highly polyphagous and extremely voracious causing severe damage to economically important crops. It can feed on more than 80 plant species, including maize, soybeans and rice, which are staple foods for humans and animals. Based on this fact, it is understandable the damage caused by *S. frugiperda* has global relevance. Therefore, global solutions will need to be discussed to manage this pest, because *S. frugiperda* can reduce the production of agricultural crops in more than 50% (Embrapa, 2016), affecting the food security of many communities.

In the countries where *S. frugiperda* recently invaded and in Brazil, control has been based on the use of insecticides and transgenic plants expressing proteins of *Bacillus thuringiensis* Berliner (Bt). However, as a result of the repeated use of the same control method, resistance of *S. frugiperda* to insecticides and Bt proteins has been reported at some locations. Consequently, urgent actions of insect resistance management (IRM) strategies need

to be implemented to manage *S. frugiperda* worldwide, because surviving larvae continue causing damage in crops and control of this insect pest is essential.

2. Student's Actions or activities

In Brazil, especially at the Arthropod Resistance Laboratory located in the University of São Paulo, I have been contributing since 2020 to an IRM program that has been done for more than two decades. We have been monitoring the insecticide resistance of the fall armyworm populations collected from major Brazilian agri-ecosystems providing basis for integrated pest management (IPM) programs and ensuring the food security of my community and communities around the world, since Brazil has been contributing to the food supply chain of other countries.

Fall armyworm populations have been collected in Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Minas Gerais, Mato Grosso do Sul, Mato Grosso, Goiás and Bahia states. After collecting different populations of *S. frugiperda* in the field, they are reared on an artificial diet under laboratory conditions. Larvae are submitted to ingestion or topical bioassay using the diagnostic concentration (LC_{99}) of the insecticide to evaluate their susceptibility to different insecticides. A total number of 480 larvae are tested per population and insecticide.

3. Implications/Results

There are more than one hundred reports about *S. frugiperda* resistant to insecticides and Bt proteins worldwide (APRD, 2022). In Brazil there are more than twenty cases and the most part of these cases are reported by the IRM program conducted in the Arthropod Resistance Laboratory (Table 1), representing approximately 60% of the cases reported in Brazil. All information developed in our IRM program is strongly relevant, hence my teammates and I are committed to continue contributing to monitoring the insecticide resistance of the fall armyworm in order to provide a basis for performing an IPM program.

Our IRM program also collaborates to implement an environment-friendly control of *S. frugiperda* since it provides information for more assertive and sustainable management, reducing the amount of pesticides applied in the agricultural landscapes. Additionally, this research has been providing information to farmers by helping them make ends meet and agriculture a profitable activity. When it comes to social impacts my teammates and I are engaged and motivated to continue developing results at the Laboratory in the University of São Paulo for both Brazilian and global agriculture, because we know youths have the power to ensure food security in several communities through better agriculture and for a better world.

4. Challenges and perspectives

Considering Brazil as a continental country, it is challenging to disseminate the information we are developing to farmers, consultants and dealers. The fall armyworm has spread worldwide. Thus, we hope to work synergistically globally to manage the pest. We also expect to take this information and knowledge to all farmers around the world through extension, global policies and summits equally to the 21st International Students Summit to

perform an IPM socially, economically and environmentally correct.

Table 1. Chemical group, active ingredient and references of *S. frugiperda* resistant to insecticides and Bt proteins reported by the Arthropod Resistance Laboratory in Brazil

Chemical Group	Active Ingredient	References
Avermectin	Emamectin benzoate	Muraro et al. (2021)
Benzoylurea	Lufenuron	Nascimento et al. (2015)
Bt proteins	Cry1Ab	Omoto et al. (2016)
	Cry1F	Farias et al. (2015)
Diamides	Chlorantraniliprole	Padovez et al. (2021) Bolzan et al. (2019)
Organophosphate	Chlorpyrifos	Carvalho et al. (2013)
Pyrethroid	Cyalothrin-lambda	Carvalho et al. (2013) Diez-Rodriguez et al. (2001)
Spinosyn	Spinetoram	Lira et al. (2020)
	Spinosad	Lira et al. (2020) Okuma et al. (2017)

Source: Adapted from Arthropod Pesticide Resistance Database (ARPD, 2022).

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

My research aimed to study one of the major challenging insect pests in agriculture which has potential to increase its damage in plants due to climate change, threatening food security of several communities. My studies can be useful for implementing IRM strategies in order to promote sustainable agriculture worldwide.

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Potential of urban tree diversity in carbon stock enhancement and climate change mitigation

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Keywords: Urbanization, Climate change, Carbon stock

1. Problem statement

More than half of the world's population now lives in urban areas and the numbers are expected to rise at a rate of 4% a decade by 2050 (Cleland, 2013). This is also the evident case in Morogoro municipality, Tanzania where the population has been rising considerably causing issues of heat stress and water scarcity in a city which was once known for its many natural rivers and waterfalls. Such rapid urbanization threatens the sustainability of cities and even worse, the efficiency of natural carbon sinks (Dangulla et al., 2021) which poses the challenge of local and regional climate change, loss of natural habitats and biodiversity among many more. Urban forests have a great potential in mitigating carbon emissions and performing other environmental services (Munishi et al., 2008). A study on the quantification of tree diversity and carbon stock in an urban area can show the exact potential of urban forests/trees in reducing global atmospheric carbon (since it largely varies with tree species and diameter (Dangulla et al., 2021)) and thus their contribution in climate change adaptation and mitigation.

2. Student's Actions or activities

With respect to the stated problem, I conducted a study as part of my final year research project on the urban tree diversity and carbon stock. The study was carried out as a case study in my university campus (SUA-Edward Moringe Campus) from 14th March to 3rd May 2022. The trees covered were mostly common tropical trees and some native but most exotic tree species for instance *Senna siamea , Polyalthia longifolia* and *Mangifera indica* to mention a few. Data collection for this study followed the approach described by Speak et al. (2018) and Staudhammer et al. (2018), and analysis of the key diversity indices were computed as described in Magurran (2021). Based on that, I calculated the diversity of the studied trees using Shannon Wiener's diversity index and Pielou's evenness index. The trees were then arranged into distinct diameter at breast height (DBH) classes and the biomass allometric equations for each species were used to calculate the dry biomass of each surveyed tree and if there is not an established allometric equation for a single species, I used one from the same genus and family equations (Munishi et al., 2008). The distribution of carbon stock in different diameter classes and the mean average carbon stock of the study area in ton per hectare was thereafter obtained.

After understanding the role of trees in sequestration of carbon in urban areas while conducting the study, I engaged in more tree planting activities around the Morogoro municipality through the Tanzania Forestry Students Association (TFSA) in which I am an active member. I also actively participated in the "Tree planting day" activities on 26th March 2022 which brought together youth from different universities in Morogoro, different government and non-governmental organizations to plant trees around the Morogoro municipality.

3. Implications/Results

The results showed the study area had 2368 trees with 76 different species and the species diversity and evenness were considerably high (H'=3.387, J=0.677). The mean carbon stock in ton per ha was 40.78 ± 12.45tonnes/ha and the average carbon stock in different DBH classes is shown in figure 1 below. It was clearly noted that the more abundant a tree is the more it contributes to carbon sequestration. This was clearly seen with *Senna siamea* the most abundant tree on campus, having a carbon stock of 5.647tonnes/ha and the *Citrus lemon* (considerably less abundant) contributing a significantly less amount with only 0.002tonnes/ha.

The large carbon stock implies that the study area is a carbon sink therefore its maintenance is important in combating climate change.

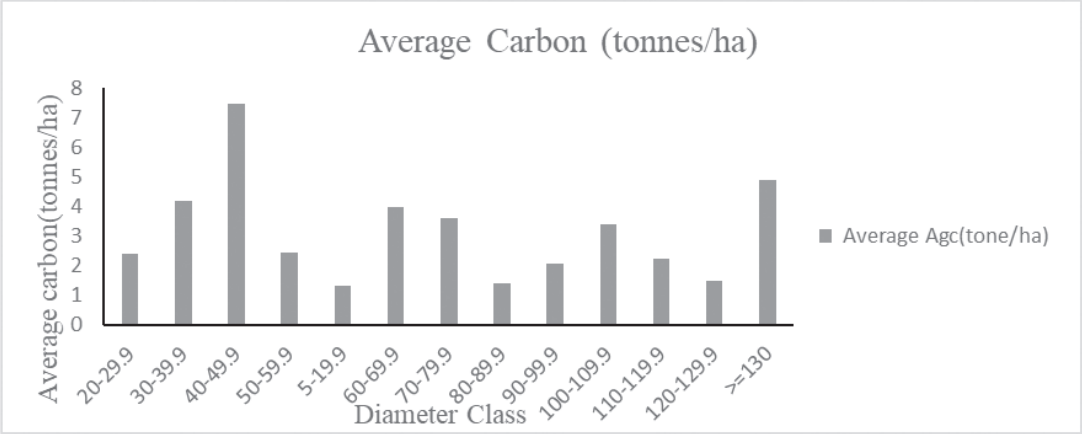

Figure 1; A graph showing average of carbon in tones/ha to DBH class distribution.

Fellow colleagues in my department actively participate in tree planting activities and community education on the importance of protecting the trees in urban areas. We are all generally motivated by passion for the environment and trees in which our careers are centered around.

4. Challenges and perspectives

The study and measures I have done are on a very small scale due to limited funds. Given a chance, this study could be conducted on a much larger scale, and the results used to convince the concerned authorities to urge more tree planting to combat the local and regional

climate change together with the recent heat stress issues. The good work will have to be accompanied by campaigns and other measures to encourage the surrounding communities to upkeep the changes and efforts being done to combat climate change. This could be by making them understand the importance of it all and offering possible alternative solutions to the factors which make them destroy trees.

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

The increasing urbanization both speeds up and increases the negative impacts of climate change and while urbanization is hard to control, my suggested actions can help adapt and mitigate the climate changes that come with it. Gaining scientific evidence on the role of trees in urban areas will encourage the government and the community to take more serious actions and support mitigation measures. Meanwhile, the youth are the manpower in the actual adaptation and mitigation measures like the actual tree planting and tending and even the process of educating and encouraging the community to adapt to conservation. Apart from aligning with the ISS theme, these actions and measures also align with the SDGs in terms of sustainable cities and communities (global goal 11), climate action (global goal 13) and life on land (global goal 15).

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Bioplastic made from banana peels

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Keywords: Food Waste, Bioplastic, Recycling

1. Problem statement

As a second-year student following the International Sustainable Agri-Business & Food-Engineering program at UniLaSalle, I have been confronted with several issues regarding sustainability and climate change throughout my two years of studies. In one of the classes I attended this year, my classmates and I were tasked with presenting to the rest of the class a product related to sustainability, which addresses the challenges facing society today in the agro-industrial sector. For this project, my group and I decided to tackle food waste, which refers, according to the Food and Agriculture Organization of the United States (2022), to "the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers, and consumers.". We chose this subject because we know that it is an urgent issue in our society. Indeed, according to the United Nations Environment Program (n.d), "Roughly one-third of the food produced in the world for human consumption every year − approximately 1.3 billion tonnes − gets lost or wasted.". Among these figures, the government of the UK led an investigation on the scale of banana waste in the country. They found out that "Britons routinely bin 1.4m edible bananas every day at a cost of £80m a year" according to the government's waste advisory body Wrap, a piece of information relayed by Rebecca Smithers in an article in The Guardian (2017). Finally, we know that our use of plastic is not sustainable and that it has impacts on the environment, so this is the reason why we also focused on the transformation of waste into bioplastic. In addition, it was reported that "While plastics have been recycled since the 1970s, the quantities that are recycled vary geographically, according to plastic type and application." (Jefferson et al., 2009).

2. Student's Actions or activities

To address this challenge, we decided to reduce the scale of concern to our school by focusing on fruit residues and especially on banana peels. Indeed, we found out doing our research that each year we eat around 100 billion bananas, which comes down to about 30 pounds of bananas consumed per person annually ("Banana Peels Utility", 2021). That is why we looked for a way to recycle this material. We got in touch with several companies working on the subject, such as Kuori, a Swiss firm producing shoe outsoles from banana peels. After gathering enough information, we decided to produce our own bio-based plastic from the peels we collected. We worked with the laboratory assistant from our school, who helped us build a

protocol and carry out the experiment. In the end, we managed to produce one sample.

3. Implications/Results

Out of the four different samples we made, only one was successful. We used different parameters and components for each sample to compare different protocols. We first cut the peels and divided them into two batches. The first one was boiled in water, while the second set was boiled in a solution made of water and sodium metabisulfite ($Na_2S_2O_5$). We used sodium because it acts as a food preservative. We then let the peels dry and mixed them in blenders, and we also had to add water to get a fluid paste. Subsequently, we further divided each batch into two subgroups. For a sub-group of each set, acetic acid and glycerol were added. For the two other subgroups, we added HCl and glycerol, so in the end, we had four different solutions. Finally, we put the pastes into four Petri-dishes and put them in an oven at a low temperature (60℃ for a whole day) to dry. Compared to the other three that did not, the most successful sample contained HCl with $Na_2S_2O_5$, which means that this component may be required to produce bioplastic in the protocols we followed. However, we did only one test, so we could not ensure that our results and observations were correct. Nevertheless, this project was a way to prove to ourselves and others that it is possible to do it at our scale.

In tackling the problem of banana peel management, we became more aware of the impact food waste can have. This project raised our awareness of the urge to change our consumption habits, and we were able to pass on this message to our classmates. As young people, what motivated us was to find alternatives to the use of plastic made from ethylene while reducing food waste. My group and I believe that youth can play an important role in mitigating and adapting to climate change.

Picture 1. Sample with HCl and $Na_2S_2O_5$

4. Challenges and perspectives

Our group believes that if we can apply this solution in our school and extend it to the recycling of other fruit residues, then we could have an impact on the food waste issue at our level. Indeed, by optimizing waste, which turns into useful material, we can give value to it and

create a whole new sector in our school. The main challenges of this project are the collection of the peels and the durability of the bioplastic. Indeed, a few days after our experiment, all the samples were already damaged, so it is necessary to increase the useful life of the bioplastic to make it last longer. In addition, if we want to implement it throughout the school, a collection system should be put in place to efficiently recover and recycle waste.

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

This project is deeply linked to this year's ISS theme because it provides an alternative to the use of plastic which takes a considerable amount of time to degrade. In addition, the production of plastic made from crude oil or coal is very harmful to the environment and causes climate change (via the increase in greenhouse gas emissions). Moreover, even though banana peel decomposes quicker than plastic, it still takes around two years to do so. Therefore, this solution bears a more sustainable way of managing waste as we reduce the use of non-biobased plastic and give a second life to fruit residues.

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Activity of youth in afforestation in Bosnia and Herzegovina

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1. Problem statement

Like most countries in the world, Bosnia and Herzegovina is facing the consequences of climate change. There are catastrophic floods on the one hand and extreme droughts on the other, especially during the last decade. Bosnia and Herzegovina has several climate types: the temperate continental climate type (northern and central parts), the sub-mountainous and mountainous type, the Mediterranean and modified Mediterranean climate type. It has a relatively preserved environment since the rural area dominates and 46.34% of the territory is covered by forests (Drašković, Miletić, Gutalj & Stjepanović, 2020 , p. 581-589).

The results of the research show that forests in Bosnia and Herzegovina were reduced by 2.95%, in the period 2012-2018, where 2.55% of them were coniferous. Forests are primarily endangered by the process of conversion to transitional forest / shrub and fires. (Drašković, Gutalj, Stjepanović & Miletić, 2021, p. 694-702).

One of the simplest ways to maintain the surface of covered forests, mitigate the greenhouse effect and reduce CO_2 in the air is afforestation. Afforestation enriches the forest fund and also controlled and planned planting provides wood of a certain quality that meets human needs.

2. Student's Actions or activities

In Bosnia and Herzegovina, in practice, volunteers are most often engaged in afforestation, mostly high school students as well as students. In this way, in addition to active work and contribution to their local community, society and environment, young people gain awareness of environmental protection. Student volunteer actions are organized in the spring and autumn when it is the planting season.

3. Implications/Results

The results of the participation of a large number of young people in afforestation actions are reflected in several different aspects.

Economic aspect: The participation of young people and volunteers, students and high school students reduces the costs of afforestation and thus the possibility of planting more seedlings because we get free labor.

Social aspect: From a social point of view, the involvement of young people in afforestation

and similar social actions is a very positive thing. First of all, the awareness of young people about the preservation of forests and the importance of the forest fund is increasing, and also the inevitable socializing and greater connection of young people is very important for the development of society.

The following results were obtained by surveying a target group of young people from all parts of Bosnia and Herzegovina. According to the results, 43,90% young people have never participated in actions of afforestation. (Table 1).

According to results survey, ecology actions are organized in 81,25% local communities in Bosnia and Herzegovina minimum one time per year. (Table 2).

Table 1: *Participation of young people in action of afforestation in B&H*

Participating in actions	Percentage	Count
One time per year	26,83%	22
More times per year	29,27%	24
Never in life	43,90%	36

Table 2: *Participation of young people in ecology actions in B&H*

Participating in actions	Percentage	Count
One time per year	46,25%	37
Two time per year	6,25%	5
More times	20,00%	16
Never in life	27,50%	22

The results of the research show the possibility of more abundant involvement of young people in environmental actions and actions of afforestation.

4. Challenges and perspectives

The activity of young people in Bosnia and Herzegovina in all spheres of activism is not at an enviable level. Such is the situation in the field of forestry and environmental protection. The biggest challenge at the moment is to mobilize passive young people and involve them in social actions. If the percentage of youth involvement in environmental actions increased, they would have a much cleaner environment with much more forested areas with very little money invested.

The students who participate in afforestation are mostly from the faculties of ecology, forestry and biology. Increasing the participation of students in these actions from all spheres of science through the mobilization of young people would contribute to a higher percentage of forested areas. The process of increasing the forest area ultimately leads to the reduction of harmful gas emissions and mitigation of climate change.

The afforestation problem in Bosnia and Herzegovina is due to the poor ways of making

records of the afforested land and then in the way that land is then displayed to the public. (Mataruga, Ballian, Terzić, Daničić & Cvjetković, 2019, p. 3-19).

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

The sustainability of forest ecosystems is also very important for agriculture and food production on a global scale. Forests maintain CO_2 levels and create oxygen, which is crucial for life on planet Earth. We have to think about future generations, climate change is very visible, which is why it is necessary to emphasize young people and their involvement, because young people are creating their future and the future of our planet.

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Greenhouse gas emission from agriculture: An outlook toward Net Zero emission in Vietnam

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1. Problem statement

Climate change is one of the biggest challenges facing humanity in the 21st century and the following centuries. Students are the ones who learn and have access to new knowledge, technologies, and grand. Therefore, students have a very important role in responding to the impacts of climate change. Practical and specific activities will enhance the self-discipline and active participation of students. Thereby, students can also supplement themselves with new knowledge, improve self-discipline in actions to protect the environment and respond to climate change.

Net Zero is achieved when the total amount of greenhouse gases emitted by humans is rebalanced by removing these gases from the atmosphere through carbon removal. First and foremost, anthropogenic emissions (such as those from vehicles and fossil fuel plants) must be reduced as close to zero as possible. The remaining greenhouse gases then need to be balanced with an equal amount of carbon removed, perhaps through activities such as reforestation or the use of direct air capture technology (DACS). Reaching Net Zero is the same as achieving "climate neutrality".

In fact, the goal of achieving "zero" net emissions by 2050 is becoming an inevitable development trend of the world, accompanied by strong statements of energy transition, low emission development, towards achieving The goal is to keep the global temperature increase at 1.5 degrees Celsius by the end of the century.

2. Student's Actions or activities

In 2020, I participated in the "World Environment Day 2020 Influence Competition" organized by the association of the Faculty of Natural Resources and The contest propagated and raised the awareness of students as well as people about the effects of climate change

And on the morning of December 26, 2020, I participated in the National Scientific Conference: "Climate change and sustainable management of the agricultural environment" organized by the faculty with the participation of nearly 100 delegates who are experts from the Faculty of Science and Technology; scientists, lecturers, researchers from universities and research institutes; lecturers and students of Vietnam National University of Agriculture. The

workshop is considered as a forum to exchange and share about climate change, its impacts on the environment and agricultural production; the successes of models of agricultural production, aquaculture and environmental management adapted to climate change.

3. Implications/Results

Through these two programs, I have gained knowledge and methods to propagate to the community about the impact of climate change as well as greenhouse gases. The workshop "Climate change and sustainable management of the agricultural environment" is one of the useful scientific activities, contributing to the synthesis and establishment of methods and tools to help control, adapt and cope with the environmental problems. recover damages and losses caused by climate change.

Due to the Covid 19 epidemic, I have not really had the opportunity to act and direct activities on the risk of greenhouse gas emissions from agriculture to the community.

4. Challenges and perspectives

The prospect of net zero emissions is a new topic for students in Vietnam. Currently, only the government, ministries and research institutes participate in research on net zero emissions. This is a rather difficult topic to approach, but with my research, the difficulty of net zero emissions in Vietnam. The roadmap to reduce greenhouse gas emissions, introduced at COP26, requires all countries, including Vietnam, to make a drastic transition to low-emission development. In order to reduce emissions and aim to end coal use, it will be a problem that Vietnam needs a lot of effort.

Accordingly, the issue of energy is the top concern in Vietnam, because currently energy is the largest emitter. According to calculations by the Ministry of Natural Resources and Environment (2020), in the energy sector, 60% of emissions in 2020 will come from the energy industry - mainly from electricity production. Therefore, reducing greenhouse gas emissions in power generation is extremely important for Vietnam to meet its commitments in the NDC and the new Net Zero target.

In order to reduce emissions, convert energy, and aim to end coal use, it will be an issue that Vietnam needs great efforts. And protecting, restoring and combating forest degradation is an area that we need to continue to promote.

Currently, our country' s coal power capacity is about 21.3GW, contributing 50% of the total electricity output. This number is also increased to 40.9GW in 2030 and up to 50.9GW in 2035. In particular, with 15.8GW of estimated power capacity, which cannot be financed in the Draft Power Plan VIII, it will be a big challenge when Vietnam has set the Net Zero target by 2050 at COP26.

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

The negative impacts of climate change are seriously affecting on a global scale, requiring the international community to act more strongly, responsibly and without delay on a global scale. With the theme of the 21st ISS "Youth actions and Innovations towards Climate Change

adaptation and Mitigation to promote sustainable Agriculture in their communities", I represent students of Vietnam National University of Agriculture, attend the program with the desire to join the international community in responding to climate change, carbon emission reduction and sustainable development. Learning and practical approach to actions to respond to climate change, suitable to the unique circumstances of each country.

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Group I

Group theme

Nutrition

Presenters:

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Matthias, Schneider, University of Applied Sciences Weihenstephan-Triesdorf

Winfrida Jilala Mihambo, Sokoine University of Agriculture

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Issa Abrahaman Kachenje, Tokyo University of Agriculture

Effects of Climate Smart Agriculture on Household Food Security among Small Scale Farmers in Kisumu West Sub-County

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Keywords: climate change, Climate Smart Agriculture, climate smart agriculture practices, household food security, smallholder farmers.

1. Problem statement

Agriculture has been a major topic of debate around the world for decades, owing to various benefits such as poverty reduction, increased income, improved living standards, and improved food security. Climate change, on the other hand, has offered the largest issue of the twenty-first century, posing a threat to food security systems. Agriculture is predicted to support the growing global population, which is expected to reach 9.7 billion in 2050 and 10.9 billion by 2100 (United Nations, 2019). Climate Smart Agriculture (CSA) has recently garnered a lot of attention due to the global focus on climate change and sustainable agricultural production i.e., agriculture to boost production in a sustainable manner, raise resilience (adaptation), reduce/eliminate greenhouse gas emissions (mitigation) when practicable, and improve national food security and long-term development goals. Food security and development are the primary objectives of the CSA (FAO, 2013a; Lipper et. al, 2014), with productivity, adaptation, and mitigation required to attain this goal (United Nations' FAO, 2018). Agriculture has remained essential to Kenya's economic development for the past three decades, accounting for 28% of the country's gross domestic product (GDP) and 65% of total export profits. The crop, livestock, and fishing sub-sectors each provide about 78%, 20%, and 2% of agricultural GDP, respectively (GoK, 2007).

Climate change has had significant impacts on water resources, human health, and food security, as evidenced by a persistent rise in temperature and erratic rainfall patterns, resulting in a drop in agricultural production (FAO, 2013). Most governments face the challenge of improving food security and reducing poverty. They must choose between food production, which is fraught with difficulties, and climate change mitigation (WB, 2013). Inadequate investment in sustainable intensification, use of old farming systems such as monocropping etc., has resulted in food insecurity due to low agricultural production (Lee, 2015).

2. Student's Actions or activities

In light of the foregoing, the purpose of this study is to gather information on smallholder

farmers' implementation (adoption and practice) of Climate Smart Agriculture approaches in Kisumu West sub-County, as well as the impact of CSA on food security and smallholder farmers' incomes, and to focus on youth involvement in climate change adaptation and mitigation. Data collected was analysed and the results have shed light on adopting and building resilience to climate change, reducing and/or removing greenhouse gases - mitigation, and sustainably increasing agricultural productivity and incomes - food security within the locality so that necessary measures can be implemented.

This study is to be carried out in the Nyanza region, Kisumu County, Kisumu West sub-county which is located on the western side of Kisumu County. The sub-county is divided into five wards (Kisumu Central, Southwest Kisumu, Kisumu West, Northwest Kisumu and North Kisumu). It has a population of 13,1246 people and an area of approximately 359.7km2 (2022 Kisumu West NG CDF). A cross-sectional study design was used, which was expanded to a mixed method incorporating both quantitative and qualitative approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of understanding breadth and depth and corroboration Harwell (2011); Invancova, Croswell, and Stick (2011). The population were smallholder farmers residing in or operating in Kisumu West sub-County who are almost always engaged in agricultural practices, including close border operatives whose activities are reasonably influenced by and thus almost sharing in most agricultural practices and/or activities within the region. The Naing (2003) formula was used to calculate the sample size and study variables for econometric analysis were identified. Key informant interviews, personal administered interviews, observation, and focused group discussions were used to collect data. Primary data was collected from smallholder farmers in Kenya's Kisumu West sub-County, Kisumu County. Data collected was analysed with SPSS 12.0, and the relationship between food security and the principal components was determined using a multinomial endogenous switching regression model. CSA strategies actively used by farmers were identified then classified using principal component analysis into table 1 below;

GROUP	COMPONENTS
Crop management practices	Use of improved crop varieties, legumes in crop rotation, cover crops, changing planting dates, and inorganic fertilizers.
General field management practices	Terraces, tree planting on cropland, and the use of live barriers.
Farm risk reduction practices	Irrigation, crop diversification, and the use of improved livestock breeds.
Soil conservation practices	Use of organic fertilizers, mulching, and food crop planting on tree land

3. Implications/Results

To have a bigger impact on food security status, farmers should be encouraged to include larger CSA packages that include at least one member from each of the four categories. This might be accomplished by first raising awareness of the need to invest in productive

agricultural assets in order to absorb climate change risks while simultaneously strengthening their ability to accept vital CSAs. Groups of people could be sensitized by extension service providers. Second, land fragmentation should be prevented through civic education and farmers' engagement in alternative income-generating activities so that CSAs can benefit farmers more when operated on wider areas of land.

4. Challenges and perspectives

Challenges during the process included scarcity of mentors, lack of funding and low demand for research by policy makers. In this perspective, research capacity building courses, collaboration and networking opportunities are urgently needed.

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

The ISS major theme and sub themes are greatly illuminated by the activities, expected results, and implications of this study, since CSAs have the potential to reduce food insecurity while also mitigating the effects of climate change when implemented in tandem. This study was conducted in response to climate change so as to diversify income-generating activities, embracing sustainability, and accelerating global efforts to reduce greenhouse gas emissions. Youth are taking action on climate change mitigation and adaptation in their native nations and communities i.e., participation in climate change programs through national and international organisations as evidenced by the growing number of engaged youth organisations in the intergovernmental climate change process. Diverse initiatives include educational, awareness-raising and behavioral change campaigns (Youth Climate Change 2013-11-12.doc). The foregoing however is not enough as most youth do not participate actively in undertaking CSAs yet youth participation is critical since they are the backbone of any nation due to their enormous potential and capability to carry out tasks efficiently.

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Young farmers actions and innovations towards Climate Change adaptation and mitigation in dairy production in Middle Frankonia / Germany

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Keywords: dairy production, climate change, young farmers innovation

1. Problem statement

The number of dairy farms has more than halved in the past 20 years. In 2021, the average German dairy farm consisted of 69 cows and 63 ha of agricultural land according to Statista (2022). The majority of these farms is run as family farms. The young students at the University of Applied Sciences Weihenstephan-Triesdorf (HSWT), who appear to be the future successors of these family farms, are now faced with the question of how they can and should develop their farms in the future in terms of climate change and societal demands.

In Germany, 55 % of greenhouse gas emissions are to be reduced by 2030 according to the will of the federal government. 8 % are attributable to reduce in German agriculture sector by 2030. In addition, the federal government wants to achieve a climate-neutral economy by 2050 (Umweltbundesamt, 2022). In addition to the political challenges, social pressure regarding animal husbandry continues to increase. Aspects such as emissions caused, competition for land and higher animal welfare standards are intensifying the pressure on German dairy farms.

2. Student's Actions or activities

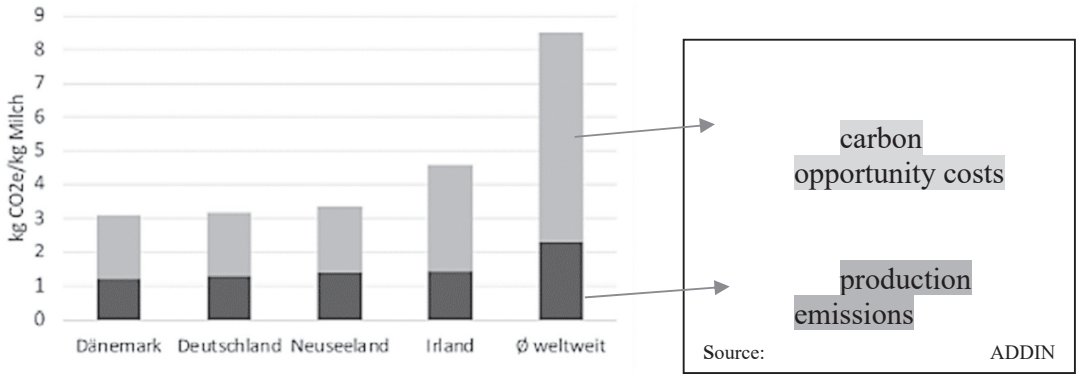
For this reason, student groups were formed to exchange views on the effects of and reactions to the climate crisis and to discuss and then implement options together.

Students at the HSWT are working very intensively on the aforementioned topics. In various project work, climate balancing methods and tools are being examined in more detail in order to explore the climate impact of German milk production in more detail.

As part of the youth activity and working group, students visited the farms directly, and analyzed real dairy farms. Carpools are organized and appointments are made with the farm managers. The farm is first introduced by the farm manager. A farm tour with a visit is also part of the activity. Questions in detail can be asked by the students directly to the farm manager. Therefore, very interesting discussions arise between already practicing farmers and the future generation. The important thing here is to gain knowledge and learn from practical experience.

3. Implications/Results

In international comparison, carbon opportunity costs in Germany are very low. This is due to the high land-use efficiency in Germany, on favorable locations. The obstacles from the political and consumer sides are offset by the good initial situation of milk production in Germany.



As a result, the young students are interested in measures that enable sustainable, efficient and more environmentally friendly milk production. Reducing energy consumption in milk production is a generally applicable approach for this. This can be achieved by using the most modern and efficient milking technology. During a tour of a farm, we became aware of a modernization measure by a farmer who is relying on a more efficient vacuum pump. A frequency-controlled vacuum pump can save between 50 and 70 percent of the energy previously required (Hubal, 2014).

Furthermore, there is the possibility to use own produced electricity through renewable energies. The combination of dairy farms with biogas plants is a constantly developing solution. The manure produced can be used to generate electricity and heat. Both can also be used in milk production. To sum up, there results further advantages, such as slurry enriched with more nutrients and improved flowability. The use of emission-reducing technology is facilitated and environmental impacts are minimized. Photovoltaic systems on the roofs of the farm buildings are an addition to generating electricity from biogas.

As another interesting finding, gained from the youth activities is the use of milk cooling systems with heat recovery. The waste heat from the milk is used via a heat exchanger when cooling the milk from 35℃ to 4℃. One liter of milk can heat about 0.9 liters of water from 15℃ to 50℃ (Lemmer-Fullwood GmbH, 2022). This can also improve the energy balance in milk production and make efficient use of the waste heat.

Acquired theoretical knowledge can be deepened only through practical exchange. The exchange between young people with/without an agricultural background promotes understanding of the possibilities for sustainable development of German milk production.

4. Challenges and perspectives

The future challenges are a complex topic for young entrepreneurs who want to get

involved in the discourse for a liveable, sustainable agriculture in the villages and in the region.

The challenges in agriculture will continue to increase in the future. A sound education and a broad knowledge horizon are therefore an important basis for future entrepreneurs.

Practical experience can be gained here during participation in the youth project, which is further deepened by the exchange among each other. Especially the “togetherness” in the team motivates the young people to accept challenges that the future will bring and to master them to the best of their knowledge.

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Food Sustainability and Climate Change: Youth Involvement in Building Resilient Food System

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Keywords: Climate Change, Sustainable Food System, Youth

1. Problem statement

Food is critical to our life. A sustainable food system is needed to ensure food security and nutrition for all in a way that future generations will not be compromised. Our life-support system consists of clean air and water, healthy food, the existence of a varied variety of other living species, and a climate to which humans are accustomed. At the same time, the food system looks to be failing in its core duty of properly feeding people (Geomans & Giuliani, 2014). Population expansion, which means more mouths to feed, and changing climatic and environmental circumstances, which will make food production more difficult and unpredictable in the coming years, aggravating the challenges of unsustainability and nutritional imbalance. Climatic and environmental circumstances contribute to population vulnerability, unemployment especially to women who are main participants in agricultural activities and pose a critical challenge to food sustainability.

This means that climate change must be considered a high priority to ameliorate the situation. This circumstance highlights the need for youth engagement in the development of sustainable agriculture. However, among young people, agriculture is seen as the least desirable career path. Because they do not see agriculture as an enticing or profitable source of income (Ibiyote, 2011).

Agriculture requires startup capital which is a crucial element for it to commence. However, most people cannot access funds for agricultural purposes. Youths are not immune to this circumstance; given their important knowledge, innovation and abilities, they have the capacity to develop agricultural businesses and produce jobs and money through commercialized agriculture (Zacharia, Adam & Abujaja, 2013). However, this is not the situation at the moment, with youth and women are among the unemployed, and most agricultural land being unused and dominated by elders.

2. Student's Actions or activities

As a student with limited time and resources, there is little I have done to address the issue. I am convinced that learning occurs through people's experiences; the ability to learn from experience implies the formation of new habits. Currently, with the help of my grandmother and with a limited budget (from my student university loan), I have started a

paddy rice production at home, acting as a role model for other young people interested in agriculture. Because agriculture is perceived by youths as an unappealing, unprofitable, and labor-intensive job; since September 2021, I have been striving to enhance agriculture's image by raising awareness of the benefits of agriculture. I have conducted two seminars: first was on 17th October 2021 with the youths from my village, second was on 4th of March 2022 with the youths from St. Vincent Pallotti Parish, Arusha Catholic Diocese which both were conducted during my holidays. Furthermore, on 25th February 2022 during my birthday, my friend and I planted hundred trees in college and neighborhood homes. We nicknamed it "BIRTHDAY TREES" as a campaign to initiate an eco-friendly birthday celebration. It aimed to eliminate the effects of climate change by preventing droughts, boosting carbon absorption, and enhancing environmental stability while increasing ecosystem benefits. Under the current situation where youth are discouraged from engaging themselves in agriculture due to the observed climatic change effects, the activities will raise awareness and morale of youth to combat the causes of climatic changes. Therefore, the result will provide motives for the youth to engage in agriculture, hence sustainable agriculture.

3. Implications/Results

My grandma expressed her delight at the rise in revenue from rice cultivation, which has improved the family's financial status. As the result of production yield from rice plantation, two youths namely: Emannuel Makelo and Evelyne Masanja, who are university graduates, used their university certificate to get a loan from cooperative union which enabled them to rent a farm for rice plantation. Few of the young people have experienced a significant paradigm change in their thinking. As a result, 27 youth have expressed an interest in working in agriculture, which we are yet to perceive how they will engage in agriculture. A few of my college friends have gained a new perspective on birthday celebrations, as a result of my birthday tree planting. Each month those who celebrate their birthdays plant a tree on the 25th of each month. Presently more than three hundred trees have been planted. My goal is to motivate a thousand tree plantations for this year. Moreover, my friend named Anna Kimario invited us to a birthday plastic collection from the streets, which we delivered to plastic recycling centers.

4. Challenges and perspectives

Young people do not feel farming is a lucrative career option. The seasonality of planting and harvesting contributes to this image, since farming earnings might arrive several weeks or months after major financial investments in materials, machinery, or labour at the start of the season. One of the impediments to this endeavour is a lack of financial resources.

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

Though small in scale, my initiatives attempt to instill confidence and a new viewpoint on sustainable agriculture among young people. Setting a tangible example of how the young generation may contribute to sustainable agriculture in new ways.

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Developing guidelines to use *Azolla microphylla* for manure nutrient sequestration

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Keywords: Azolla, waste management, circular economy, nutrient cycling

1. Problem statement

Agriculture is an integral part of modern society and holds great potential for both environmental degradation and restoration. The difference between ecosystem damage, sustainability and restoration is often a matter of agricultural waste product management (Sanjeev et al 2022). Inefficient farm waste management is a leading cause of air and water pollution. Meanwhile, animal manures have particularly been problematic, causing excess greenhouse gas emissions as well as freshwater and marine contamination. Farmers and scientists around the world are making attempts to solve these animal manure pollution problems by developing manure management programs (Adejumo and Adebiyi, 2020).

Efficient waste management can change a burden into a resource by cycling animal manure back into a farm system to sequester nutrients (Khare et al 2016). This approach has great potential for decreasing farm resource use, since nutrients are kept in the farm area. Economically, farmers save capital by importing fewer nutrient sources and, therefore, decrease input costs. This strategy is modeled after nutrient cycling in natural ecosystems, in which the human concept of "waste" does not exist.

Although we may never be able to completely understand the intricacies of natural nutrient cycling, attempts to copy these processes on farms can be beneficial for environmental, social, and economic sustainability. In fact, using these natural processes to our advantage may prove to be necessary for farm sustainability in the future. The scientific community has known about the advantages of keeping nutrient streams on farms for some time now but management complexity has been a deterrent. As more research is done to develop whole-farm waste management systems, farmers will likely adapt these systems to use on their farms.

2. Student's actions or activities

In this research, we conducted 3 experiments to utilize animal manure using the azolla fern (*Azolla microphylla*), in order to determine a suitable type and rate of animal manure and optimal light intensity for growth and yield. Data gained from this study is meant to be used as a guideline for azolla production in cement ponds on livestock farms.

In all 3 experiments, azolla was cultivated in cement ponds and harvested every 10 days, for a total of 3 harvests. The first experiment design was completely randomized design (CRD) with 6 treatments and 3 replications. Treatments consisted of T1: no fertilizer (control), T2:

100% cow manure, T3: 100% pig manure, and T4-T6: cow manure and pig manure in ratios of 25:75, 50:50 and 75:25% by weight, respectively. Results showed that the application of 100% pig manure gave the highest growth and yield. Therefore, pig manure was selected for further experimentation. The second experiment used a CRD design with 4 treatments and 3 replications. Treatments consisted of T1: no fertilizer (control), and T2-T4: pig manure at 20.16, 30.16 and 40.16 gN/m^2. The results showed that there was no significant growth and yield difference between the different dosages of pig manure treatments. The minimum pig manure dosage, 20.16 gN/m^2, was selected for further experimentation. The third experiment was conducted using a CRD with 4 treatments and 3 replications. Treatments consisted of T1: no shading (control), and T2-4: 20, 40 and 60% shading, respectively. The results showed that the application of 40% shading gave the highest growth and yield of azolla.

3. Implications/Results

According to the results of these three experiments, application of pig manure at a rate of 20.16gN/m^2, together with 40% shading, is a suitable method for azolla cultivation, giving a fresh weight of 922.13$g/0.3m^2$/month. The analysis of azolla chemical properties showed that the total nitrogen, phosphorus and potassium in azolla tissues were 3.81, 0.67 and 1.88%.

This preliminary data can be used to design manure management programs for swine, cow and other livestock systems. Azolla produced from livestock manure can be calculated into livestock feed programs, and used as a protein source, offsetting the costs of other sources of protein that would normally need to be brought in from elsewhere. This could benefit the economic sustainability of farms through a circular economy model.

Nitrogen and other nutrients that stay on the farm, and is cycled back into the farm system as animal feed, is less likely to be leached out of the farm system and end up as a source of pollution. This could benefit the ecosystem sustainability of individual farms by making them more independent and reduce the use of fossil fuels for importing nutrient sources, and removing waste materials from the farms. A decrease in odorous nutrient streams leaving farms, especially those of animal manures, can have long-term impacts on the social sustainability of farms by improving relationships between farms and neighbouring establishments.

4. Challenges and perspectives

A prevailing problem seen when trying to introduce sustainable practices and strategies to farmers is reluctance of farmers to take on new tasks and/or approaches. This is because farmers, many of whom are already quite busy and overworked, value their time and energy and often are not enthusiastic about trying new practices that they don't have accurate information about. However, further research can increase farmers' confidence in waste management systems by demonstrating, in detail, how circular economy-based waste management systems can actually lead to profit increase. Since farmers seem to be more focused on economic sustainability, we may need to prove to farmers that these systems can indeed bring economic sustainability to their farms by doing further experiments that also

include specific cost-benefit analysis of the systems.

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

Improving nutrient cycling in farm systems holds great potential for sustainable development. As the world population increases, pressures on farm systems will increase and it will be imperative that they are improved for efficiency. This study helps us the move in the right direction by providing preliminary data that can be used to make guidelines for livestock farmers to make their operations more self-sufficient by recycling nutrients from manure waste streams.

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Group J

Group theme

Education

Presenters:

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Hope Christina Thome, Michigan State University
Mariela Beatriz Responde Obciana, University of the Philippines Los Banos
Julius Mwangi Kamita, Jomo Kenyatta University of Agriculture and Technology
Anziran Ibrahim Msoke, Sokoine University of Agriculture

Chairperson:

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Development of *In Vitro* Protocol for Mass Propagation of *Christia vespertilionis*

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Academic Advisor: Dr. Mohd Hakiman Mansor

Keywords: *Christia vespertilionis*, micropropagation, sterilization, multiplication

1. Problem statement

Malaysian rainforests are gifted with a multitude of herbs that possess medicinal and nutritional values. *Christia vespertilionis*, commonly known as butterfly wing, possesses great potential in modern medicine. This herb has gained significant interest in Malaysia as an anti-cancer agent which used as an alternative medicine to modern treatment (Bunawan, Bunawan & Baharum, 2015). This resulted to high demand and over-harvesting of *C. vespertilionis* which led to the decimation from its wild habitats. Zakaria (2015) also proclaimed that unregulated collection of wild herbs has caused it supply to decrease. Due to the lack of supply, this herb became very expensive.

Rising temperatures, fluctuating rainfall patterns, and increasingly extreme weather events pose serious threats to butterfly wing production, leading to further insufficient supply of raw materials. Malaysia has a limited source of raw materials as is proven by the higher quantity of imported raw herbs every year. As reported by Zakaria (2015), Malaysia is a net importer of herbal products and most of imported materials are used in local markets based on the import and export value. These raw herbs are processed by Small and Medium Enterprises (SMEs) to become herbal products. Inconsistent supply by local farmers leads to the increase of the imported raw herbs.

2. Student's Actions or activities

Therefore, to address the challenges of this herb cultivation, in vitro protocol for disease-free clones of *C. vespertilionis* was developed. For this study, the plant was collected, then multiplied in aseptic culture.

For the first experiment, *C. vespertilionis* nodal segments (1-1.5 cm) were used as an explant to investigate the surface sterilization efficiency of chemical sterilants; Clorox and Nanosilver (SILVECO) at different concentrations. The parameters taken were percentage of explant contaminated by fungi, percentage of explant contaminated by bacteria, percentage of explant die and percentage of explant survive. Results obtained show that Nanosilver is a better sterilizing agent compared to sodium hypochlorite.

For the second experiment, multiplication of *C. vespertilionis* is carried out to evaluate in vitro growth of the clones to different plant growth regulators (PGRs) and their

concentrations. After six (6) weeks of incubation, the sterile and healthy regenerated nodes from shoot clusters were cut and transferred to multiplication media for further multiplication. The multiplication media contained Murashige and Skoog (MS) medium with different concentrations of 6-benzylaminopurine (BAP) and kinetin (Kn) hormones. After six (6) weeks, the growth of plantlets was observed. The parameters taken were the percentage of explants producing shoots, number of shoots per explant, and shoot length.

3. Implications/Results

The best sterilizing agent is Nanosilver using nodes 2 and 4 of *C. vespertilionis* while the best PGR concentration is 1.0 mg/L for both BAP and Kn as presented in Table 1 below.

Table 1. Effect of different concentrations of BAP and Kn on percentage, mean number of shoots formed per explant, and shoot height of *C. vespertilionis* after 6 weeks of culture.

Treatment	6-benzylaminopurine concentration (mg/L)	Kinetin concentration (mg/L)	Percentage of explant regenerating shoot	Mean number of shoot per explants	Shoot height (cm)
1	0	0	77.80^{a}	1.37^{de}	0.90^{e}
2	0	0.5	88.90^{a}	1.80^{cde}	1.07^{cde}
3	0	1.0	88.90^{a}	1.77^{cde}	1.17^{cde}
4	0	1.5	88.90^{a}	1.87^{cde}	1.07^{cde}
5	0	2.0	88.90^{a}	1.80^{cde}	1.23^{bcde}
6	0.5	0	88.90^{a}	1.90^{cde}	0.93^{e}
7	0.5	0.5	100.00^{a}	2.00^{cde}	1.63^{abc}
8	0.5	1.0	100.00^{a}	1.97^{cde}	1.57^{abcd}
9	0.5	1.5	100.00^{a}	2.10^{cde}	1.27^{bcde}
10	0.5	2.0	77.80^{a}	1.90^{cde}	1.27^{bcde}
11	1.0	0	88.90^{a}	1.90^{cde}	1.07^{cde}
12	1.0	0.5	88.90^{a}	3.23^{abc}	1.33^{bcde}
13	1.0	1.0	100.00^{a}	4.53^{a}	2.07^{a}
14	1.0	1.5	88.90^{a}	3.87^{ab}	1.83^{ab}
15	1.0	2.0	88.90^{a}	2.10^{cde}	1.27^{bcde}
16	1.5	0	88.90^{a}	2.23^{cde}	1.00^{de}
17	1.5	0.5	88.90^{a}	2.90^{bcd}	1.17^{cde}
18	1.5	1.0	88.90^{a}	2.53^{bcde}	1.20^{cde}
19	1.5	1.5	77.80^{a}	2.20^{cde}	1.23^{bcde}
20	1.5	2.0	77.80^{a}	1.70^{cde}	1.13^{cde}
21	2.0	0	88.90^{a}	1.87^{cde}	0.90^{e}
22	2.0	0.5	88.90^{a}	1.70^{cde}	0.97^{de}
23	2.0	1.0	88.90^{a}	1.67^{de}	1.07^{cde}
24	2.0	1.5	88.90^{a}	1.13^{e}	1.13^{cde}
25	2.0	2.0	77.80^{a}	1.53^{de}	1.13^{cde}

Means with the same letter within the same column are not significantly different at 0.05 (5%).

In terms of social implications, higher yields obtained will lead to an increase in local farmers and SME accessibility of this herb. This will improve profitable herb supply chain financial and social outcomes.

In terms of economic implications, the constant supply of *C. vespertilionis* as a raw material will be able to meet the high demand in the market and become the economic powerhouse for the farmers and their community.

Finally, the environmental implication that can be observed from this practice is, aside

from avoiding this herb extinction in their natural environment, several thousands of plants can be produced with a single explant of *C. vespertilionis*.

4. Challenges and perspectives

This practice faces two challenges in terms of cost and participation. This micropropagation technology is expensive when compared to conventional methods of cultivation and the participation among youth is not very promising as the process is very delicate and time-consuming. Thus, it is important to highlight more the contribution and impact of this tissue culture of high-potential herbs, to ensure these practices are kept on being carried out.

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

The cultivation of *C. vespertilionis* through in vitro approach with the objective to determine the best sterilizing agent and the best cytokinin and its concentration for multiplication of this herb can be linked to this year's ISS theme in terms of moving to sustainable cultivation practices of this herbaceous plant that decrease unnecessary collection from natural habitat, following in ecological degradation and loss of biodiversity. This research also will contribute to small-scale farmer accessibility to this *C. vespertilionis* for commercial-scale production regardless of environmental conditions as it will not be dependable on the seasons and can be done throughout the year.

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No Need for Weeds: Herbicide Use in Michigan's Commodity Crops

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Academic Advisor: Rhonda Crackel

Keywords: herbicide, agriculture, local

1. Problem statement

The market for commodity crops is not insignificant but is often overshadowed in terms of funding and research by the field of agronomy dealing with the cash crops: soybeans, corn, and wheat. Farmers supplying other essential produce including berries, cole crops, cucurbits, and pome fruits are left without herbicides catered to their specific needs. As a result, the chemicals they choose to combat weeds in their fields may prove ineffective in control or damage the crop, decreasing yield and thereby profits (EPA, 2021). Furthermore, excessive herbicide use needlessly pollutes waterways through runoff, threatens pollinator populations, and causes weeds to develop resistance more quickly, creating a dangerous positive feedback loop between herbicide use and weed resistance.

2. Student's Actions or activities

Each of these risks may be mitigated through increased efficiency. Conveniently, this principle is also the foremost strategy when considering sustainability. The Chaudhari Lab in the MSU Department of Horticulture has collaborated with local farmers on research to address this niche at the intersection of commodity crops, herbicides, and efficiency. Demonstrating further progress towards sustainability, the Chaudhari Lab has incorporated trials involving the use of an electrical tractor attachment called the Weed Zapper and a Vision Guided Sprayer mounted on an ATV for more pinpointed weed control, both from the company Weed It, and an organic herbicide called Homeplate that could potentially allay the need for synthetic herbicides completely.

I began working in the Chaudhari Lab in April of 2021. Since becoming a member of the team, we have spent countless days planting, weeding, harvesting, rating, spraying, and traveling. Recently, I have taken on a new role as Assistant to the Student Supervisor, instructing new undergraduate research aides; achieved certification for my Pesticide Applicator License; and began acting as the Study Director for trials on micro dosed levels of common herbicides on onions and celery to replicate the potential effects of herbicide drift as part of CSUS 493, my Professional Internship in Community Sustainability.

The perspective of a student is unique in that at the forefront of our minds, we have the desire to learn, whereas an individual hired from the workforce may be simply making a living.

Our inquisitiveness paves the way for us to produce comprehensive, accurate results that will cultivate both grower success and sustainability. Hiring students is a long-term investment, the return being more individuals in this field of academia with a better understanding of farmers and their interests.

3. Implications/Results

The local component of this research is especially vital in terms of its social, economic, and environmental implications. By performing research on the exact weeds that threaten the exact crops of interest in the exact locations where they are grown commercially and by building relationships with the farmers themselves, the lab caters directly to the needs of this group, educating them on best practices both in terms of profitability and sustainability and empowering them to make informed decisions. A concrete way of implementing the new knowledge gained by our research is publishing herbicide label recommendations through MSU Extension. Special Local Need (SLN) labels, also known as 24(c) labels, are intended to provide specialized information on best practices for Integrated Pest Management (IPM) for each individual herbicide. An example of one that Dr. Chaudhari has published since I began working for her details ideal timing for sprays of the herbicide GoalTender on onions and cole crops (Chaudhari, 2022).

Additionally, visiting the farmers regularly to perform sprays and ratings allows them to build trust and play an active role in the development of more sustainable practices. Michigan's climate and soil characteristics are unique to this region and provide growth conditions for both crops and weeds that would not be applicable in a distant region, defeating the purpose of improving efficiency. Overall, the hope of the lab's research is to contribute to a more holistic form of IPM for the wellbeing of the environments affected by agricultural production.

4. Challenges and Perspectives

A difficulty that we face is the disconnect between researchers and growers. There is an entire school of knowledge to which that those in academia are not privy, one gained through trial and error and passed on by word of mouth through generations. To address this, Dr. Chaudhari devotes a significant portion of her time to acting as an extension agent, meeting with growers individually and attending conferences to offer advice while simultaneously obtaining invaluable insights into their problems, discoveries, and communities.

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

Working in the Chaudhari lab relates to the theme of mitigating climate change through the ability to decrease both the volume of crops lost to weeds and amount of herbicide wasted on ineffective control, thereby diminishing the need for seed, fertilizer, and herbicide production and the pollution involved with all of them (Ziska & Dukes, 2011). Researching weed control also allows farmers to better adapt to the changing climate. Without new innovations such as those we strive after in our research, growers could struggle to provide for the ever-increasing population.

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MugKwentuhan Tayo (Let's Tell Stories) ! A Podcast for Agricultural Awareness: A Project Initiated by AIESEC in UPLB

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Keywords: educational podcasts, agricultural awareness, volunteerism

1. Problem statement

In the Philippines, the agriculture sector has been facing a persistent problem with human capital owing to a consistent decline in the youth labor force participation in the sector. This constant fall may raise concerns about the future of agriculture in the country owing to the relatively older average age of its farmers (Asis, 2020). Moreover, this also creates a rippling effect that could inhibit the fulfillment of food security goals, especially in developing countries (Leavy & Hossain, 2014). The Food and Agriculture Organization (2014) stated that investment in the capacity-building of the youth is made more salient by the rising challenges of introducing sustainable and climate-resilient methods in production. It is also supported by Quijano-Pagutayao (2020) that the youth have the capacity to establish concrete and feasible solutions to global agricultural issues although they are more generally averse to employment in the sector. With this, analyzing youth motivations could be used to empower young individuals to take part in cultivating the sector.

In a study conducted by David et al. (2022) in Region 8 (Eastern Visayas), it is reported that education has a weak positive relationship to student intention to participate in the agriculture sector. Therefore, there is a potential to bridge this informational gap to increase youth participation in the sector.

2. Student's Actions or activities

Podcasts in the educational setting, are auditory learning materials using renowned streaming platforms like Spotify (Prakash, Muthuraman, & Anand, 2017). From previous studies, students' motivation increased with podcasts as a supplement to online teaching (Tam, 2012; Rockhill, Pastore, & Johnston, 2019). With this, the members of the Association Internationale des Étudiants en Sciences Économiques et Commerciales (AIESEC) in the University of the Philippines Los Baños (UPLB), an organization of young undergraduate students, launched a project entitled MugKwentuhan Tayo (Let's Tell Stories) !

MugKwentuhan Tayo! is an initiative to encourage local Filipino youth (ages 18-30) to participate in the agricultural sector by raising awareness for farmers and promoting locally grown products. The project was implemented in a five-week time frame where youth

volunteers are invited to knowledge transfer sessions and workshops with partner organizations to guide them in creating a meaningful podcast series. In line with the project's objective, these sessions include a dialogue with indigenous (IP) Filipino farmers from T'boli, South Cotabato, members of the Agriculture Students Association of the Philippines (ASAP), and the Philippine Coffee Guild (PCG). Specifically, the sessions tackled the current situation of the coffee industry in the country and how IP farmers are treated, the youth perspective on agriculture, and the industry perspective on local agriculture products respectively.

3. Implications/Results

The project was able to invite two batches of volunteer groups who managed to record four podcast episodes available for public streaming garnering 252 streams to date. The podcasts discussed the Philippine agribusiness industry, youth engagement in agriculture, community empowerment in agriculture and the Philippine Coffee Industry respectively. Volunteers realized that they could contribute and participate in sustaining the sector through meaningful conversations and formation of innovative technologies that aid in local farmers' labor efficiency and promotion of local produce.

Based on the analytics provided on the podcast creation app, most of the listeners of the podcasts belong to the 18-22 demographic owing to 41% of the listeners which also represents the project's target audience. Moreover, the contribution per region is given in the table below with more than 50% of the listeners coming from Cavite, Laguna, Batangas, Romblon, and Quezon (CALABARZON), since most of the podcast promotion was done among UPLB students in Laguna. As such, future implementations of the project must ensure a wider reach, especially for provinces with huge contributions to the agricultural sector.

Table 1. Distribution of listeners per region

Region	Distribution %
CALABARZON	51
Metro Manila	36
Central Luzon	5
Central Visayas	3
Northern Mindanao	2
Cagayan Valley, Ilocos, Western Visayas	<1 each

4. Challenges and perspectives

The main challenge for this project is to increase its number of audiences by promoting the podcast series. With this, the organization suggests that in its future installment, MugKwentuhan Tayo! must partner with more schools to introduce the project to a broader set of students in line with its objective to engage the youth more in agriculture through appreciation of the sector. Additionally, the organization may use online paid advertisements for a wider reach, if financially sound.

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

This project specifically aims to contribute in upholding target 2.3 of the Sustainable Development Goals (SDGs) which is doubling agricultural productivity and income generation of farmers and fishermen. Additionally, climate change further decreases agricultural productivity due to reduced yields of desirable crops. Climate change adaptation does not only involve direct mitigating actions but also those that enhance the future adaptive capacity of the sector. By initiating this project, they were able to increase sociocultural awareness on agriculture and encourage the youth to actively participate thereby strengthening the sector in combating adverse climate change impacts.

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Youth and Emission Trading: An Integrated Approach towards Climate Change and Sustainable Farming

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Keywords: Carbon trading, Fruit tree, Carbon sequestration, Youth

1. Problem statement

Kenya loses 2.0-2.4% of its gross domestic product annually due to the effects of climate change, such as drought and floods (National Climate Change Action,2018). Activities such as deforestation and emissions of GreenHouse Gasses (GHGs) from industries are limiting the chances of sustainable living in Kenyan communities, including those in the agrarian sector (FAO-UN. http://www.fao.org/redd/en/). Young people are increasingly aware of the challenges and risks presented by the climate crisis and of the opportunity to achieve sustainable development brought by a solution to climate change. *Polluter pays* principle from the Kyoto protocol 1997 resulting in Clean Development Mechanisms Projects and Voluntary Carbon Credit Schemes which provided entry by youths to carbon trading (United Nations, 1997). Carbon sequestration via forestland, farmland, Orchards and grasslands could almost completely offset greenhouse gas emissions from agrifood systems by 2060 (Government of Kenya, 2016). Proper fruit orchards management systems and propagation protocols that maximize carbon reservoirs (Sekikawa &Koizumi, 2003). Therefore, the objective of this study is adopting emission credits to incentivize sustainable farming through planting of fruit trees as carbon sequeststrator.

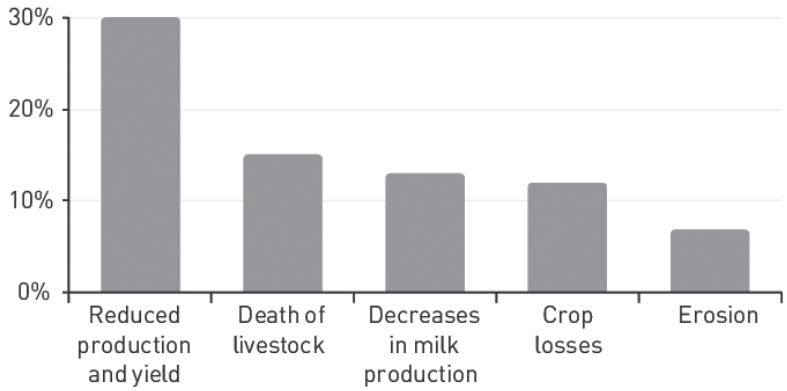

Figure 1: *Effects of Climate change in Kenya*

2. Student's Actions or activities

Jomo Kenyatta University of Agriculture and Technology (JKUAT) through its enterprises, Jomo Kenyatta University of Agriculture and Technology Enterprises Ltd (JKUATES) has been in the forefront of propagating fruit trees' seedlings and distributing them to the society to advocate for food security and improve climatic conditions. One of JKUATES programs is "*Taking the University to the People*" which was started to oversee commercialization of the University's technological advances and research capabilities. I have been in the program advocating for the planting of fruit trees as carbon sequestrators. Specifically, we approach industries and multinational corporations such as flight companies that generate large amounts of carbon to pay for their emission where the amount is used for fruit tree production. JKUAT has been working with partners such as Kenya Agricultural Carbon Projects (KACP) and Kenya Emission Trading Systems (KETS) to give us training opportunities on carbon trading where I attend all sessions to sharpen my skills. I am involved in propagating seedlings such as macadamia, pawpaw, mango, hass avocado, oranges and passion fruit trees.

Figure 2: *JKUATES seedlings nursery/*me and my friends

3. Implications/Results

Planting fruit trees by youths have presented a reliable source of income, both economics and projects in form of Payment for environmental services (PES), especially carbon trading (Mwania, 2020). A case study from Muranga County, Central Kenya where there are landslides brought by erratic rainfall, Samuel Ndung'u a youth from the latter place filled the land with Macadamias and avocado trees that resulted to improved livelihood, tree cover, food supply and mostly important soil and water conservation (Danny's Farm,2015).The Kenya Agricultural Carbon Project (KACP) received appreciation from 60,000 farmers on 45,000 hectares that were transformed to more sustainable, productive and climate friendly farming as a result of carbon trading. (Syngenta, 2014)

4. Challenges and perspectives

New actors are attracted to the trade in carbon, however they have limited accountability

and transparency due to the complexity of carbon market governance. This leads to reluctance by companies to participate in carbon trading. Moreover, acceptance by the society is still low due to tenure, size and configuration of landholdings. Opportunities should be harnessed to have planting of fruit trees at primary and elementary level.

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

Fruit trees such as avocado, mango, macadamia, strawberries and oranges have shallow roots that are good at holding top soil in place. They are also fast growing, and provide a repeated source of income to youth as they maximize carbon storage over a long period. Fruit trees require few mechanization and chemical inputs addition once they mature which significantly reduces greenhouse gases emission. This study has demonstrated synergies between climate change adaptation and return-on investment in agriculture.

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Youth Readiness in Adaptation of Digital Technologies in Addressing Climatic Changes to Promote Sustainable Agriculture

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Keywords: digital technologies, climatic changes, sustainable agriculture

1. Problem statement

Climatic change has become a global challenge that affects several productive sectors mainly agriculture. Malhi (2021) asserted that climate change is a global threat to the food and nutritional security of the world. According to the United Nations Department of Economics and Social Affairs (2017), the world population is projected to be 9.8 billion by 2050, then 11.2 billion by 2100. This raises a challenge on how we would sustainably feed this increasing population sustainably.

According to Umesha et al (2018), sustainable agriculture has a unique potential to mitigate climate changes and strengthen resilience to its impact. Also, Fredrick et al (2013) reported that ICTs in agriculture have the potential to increase the efficiency, productivity and sustainability in agriculture by providing information and knowledge sharing opportunities. On the other hand, youth are observed to be one of the highest users of smartphone technologies in the agricultural ecosystem (Misaki, 2019). Not only that study shows that farmers use massaging applications, call applications, calculator apps and clock applications the most while WhatsApp, Facebook, email applications and photo apps are rarely used (Misaki, 2021). This study seeks to explore the readiness of youth in Tanzania in using mobile app technologies in addressing climate changes and its impact on livelihood. We assess the accessibility, exposure, education and usage of the mobile phone applications that every smartphone holder can freely access and use, in enhancing sustainable agriculture and mitigating the impacts of climate changes.

2. Student's Actions or activities

In this study 100 youths practicing horticulture in Morogoro and owning smartphones were purposefully obtained, later 50 respondents were randomly selected. The collected survey data from the responded questionnaires were analysed using SPSS. The data collection process was done subsequently with a two-day digital training programme that was organised in collaboration with fellow students and my universities' chapter of the youth of the United Nations association. Skills on how to download, and use different mobile applications including

WhatsApp, Facebook, Instagram, twitter, LinkedIn, email application, farmers wallet, citizen science apps and Ugani Kiganjani application in their farming activities for marketing and getting market information, getting climate and weather information, extension services, managing farm finances, share climate information were provided. Through this training we expect to make these young actors in the agriculture sector more resilient and adaptive to the impacts of climate changes.

3. Implications/Results

Findings revealed that about 90% of the youth sampled had access to mobile phones i.e., smartphones technological gadgets. Despite this high adoption rate, the level of exploration and application to its full potential was still very low, especially in farming and environment activities. It was observed that most youths used the readily available mobile applications and very few of them used popular social media applications downloaded from the Google Play Store and Appstore. Further observations revealed that readily available technologies were not fully utilized for agriculture and environment. Educational level and number of years using a mobile phone were observed to significantly influence the level of exposure, education and usage of mobile phone applications for on-farm and off-farm agricultural activities.

The digital training programme was so insightful to the youth. The post-training feedback from the participants (young horticulture farmers sampled in our study) revealed how satisfactory and enthusiastic the youths became. 100% of the youths who participated in the digital training programme agreed upon further learning, on how they could possibly and cheaply employ their smartphones in enhancing their agriculture endeavours for sustainability using the knowledge they acquired.

Mobile application	Post personal issues (%)	Advertise business (%)	Learn Agri-related issues (%)	Keep farm record (%)	Conduct farm accounting (%)
Facebook	90	80	75	0	0
Instagram	100	73	60	0	0
Twitter	60	60	60	0	0
LinkedIn	30	15	0	0	0
SMS app	100	45	0	0	0
Agri-App	0	0	0	0	0
Farmer's wallet	0	0	0	2	2
Ugani Kiganjani	0	0	15	0	0
Other agric. apps	0	0	0	4	4

Table 1. Usage of mobile apps by youth practicing horticulture business in Morogoro, Tanzania (n=50)

Note: Ugani Kiganjani is a mobile application name that translates to extension services on your palm application.

Interventions by the government and other development partners have to be taken to support these young actors in the agriculture value chain on the utilization of digital technologies for addressing climatic changes and promote agriculture in the country for their livelihoods and income generation.

4. Challenges and perspectives

This study has unlocked significant skills and clarified the exposure gap among Tanzanian youths on the use of their technological gadgets. Sokoine University of Tanzania has facilitated and supported these digital trainings and research by providing venue and expertise from fellow students and lecturers. With its expected impact and potential, execution of a nationwide program to reach all young agribusiness managers, for provision of knowledge and spreading awareness on technological mobile applications is the next plan. In order to continue this project and expand its reach to majority youth in Tanzania, this project will require funding and support from various stakeholders and experts.

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

This project is essential in ensuring that youths use the available technologies they possess to mitigate the climate change impacts on agriculture. Nevertheless, this project addresses food security, considered a global challenge posed by climatic changes and rapid population growth by enabling youths to efficiently utilize their digital technologies to ensure high productivity, effective management of resources, and sustainable agricultural practices.

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Group K

Group theme

Agriculture

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Influence of climate change on farmer-herder conflict complexities

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1. Problem statement

Climate change is a long-term change in weather patterns primarily driven by human activities (e.g., burning fossil fuel) which raise Earth's average surface temperature, resulting to increase frequency and severe changes in extreme weather such as hurricanes, heatwaves, wildfires, droughts, and cloud and vegetation cover have ben prevalent. Increasing agricultural productivity while reducing negative effects on the environment is required to meet global demand for food, feed, fiber and fuel with limited expansion of agricultural land (Hubert *et al.*,2010). Intensification of small-holder agriculture can contribute considerably to satisfying this demand since small-holder farmers produce a large proportion of food globally (Vanlauwe *et al.*,2012). On the other hand, herders have a number of potentials including traditional classification and assessment of landscapes for grazing resources by using only soils, topography and vegetation in northern Tanzania (Oba *et al.*,2006). Now in spite of the stated significance of farmers and herders in the world and Tanzania, farmer-herder conflicts still lingers on, the study by Benjaminsen *et al.*, (2012) found that Sahel has been affected by conflicts between pastoralists and farmers which has been proven to be triggered and exacerbated by climate change. Changes in weather patterns has been causing droughts which force farmers to encroach and obstruct mobility of herders. Similarly, drought affect the nutritive quality of the pasture thus compel herders to encroach farm land in search for water and feeds for the herd. These conflicts have been causing a number of adverse effects such as deaths, destruction of properties (houses, farms, cattle) and development disruption of the social and economic structure of the communities. Moreover, these conflicts put pressure on utilization of land and wetlands of global importance (Ministry of Natural Resources and Tourism, 2004).

2. Student's Actions or activities

In relation to the stated problem I am currently participating in a research project "Space-Time Analysis to Uncover the Nature and Complexities of Farmer-Herder Conflicts in Kilosa - Tanzania" under the project leadership of Dr Tumaini Allan Tuni. The project explores how space and temporal dimensions affect the nature and complexities of farmer-herder conflicts

over natural resources. In this project I will be working with local communities to analyse the influence of climate change to farmer-herder conflicts complexities. This will be achieved through transect walks, community mapping, in-depth observation, focus group discussions which aim to identify the influence of natural resources availability and utilization to these conflicts.

Activities done at preliminary stage of the project.

At district level

- Situational analysis of farmer-herder conflicts in Kilosa district
- Conducting key informants' interviews with district officials including district agricultural officer and livestock officer.

At ward level (Kitete and Mfulu)

- I participated in organizing focused group discussion with farmers and herders to uncover years with low amount of rainfall and find out the occurrence of conflicts.

3. Implications/Results

I got certain prior results from preliminary conducted activities stated as follows: -

- The basic analysis showed that levels of conflicts differ with the nature or topography of the area.

Table 1. Level of Conflict by land location

Nature of the area	**Level of conflict**
Highlands	low
Midlands	moderate
Lowlands	high

Simple analysis

Highlands have low levels of conflict because it is difficult to conduct farmer-herder activities in very raised land.

In lowlands the level of conflict is very high because farmer-herder activities function properly in flat areas, to mean that farmers can easily cultivate with minimized problems of soil erosion and herders can easily make their cattles move from one point to another. On the other side level of conflict is moderate at midlands as the nature of the area suggests.

- Also, conflict is intensive in wetlands which have water flow throughout the year because it is at these areas where crops can grow well and high availability of pastures.
- Again, from focused group discussions I pointed out that there is correlation between rate of rainfall and occurrence of conflicts. Farmers and herders clarified that years which had low levels of rainfalls, also had high levels of farmer-herder conflicts as it was identified earlier by other researchers who concluded that farmer-herder conflicts are often presented as being driven by environmental scarcity (Benjamisen *et al*., 2009)

4. Challenges and perspectives

The expected challenges so far are reluctance among pastoralists to participate in the study and time constraint since we are having to spend a lot of time to build rapport during preliminary survey visitations.

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

This project fits perfectly with the ISS theme on climate change, specifically the segment on environmental issues related to herder-farmer relationship in the world. As previously mentioned, I am actively participating in the project offering my contributions towards better environmental conditions and minimizing problems resulting from climate changes.

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Empowering Vietnam Youth Engagement in Climate Change Mitigation through "Green Youth Labs" Project

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Keywords: youth, environment, initiatives

1. Problem statement

Youth plays a key role in tackling climate change and has the enormous potential to bring a climate resilient future to the world. They are in a unique position as they are affected by the decisions of older generations, while taking leadership of nations in the future. Although many young people have begun to fight back the consequences of climate change (Corner et al, 2015), the young have to deal with many difficulties in their climate change mitigation and adaptation actions. Especially in Vietnam, our youth groups still must confront major bottlenecks such as lack of support from stakeholders, financial burdens, and limited soft skills (UNDP, 2021). Above all, their voices do not play a prominent part in the climate change problem. Therefore, youth engagement with climate change is in many ways limited in Vietnam. To make the matter worse, even though they have a passion for acting to prevent climate change, many young people do not choose their majors related to climate change such as agriculture and environment as they do not see a future with those fields.

2. Students' Actions and initiatives

To make the young in Vietnam have a community where their voices and their initiatives can be heard and supported and have more opportunity to practice in designing and managing climate projects, I participated in "Green Youth Labs" project which was implemented by Friedrich-Ebert-Stiftung (FES) Institute Vietnam and Live & Learn Center in April 2022. This is a project aimed for all youth from all parts of Vietnam regardless of their majors and backgrounds. This project has three (3) main activities to support youth engagement in climate change. The first activity is organizing training programs to improve youth capacity. In this program, the young can acquire knowledge and skills in presentation, project management, negotiation, and communication. During the training course, experts in the field of agriculture and environment are invited to deliver lectures that inspire the young and give them a closer view in the climate change situation in Vietnam such as explaining career prospects and how to pursue their career in Vietnam. The second activity is creating a network on Facebook and Zalo (a popular social media platform used in Vietnam) where participants can share their ideas, perspectives, experiences, and job opportunities. The third activity is organizing field visits to have a real experience learning from existing models and connecting with potential

seniors for their future projects or career.

3. Implications

Through this project, a youth network of "Green Youth Labs" is created with the participation of 150 young people aged from 16 to 35 years old (we define 'young people' using this broad age category as there is no universally agreed definition) from more than 15 provinces and cities in Vietnam. They are high school students, college students, and workers from diverse backgrounds and sectors such as agriculture, environment, and economics. Thanks to this network, information about projects and jobs related to climate change can be reached to more potential youth. Moreover, through this network, all the participants become 'green' ambassadors, meaning they actively share their "green" activities on their social media such as Facebook and Instagram. Those activities include their daily actions or their knowledge in their specialized fields in diverse forms such as short videos, posts, or infographics. Remarkably, after group discussions and teamwork in the training program, two (2) potential initiatives are being developed into youth-led projects with the active support from Live & Learn Center among many creative initiatives generated in the activities. They are "Reduce the use of honeycomb briquette stove in Lang Son province, Vietnam" and a network of universities 'environmental clubs.

4. Challenges and perspectives

Even though the project has many positive impacts on the youth in Vietnam, it still faces many challenges related to stakeholders when the youth want to carry out their projects. If local authorities support necessary procedures and documents, youth projects will be established and implemented faster and more efficiently. This may further motivate the youth to continue developing their projects. Currently, available funds for this project are limited and unstable. For long-term continuity of this project, sourcing funds is vital. If these problems and challenges are properly solved, this project will actively develop and support youth-led projects. This will become the solid foundation for the prospective activities for the youth to mitigate climate change in the future. By increasing youth participation in the project like this, youth people have an opportunity to raise their voices on the climate crisis and generate prospective ideas for confronting climate change.

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Evaluation of *Tithonia diversifolia* as a Nutrient Source in a Hydroponic System for Sustainable Vegetable Production

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1. Problem statement

As the world population nears 10 billion by 2050, overall food demand is expected to increase by over 50%, according to the World Resources Institute (Mgbemene et al., 2016). Climate change will make feeding the population more difficult in some regions. One of the major challenges posed by soil-based agriculture is its vulnerability to pests and diseases, and environmental changes such as floods, wind, drought, and climate change. According to Jemma Gornall, Richard Betts (2015), these changes can lead to huge losses for farmers leading to food insecurity.

For many years, synthetic fertilizers have greatly boosted crop production, enabling farmers to grow more food on less land. But its usage has come at a cost: global warming, and greenhouse gas emissions. Agriculture is the second-largest source of the world's climate change pollution and both the manufacturing and application of fertilizer are considered to account for the heavy emissions. The improper and heavy use of inorganic fertilizer which has increased cases of residual effects on human health. Therefore, there has been a need for a healthy and safer way of food production and a better system which will fully address the issue of reducing arable land and will still be able to produce sufficient food in a sustainable manner.

2. Student's Actions or activities

There has been an increasing interest in the use of *Tithonia diversifolia* as green biomass in the organic crop production especially of leafy vegetables. This research will add to the on-going work about the transition from inorganic cultivation of crops using organic fertilizers in hydroponic systems.

Fresh leaves of *T. diversifolia* will be obtained from the farm and prepared as recommended by Altieri (2001). With a ratio of 1:10, the small tender and fresh leaves will be put in the bucket and water added to it. Specifically, 1kg leaves will be fermented with 10 l of water to maintain the required leaf tea ratio for 3 weeks. The mixtures will be covered with a lid to reduce volatilization and kept in a shade. Mixtures will be agitated once after every 2 days for 3 weeks to allow mineralization. When the water turns to dark green, this is an

indication that most of the nutrients have dissolved. A sample of the extract will then be taken for NPK nutrient analysis in the laboratory using a complete randomized design (CRD). There will be four treatments: T0 represents the control (inorganic fertilizer solution), and T1, T2 and T3 represent *Tithonia diversifolia* nutrient solution with different concentrations which will be replicated three times in a modified Kratky hydroponic system. Spinach will be used as the crop of choice for the research since it's the most commonly used vegetable and easy to propagate. Data will be collected for yield and quality parameters. Fresh matter will be weighed on the weigh scale after harvest. The size of leaves i.e. leaf girth and number of leaves will be recorded as per the different Tithonia solution concentrations. Leaves' extract will be taken to assess the nutritional value such as vitamins and sugars using a brix meter or refractometer for quality determination.

Implications/Results

This experiment is aimed at cultivating organically using a hydroponic system from the Mexican sunflower plant (*Tithonia diversifolia*). This plant provides essential organic elements, N, P, and K thus evaluation leads to an appropriate concentration requirement for production with greater yields and quality. According to Olabode et al., (2007) chemical properties of organic matter, N, P, K, Ca, Mg, C and C/N in *Tithonia diversifolia* were 24.04%, 1.76%, 0.82%, 3.92%, 3.07%, 0.005%, 14.00% and 8:1, respectively. Because it is an organic input, readily available and can be sourced easily by local farmers, this will empower farmers by helping them design agronomic systems that are more resilient towards the impacts of climate change. This will be possible by enabling them to reduce dependence on external inputs, and by promoting the development − rather than the depletion of the natural resources on which we depend for food production. The use of a simple hydroponic system like Kratky, will mitigate the problems farmers face when using soil-based agriculture. This is because hydroponic farming involves suspending plants in a water solution with each essential nutrient necessary for a plant to grow, removing the need for soil. This way, plants can be stacked on top of one another in a climate-controlled greenhouse almost anywhere, instead of taking up acres of fertile land. Incidences such as the occurrence of soil borne pests and diseases will also be mitigated. And in the case of reduced arable land, the hydroponic system will be of much help since the conditions can be controlled.

3. Challenges and perspectives

Purchasing hydroponic kits is somehow expensive and also it requires a lot of skill for setup processes. The fermentation process of *Tithonia diversifolia* also takes a bit of time (3 weeks) which might delay planting time hence affecting marketing strategy. Gaining an appropriate fermentation kit, which can speed up the fermentation process, could be of help. Additionally, an affordable and easy to install hydroponic system for local farmers can increase the efficiency of the system. A negative perception of agricultural activities is another major challenge in promoting youth agripreneurship. One of the most difficult challenges in Kenya, according to Noorani (2015), is changing the youth's attitude towards agriculture. Lack or

inadequate skills, limited access to infrastructure, lack of access to land, finance, and information, networking and mentoring, insufficient market information, negative effects of climate change, low levels of value-addition, inadequate policies supporting youth agripreneurship, and poor markets opportunities are also the limiting factors on student action toward the project.

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

The use of *Tithonia diversifolia* as an organic fertilizer input is the ultimate start-up point for sustainable food production which will curb the environmental footprint left by synthetic fertilizer. The hydroponic system plays a role in increasing food production in reduced arable land which has been caused by climate change and thus lies with the thematic objectives of the summit. Students' action towards capacity building and knowledge extension plays a major role in speeding up transformation of production from conventional methods to organic fertilizer input in the hydroponic system which is the ultimate goal.

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Uptake of residential energy efficiency measures and renewable energy: Do spatial factors matter?

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Keywords: Energy efficiency measures, renewable energy, spatial factors, climate change and energy transition policies, the Netherlands

1. Problem statement

The climate crisis is profoundly impacting societies, and to mitigate the precarious situation one of the main priorities is the sustainable energy transition (see e.g., International Renewable Energy Agency, 2020; Pollin, 2019). A main domain that presents both opportunities and challenges is the built environment. Especially for the Dutch case, phasing out natural gas and increasing the energy efficiency in buildings are key targets as they are expected to lead to significant decreases in emissions. The built environment accounts for around 33% of the Netherlands' final energy consumption, of which 20% is used in residential housing (Klimaatmonitor, 2021). For larger cities like Amsterdam this is more, with around a quarter accounted for by residential housing (Klimaatmonitor, 2021). In the shadow of the ongoing Covid-19 pandemic, it is expected that households will be responsible for even more of the final energy consumption due to lockdowns, telecommuting and remote learning when viable, as well as an expected trend towards a wider adoption of a hybrid model combining home and office working. This makes it ever more pertinent to encourage the reduction of energy use and emissions in residential buildings. However, for the central government and municipalities, a challenge is how to stimulate owners and tenants (landlords) to invest in carbon emissions reduction measures (henceforth, ERMs) to improve energy efficiency and the uptake of renewable energy when there are no mandatory regulations. To support policy for enhancing the uptake of ERMs by residents, it is first imperative to understand how different factors influence their investment in these measures.

2. Student's Actions or activities

To examine recent trends and appraise factors influencing the uptake of ERMs, we conducted a study from October 2020 to September 2021 using the latest release of the triennial Dutch Housing Survey from 2018 (Ministry of the Interior and Kingdom Relations, 2019). The survey provides data on the composition of almost 75,000 households, their housing situation, moving behavior, and preferences and decisions concerning energy. There is information on the uptake of ERMs between 2012 and 2018.

To better understand the observed differences in uptake, the probability of uptake of each ERM is modeled as follows:

$$Pr(x_i)= \frac{exp\ exp\ (x'_i \beta)}{1+exp\ exp\ (x'_i \beta)} = \Lambda(x'_i \beta) \quad (1)$$

where Λ denotes the logistic cumulative distribution function. The binary dependent variable y_i thus represents the uptake of a measure, over the period 2012-2018. Since the measures are not mutually exclusive and considering the aim of analyzing explanatory factors behind the uptake of each type of measure, we model them separately. This is also apropos since they are distinct despite the shared objective of carbon emissions reduction. The four ERMs are: (1) the application of double or insulated glazing, (2) the improvement of roof, floors and/or walls insulation both by adding to pre-existing insulation or insulating new areas, (3) the installment or replacement of solar panels, and (4) the renewal of a combi boiler or other such installments (e.g., geyser). Index i denotes the households (i=1,…,n), x_i is a vector of explanatory variables consisting of building features, socioeconomic characteristics, motives, and spatial factors, with associated parameter vector β estimated by maximum likelihood. Owners and tenants are analyzed separately, as this enables them to assess expected differences in outcomes and thus policy considerations.

3. Implications/Results

We do find that space matters, both at the local and regional levels. Not surprisingly, there are also regional differences across specific measures. Moreover, it is notable that for tenants, spatial patterns are quite different from that of owners, which could partly be due to cooperatives having a large impact. At the local level, for type of neighborhood (urban-rural gradient) is especially relevant for the insulation of roofs, floors, and walls, which is more often done in inner cities compared to suburban neighborhoods. Also, new combi-boilers are more often installed in owned residences in inner cities compared to towns and rural areas. For the new combi boiler and related measures category, in contrast to solar panels, owners are less likely to invest (ceteris paribus) if they reside outside city center areas; in particular, on average, the likelihood of uptake by owners living in rural areas is approximately 18% less than those in urban areas. Villages also show a significant effect (～12% lower). Indeed, these two measures are less dependent on the availability of space. In line with expectations, solar panels are far less often installed in both owned and rented residences in inner cities compared to the other neighborhood types. For example, owners living in rural areas, villages (result similar for suburban areas), and green urban areas are around 58%, 36%, and 51% more likely to invest than city dwellers.

4. Challenges and perspectives

One complication is that although there is evidence that local and regional characteristics and policies do matter in terms of uptake, whether local and regional conditions impact environmental awareness and motives, and thus ERM uptake is less clear from our analyses. There is evidence that strongly feeling co-responsible for neighborhood livability influences the decision-making process. In more rural areas where bonding capital tends to be higher, people may feel more connected to the community and be willing to invest in measures, but still it is found that residents in suburban areas are less likely to invest in insulating homes. The subjective motives factors (e.g., “My residence is energy efficient”) come out to be significant drivers, but due to data limitations interpretation is not straight-forward and there can be quite

a discrepancy between these perceptions and reality. Spatial differences in for example, pro-environmental attitudes and behavior, as well as on possible endogeneity, has received less attention. In addition, in the case of energy saving behavior, there is also the well-known issue of rebound effects (see e.g., Azevedo, 2014). Since households invested in ERMs, they feel entitled or excused to use more energy in other domains. Thus, more research is needed on these behavioral aspects and interrelationships with space, which could further inform the development of more place-sensitive policies directed towards daily behavior.

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

Most students in the Netherlands are tenants living in private rental housing, a key factor that we find to have a negative impact on uptake of ERMs. As there is a supply/demand discrepancy where student housing is concerned and students tend to have a restricted budget, students categorically have limited options and voice when it comes to carrying out ERM renovations, in line with other renters in this sector. Although students may not be able to invest in ERMs in their current phase of life, they are able to focus on behavioral factors that will also affect the use of non-renewable energy. For example, students who cannot insulate their walls further may choose to insulate through thicker clothing, and students who cannot place solar panels on their roof can make more conscientious choices in their use of electricity. Furthermore, students can also educate themselves concerning ERMs and spread this knowledge, both amongst themselves (also in relation to future housing decisions) and amongst those who are more autonomous in housing renovation decisions. In these ways, students can fulfill a key role in the energy-transition in the built environment.

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Assessment of low-cost hydroponic farming in rural communities for adaptation of climate change

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Keywords: Rural Hydroponics Farming, Climate change adaptation, youth actions.

1. Problem statement

Hydroponics farming system is one of the most suitable techniques to enhance agricultural productivity with less application of resources and high environmental conservation impact (Velazquez-Gonzalez et al., 2022). Furthermore, the special advantages of soilless culture allows vertical farming in small areas compared to conventional agriculture, which expands the production by square meter (Pandey et al., 2009). But the principal advantage of these systems relies on the adaptation of conditions for crop growth which benefits the agricultural sector when dealing with climate change. However, since the market for hydroponics targets the crop production inside cities only, there are no limitations regarding energy usage, fertilizers application or lack of qualified personnel for operation. Recently, several researchers saw the necessity to reduce operation costs for small and medium scale farmers; however, promotion and application of these systems in rural agriculture is not clearly projected. Itchwana et al., (2020) and Abul-Soud et al., (2021) used Arduino platform to create a low-cost device, which allows to collect information of several parameters, with the objective to maximize crop production under greenhouses and reduce ecological footprint of the climate change impact. Also, the use of wastewater as a source of nutrients was discussed by Cifuentes-Torres et al., (2020), and they recognized that there is a significant amount of nitrogen and phosphorus in it. Furthermore, a low cost hydroponic was tested by Naz et al., (2021) in Bangladesh using cow urine and pond water to compare the crop growth when using different media such as bottles, foams, bamboo, coco coir and semidried *Eichhornia* leaves; obtaining the same productivity to free irrigation on conventional farming but with the advantages of cheap production and water efficiency in a small area.

2. Student's Actions or activities

Aiming to the reutilization of resources to build cheaper hydroponics systems, a waste recovered from Municipal Solid Waste Incineration process called "Molten Slag" was tested as a source of nutrients. Due to its origin and the combustion carried out during the incineration, the dry mineral content in this type of material is high; therefore, it was necessary to confirm how much of this mineral can be released into the water to be uptake by plants.

Valuable information like this and the previous examples have been published, and some of them are free for consultation, some others might be purchased from journals, institutions, etc. However, it is possible that not so many farmers are familiar with technical terms and concepts. For this reason, we proposed the creation of Rural Hydroponic Farming, which main goal is to bring information as much as possible to the farmers by manuals, guidelines, and workshops to facilitate the creation of more greenhouses in rural areas around the world.

3. Implications/Results

From the experiment with Molten Slag, it was confirmed the high potential to use this material as a support for crop fertilization. In this experiment, corresponds to be MS3 the variety which releases higher amounts of K^+, Mg^+ Ca^+ and SO_4^{2-} as shown in the performance equations in Fig. 1. To be able to use this material is important to confirm the presence of heavy metals and their leachability, this factor causes that not so often wastes are seen as a good option to reuse in agriculture.

	K^+		Mg^+		Ca^+		Na^+	
	a	b	a	b	a	b	a	b
MS1	0.05	0.55	0.13	0.30	1.97	9.20	0.01	3.69
MS2	0.10	0.21	0.15	0.32	2.27	7.59	0.33	1.54
MS3	0.13	0.79	0.17	0.37	2.61	10.72	0.38	3.40

	Cl^-		PO_4^{3-}		SO_4^{2-}	
	a	b	a	b	a	b
MS1	-0.172	3.09	-0.011	0.17	-0.017	2.73
MS2	0.080	1.01	0.039	0.16	0.111	2.77
MS3	0.264	1.81	0.008	0.03	0.503	1.56

The behavior of releasing cations in given in the Equation (1)

$$y = a\ \ln(x) + b \qquad Equation\ (1)$$

Fig. 1 Releasing ion capacity of three varieties of Molten Slag.

4. Challenges and perspectives

To implement rural hydroponic farming, it is necessary to establish a direct connection with institutions and governments willing to help in the transformation of the agricultural sector. One of the biggest challenges for rural hydroponic farming is the acceptance of the communities and traditional farmers to change their way to produce their foods; in some regions, the traditions, culture and religion play a key role for development and improvement of life quality. A secondary challenge concerns having the proper information as possible regarding low-cost hydroponics. The collaboration of many research institutes and journals should be engaged to provide investigations of this topic.

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

Our contribution is expected to support communities and rural areas through inclusion of cooperatives farmers during the adaptation of agriculture to climate change; in this sense, the outputs of this project will be reflected on the next following actions:

- Creation of cooperatives in rural areas to assess cheap hydroponics development
- Development of low-cost technology for vulnerable farmers
- Decrease of cost production under hydroponics systems
- Adaption of rural farming

In future years, adaptation of environments for crop production will be necessary not only

to increase yield in small areas but to provide food safety in every region around the world. This research materials looks forward to include small and medium scale farmers in the greenhouse revolution and to make it accessible for rural areas.

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Group L

Group theme

Environment

Presenters:

Tristan, Edward Wesley, Burrow, University of the Highlands and Islands
Barsha Lama, Agriculture and Forestry University, Nepal
Faith Wariara Mwiruri, Jomo Kenyatta University of Agriculture and Technology
Novitasari, Istiani, Tokyo University of Agriculture

Chairperson:

Nishizaki Anju, Tokyo University of Agriculture

General Chairperson:

Tran Thi Ha Chau, Tokyo University of Agriculture

Is there a difference in carbon stock between conifer and broadleaved tree species?

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Keywords: Environment, Forestry, Carbon

1. Problem statement

As part of Scotland's national plan to tackle climate change planting trees forms the backbone. This is aimed at carbon sequestration and capture, promotion of renewable energy and wood as an alternative to carbon heavy materials (Scottish Forestry, 2020). As part of these schemes conifers, a category of tree species, are planted in large numbers, consequently being favored over broadleaves (SEPA, n.d.). The reason being is that conifers provide a quick economic return, are resilient to pest and diseases and are suitable to many varied environments (Forestry and Land Scotland, 2022). As one category of species, conifers, is planted in larger numbers it is therefore fair to ask which of the two are able store carbon in larger quantities.

2. Student's Actions or activities

The conifer species that were chosen were Sitka spruce, Norway spruce and Scots pine and for the broadleaves it was Pedunculate oak, Downy birch, and Sycamore. Craigie Hill, located 11km northwest from the center of Edinburgh, was chosen due to its accessibility and the available species on site. The study was undertaken over two days, 9.03.2022 and 10.03.2022.

A sample site, that has required species, was identified. A diameter at breat height (DBH) and height measurements (clinometer) were acquired. Tariff number was attained through cross referencing DBH and height (Forest Mensuration Handbook). A cubic meter (m^3) result was provided by cross referencing the tariff number and DBH. Kilograms per meter cubed was calculated by multiplying m^3 by grams per cubic meter (g/m^3). Dry weight was determined by using data from the University of Nebraska, which claims when the data is collated and averaged indicates that a tree is 72.5% dry matter and 27.5% moisture (De Wald, 2005). Carbon content was then calculated by dividing the resultant figure in half (National Museum Wales, n.d.). An independent T-Test analysis was then carried out to test if there was a correlation in difference in carbon content between broadleaved and conifer species.

Null Hypothesis (H0) − There is no significant statistical difference in the amount of stored carbon between conifer and broadleaved tree species.

Alternative Hypothesis (H1) – There is a significant statistical difference in the amount of stored carbon between conifer and broadleaved species.

3. Implications/Results

The obtained results have shown that there is a statistically significant difference in the amount of carbon stored between conifer and broadleaved tree species. It shows that of the sampled trees, conifers as a category contains more carbon than broadleaves.

The independent t-test analysis returned a result lower than 0.05 (Table 1), meaning that the null hypothesis can be rejected.

Table 1: *Degrees of freedom (df) and P-Value.*

df= 28 P-Value= 0.0142

The results imply that the current economic model, implemented in Scotland, of planting large areas with conifers helps extract more carbon from the atmosphere than if it were broadleaves, this therefore suggests that the current economic model is suitable in mitigating climate change. The environmental implications of focusing on just planting conifers would impact ecological diversity and risk greater exposure to pest and diseases, it would however, more effectively combat and limit climate change.

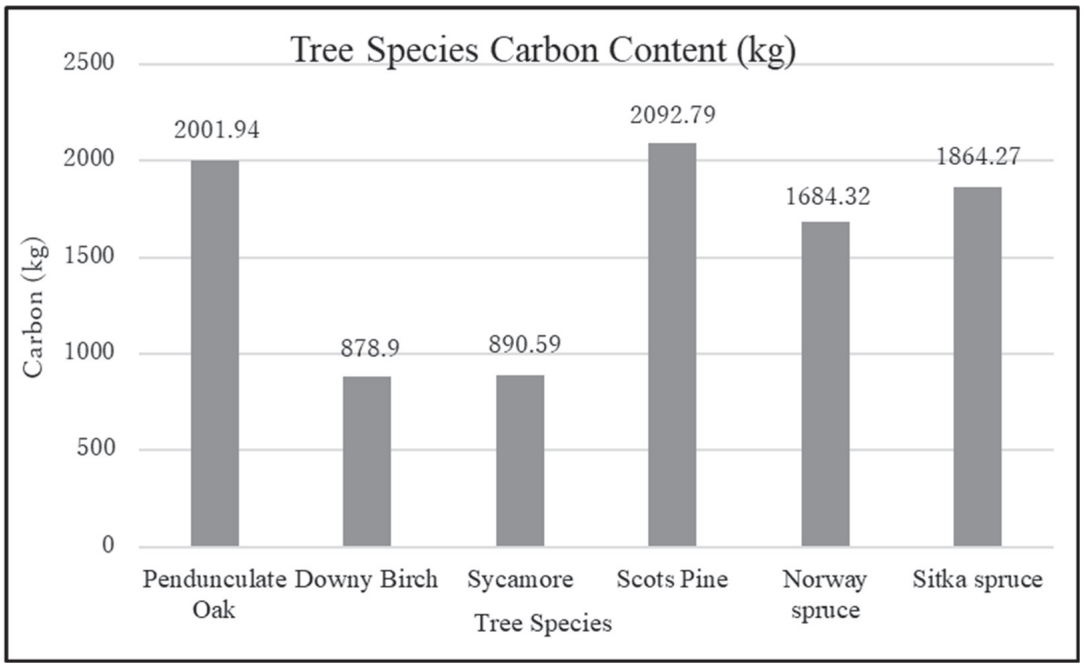

Figure 1: Accumulated carbon content (kg) per tree species.

4. Challenges and perspectives

Difficulty came in selecting an appropriate sample site. The chosen site was part

sufficient, however, some species were grown under different conditions, most likely affecting the result.

Test only includes a select variation and doesn't encompass all species. A further study, within which a wider range of species, with a larger sample and that are grown under more similar conditions, is planned to be undertaken early next year.

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

The ISS theme of this year is, *'Youth actions and innovations towards climate change adaptation and mitigation to promote sustainable agriculture in their communities.'* This study directly relates to this year's theme as it addresses a key component of removing and storing CO^2 from the atmosphere, one the major gases causing climate change. Being able to choose a species that has the capacity to store large amounts of carbon, as compared to other species, will allow increased amounts of carbon to be stored safely and sustainably as opposed to in the atmosphere.

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Assessment of Climate Change Adaptation Activities in Local Community（A case study of Manahari Rural Municipality, Nepal）

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Keywords: Climate, Adaptation, Impact

1 Problem statement

Nepal, a small landlocked country, also known as a highly vulnerable country in the world, is among the disaster hotspots（Kafle & Murshed, 2005）. Nepal is more prone to natural disasters due to its fragile geophysical structure, increased climate variability, and poor economic situations（GoN, 2017）. Regarding food security, climate change, and earthquakes, it is classified as being in fourth, eleventh, and thirtieth places, respectively（MoHA, 2017）. Under Makawanpur district of Nepal, Manahari, a Rural Municipality, is a highly rural place showing impacts of climate change（NCCSP, 2016）. Thus, the study was conducted with objectives to identify, review Climate Change Adaptation（CCA）activities and to assess the perception of local people Climate Change（CC）impact on local community as well as to assess the activities that are required for climate change adaptation.

2 Student's Actions or activities

This study was carried out in the Manahari Rural Municipality（RM）. All the primary data were collected by participatory tools and methods i.e. Key Informants Interviews（KII）, Household surveys（HH）, Focus Group Discussions（FCG）and Direct observation through semi structured questionnaires. All the secondary data were collected from the published government reports, journal, published and unpublished reports, articles and websites. All the data collected through the field were fed into the computer and analyzed by using MS Excel. Many activities related to CCA were organized during my work tenure of two years as Local Project Coordinator of Manahari RM. Many activities were conducted among the community people regarding forest conservation, protection and sustainable management ensuring environmental sustainability as forest is one of the major sources of CCA. Many awareness programs were conducted during that tenure regarding community forest management as well as CCA. For example: Sustainable management of forest through forest-based enterprise development, ensuring water resources conservation by conserving forest, conducting green discussion programs among local community people regarding forest and environment conservation etc.

3 Implications/Results

As communities are the first responders in case of any disasters, regarding this, their perception on CCA is also an important consideration to bring out the positive change (Pariyar, 2019). Here under this study, I have studied about the knowledge of CC among the local people, perception and activities that are performed for assessing climate change adaptation on environment, forestry as well as at household level among the local communities of Manahari RM. We studied local authority perception on the level of effectiveness of CCA activities along Manahari RM. Out of 16 KII respondents, 37.5% were positive towards the work and think that CCA activities hold a high level of effectiveness. Whereas 50% respondents were found moderately positive and more activities need to be mainstreamed for effectiveness of CCA and remaining 12.5% neither positive nor negative.

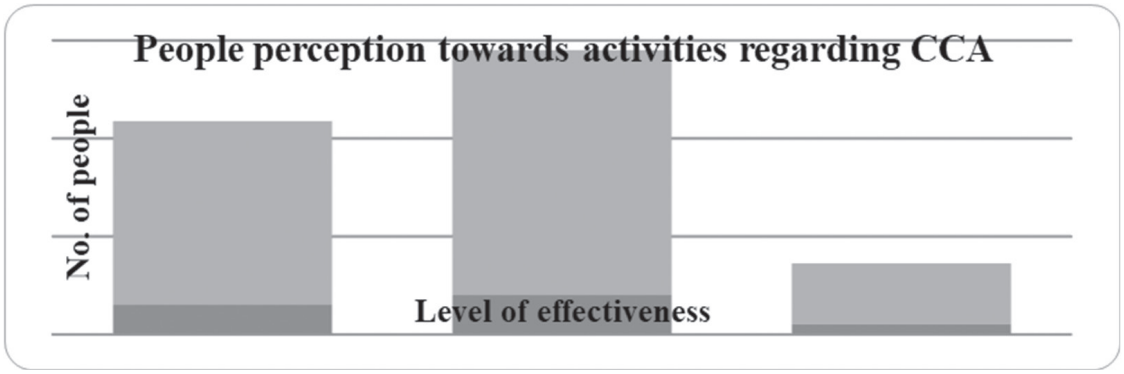

Figure 1 : Category of People perception regarding CCA

From this study, I concluded that the overall performance of mainstreaming work is satisfactory in the case of Manahari RM. Introduction of various activities like dam construction, vegetable farming and tunnel farming showed positive impacts on the rural community. Still there are negative perceptions regarding CCA measures because of the lack of concrete CCA plan and activities and less people's participation to address the current prevailing environmental issues. However, many people of this RM are still unaware about the climate change impacts and its adaptation measures.

4 Challenges and perspectives

The lack of people's participation, lack of inclusiveness and lack of awareness among people are the major challenges of this study. To solve these problems, engagement of local people in every step from selection to implementation of CCA should be prioritized, the CCA committees at local level should be inclusive along with indigenous knowledge and practices and CCA focal persons, local leaders, and local facilitators should be well trained for its effective mainstreaming.

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

From this study it is concluded that overall activities performed regarding CCA are

moderately effective in CCA in Manahari RM. As this study report is completely based on the assessment of people's perception and activities regarding CCA performed by me as a youth, my actions are completely related to the ISS general theme.

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Promotion of Sustainable Agriculture in Smallholder Farmers by curbing Climate Change through Integrated Pest Management (IPM)

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Keywords: Integrated pest management, sustainable agriculture, climate change

1. Problem Statement

Climate change is one of the most critical global challenges and environmental issues in the 21st century which is affecting the distribution, biology and the potential outbreak of organisms such as pests (Heeb *et al*., 2019). According to Karthik *et al*., (2021) climate change is characterized by effects such as a sharp rise in global average temperatures, shifts in precipitation patterns as well as unpredictable harsh weather patterns due to anthropogenic climate change caused by release of greenhouse gases such as Carbon (IV) Oxide and nitrogen which contribute to global warming.

The occurrence of global warming has been caused by use of chemicals such as pesticides which have led to the gradual increase in temperature and rainfall levels favoring the growth and distribution of most pests in warm and humid conditions. This has led to an increase in pest populations such as armyworm which is a new invasive pest in Africa. The pest has also spread to countries such as China, India, Thailand, Japan, Philippines and Australia (Karthik *et al*., 2021). These pests pose a major global challenge to food security and agricultural livelihoods and according to Luca & Emma (2017), up to 40% of the world's food supply is already lost to pests. Therefore, reducing the impact of pests is important to ensure global food security, reduced use of pesticides and unnecessary greenhouse gas emissions.

2. Student's Actions or activities

Youths have come up with the implementation of Integrated Pest Management (IPM) program which aims to curb environmental pollution by reducing the application of inputs such as pesticides and instead encouraging the use of cultural and biological control methods among farmers. Integrated pest management refers to the introduction of a variety of pest management methods to complement, reduce or replace the use of synthetic pesticides. (Pretty *et al*., 2015).

Youths have also come up with ways on improving farmers' knowledge on how to grow crops under the integrated pest management program in order to reduce the use of pesticides and promote sustainable agriculture such as establishment of Farmer Field Schools (FFS) in communities, complemented by extension methods that include the use of video, song and radio.

This program has been accomplished through the implementation of pest prevention, mitigation, surveillance and suppression techniques such as cultural control, biological control such as use of predators such as wasps and the use of pest resistant varieties such as genetically modified maize and cultural practices like lengthening crop rotation cycles and intercropping of plants. Biologically, youths have massively reared predators such as *Trichogramma* wasps and *Epidinocarsis lopezi*, in laboratories then released into farms, especially maize farms to control various pests such as fall army worm and sugarcane borer.

3. Implications/Results

The introduction of integrated pest management methods has resulted in a significant decline in pesticide use which has translated into increased yields in most countries, including Asian and African countries. Reducing the use of pesticides to support biological methods, has reduced production cost and increased savings for farmers. In addition, greenhouse emissions from pesticide chemicals have been reduced and biodiversity conservation has been achieved improving climate change mitigation. Establishment of Farmer Field Schools (FFS) by youths among communities has been seen in countries like Mali and Burkina Faso where pesticide use has been reduced to 8% and an increase in yields (Pretty *et al*., 2015).

Crop rotation has helped reduce the proliferation of pests encouraged by various plantings thereby increasing soil organic matter, and improving soil health and water quality by preventing excess chemicals from getting into water supply. Intercropping has helped control pests, improved soil and water quality by adding crop cover and reduced the use of pesticides in agriculture. Introduction of pest-resistant crops such as genetically modified maize, potato and cotton plants expressing genes encoding the entomocidal and endotoxin from *Bacillus thuringiensis* bacteria has led to an increase in plant resistance to pests and large reduction in pesticide use in crops such as cotton and beans and increased profits and reduced production costs for farmers (Gateway *et al*., 2011).

Introduction of a parasitoid wasp (*Epidinocarsis lopezi*) from Latin America has caused reduction of cassava mealybug populations in Central and West Africa. The annual release of *Trichogramma* wasps in large numbers just in time with the presence of Sugarcane borer eggs in Agricultural crops and forests in China, has enhanced reduction of sugarcane borer populations in sugarcane (Landis *et al.*, 1996). According to Prasanna *et al*., (2018), *Trichogramma* or *Telenomus* wasps in Africa inundatively released by youths have been successfully used to control Fall Armyworm eggs in plants. Early release of *Trichogramma* wasps in the season, has also helped in reducing the pest larvae population in the maize ear. Introduction of natural predators like wasps in farms has led to increase of yields and killing of pests biologically.

4. Challenges and perspectives

The implementation of Integrated Pest Management (IPM) by youths in communities especially in developing countries has faced various challenges such as resistance from farmers in adopting the biological pest control methods as they claim its time consuming compared to

the spraying of synthetic pesticides. Moreover, insufficient knowledge on the integrated pest management methods has made it impossible for farmers to implement the methods on their farms. Youths have found ways to educate more about the benefits of integrated pest management methods. This is through the establishment of extension methods to ensure all farmers get educated on integrated pest management and its benefits.

5. Relationship of Integrated Pest Management Program (IPM) to the ISS theme

The introduction of an Integrated Pest Management Program (IPM) such as cultural and biological methods as a means of controlling pests by youths through innovations has helped reduce the use of synthetic pesticides by farmers engaged in agriculture. It has also improved agricultural efficiency by building on ecosystems such as pest predation while protecting pollinating insects. In addition, it has helped increase food availability and agricultural productivity by reducing pre- and post-harvest crop losses. Minimizing the use of synthetic pesticides reduces greenhouse gas emissions, reducing the global warming impact on the environment and promoting sustainable agriculture in communities.

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Exploration of Potential Bacteria Consortium for Biofertilizer Microorganism-based Formulation

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Keywords: biofertilizer, nitrogen fixation, phosphate solubilizing, plant growth promoting rhizobacteria

1. Problem statement

The usage of chemical fertilizers is driving up greenhouse gas emissions that contribute greatly to climate change. Worldwide, agricultural soils produce the second-highest emissions in the sector of agriculture, forestry, and land use (Ritchie, Roser, & Rosado, 2020). Both manufacturing and application of fertilizers have a heavy emissions toll ("Massachusetts Institute of Technology", 2021). For example, ammonia which is used as a chemical fertilizer comes from burning fossils and releases gas carbon dioxide (CO_2). Besides, nitrous oxide (N_2O) as a strong greenhouse gas is released when synthetic nitrogen fertilizers are applied to soils. It is an urgent need for greater learning and understanding of how to deal with chemical fertilizers to mitigate climate change.

Looking at the details of Indonesia's domestic market, the total consumption of chemical fertilizers was higher than organic fertilizers from 2016 to 2021. During this period, the average total consumption of chemical fertilizers (tons/year) sequentially for urea was 5,800,000, NPK 2,900,000, ZA/AS 931,000, and phosphate/SP-36 723,000 while organic fertilizers consumption just reached 644,000 (*Indonesia Fertilizer Producers Association*, 2022). This happens because the government is still supporting 94% of chemical fertilizers subsidized programs based on the distribution report of fertilizers (*Pupuk Indonesia*, 2020). Furthermore, local farmers' knowledge and awareness also still need to be improved, such as pest resistance which is caused by a higher dosage of chemical fertilizers (Tasmiyah, 2021).

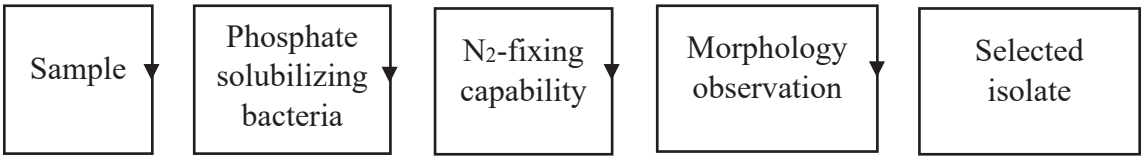
2. Student's actions or activities

I have research to find plant growth promoting rhizobacteria as a consortium to replace chemical fertilizers in the future. These microorganisms are potential in the capability of phosphate solubilizing and nitrogen fixation. The research was conducted in the Laboratory of Microbiology, Department of Biology, IPB University, Indonesia. It consists of three main methodologies, such as isolation, screening, and molecular identification with focusing on phosphorus (P) and nitrogen (N). The used sample is a soil with sandy-clay texture from the

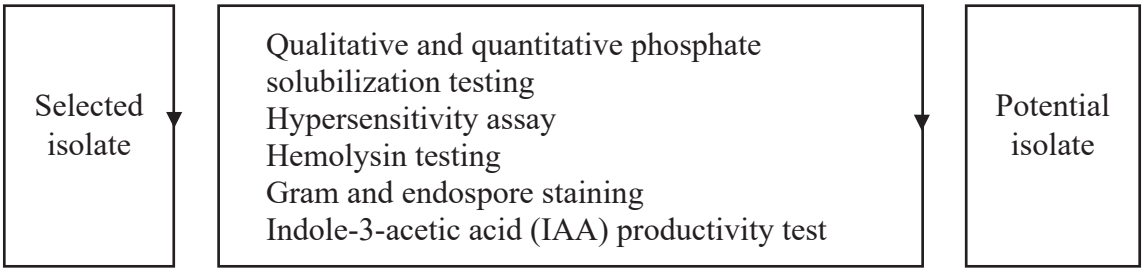
former limestone mining area in PT Indocement Tbk, Bogor, Indonesia.

Here is the research procedure:

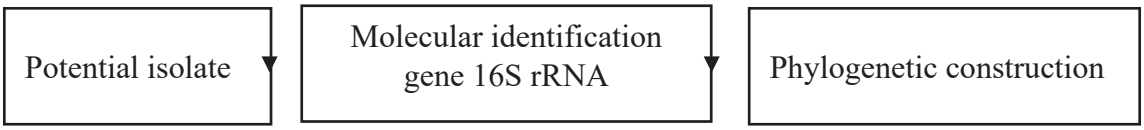
1. Isolation



2. Screening



3. Identification



3. Implications/Results

The research successfully isolates two potential bacteria strains. Based on the molecular 16S rRNA were identified as *Bacillus cereus* (the first bacteria) and *Bacillus aryabhattai* (the second). Both bacteria show Gram-positive with rod shape and single arrangement in microscopic observation. According to hemolysin testing and hypersensitivity assay, these bacteria are safe and non-pathogenic. The first bacteria identified is capable of producing 34.23 ppm IAA and dissolving 109.03 ppm phosphate. The second also produces IAA as much as 20.18 ppm and dissolves phosphate at 92.76 ppm. These results indicate the ability of microbes in phosphate-solubilizing and N_2-fixation which is a starting point to formulate microbial consortiums.

4. Challenges and perspectives

A lot of research notes that chemical fertilizers have greatly boosted crop production and let farmers use them more. Meanwhile, I also realize that there are challenges to promoting the use of biofertilizers. Such as how to formulate bacterial consortiums, how to apply them to agricultural land, and what kind of appropriate approach to farmers. Cooperating with the community agriculture and youth generations is a worthwhile action to face this challenge. Through its collaborations, a household scale can be a focused goal to promote biofertilizer applications. Improving the knowledge and awareness of local farmers and classifying biofertilizers as government programs are other concerns as well. The action plans I take can be in the form of a free trial sample of biofertilizers for the community's agriculture, urban-

farmers meetings, and workshops not only on biofertilizers but also on natural composts.

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

Microorganisms are known to provide soil nutrients for plant growth and development, such as phosphorus and nitrogen. From this point of view, it is currently practicable to use beneficial microbes as biofertilizers. This kind of more eco-friendly fertilizer can reduce the total percentage of greenhouse gas emissions. Swandi, Mubarik, and Tjahjoleksono (2019) conducted biofertilizer research on living microbes. The soil analysis reveals a change in pH neutral, the percentage of organic carbon, and the concentration of absorbed phosphorus. Plant growth, therefore, increases significantly compared to chemical fertilizer. My actions, which had and will be taken, can be contributions to solving the environment related to climate change problems, specifically in the community around me.

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MATERIALS

TOKYO DECLARATION

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

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

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

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

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

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

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

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

November 20, 2001
Tokyo

International Students Summit Action Plan

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

General Actions

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

Specific Actions

Environmental Conservation

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

Biotechnology

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

Food Safety

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

Food Security

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

Students Network

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

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

November 17, 2002
Tokyo, Japan

Establishing International Students Forum (ISF)

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

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

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

1. Objective

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

2. Organization

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

3. Role

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

4. Activities

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

5. Participating Universities

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

6. Secretariat

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

November 17, 2002
Tokyo, Japan

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

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

Objective

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

Membership

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

Activities

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

November 25, 2005
Tokyo, Japan

Mission Statement of International Students Forum（ISF）

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

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

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

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

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

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

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

Acknowledgment

The global outbreak of COVID-19 forced us last year to hold the “International Students Summit on Food, Agriculture, and Environment (ISS)” online. With the partial lifting of the prevention measures in force in several countries and the reopening of the country borders to travelers, this year’s summit has moved to a hybrid conference system, allowing few students to attend in-person, while the remaining participated virtually. We take advantage of the technological evolution which allows a wider audience around the world to see the students’ discussions.

It would be great if the students could share their activities and ideas and find new perspectives that they cannot attain from their original ground. We hope the awareness and relationships gained through the ISS will form a new path for agriculture and the humanosphere shortly, especially at the period when our world must take countermeasures against the effects of climate change.

Our thanks go to all those who have helped us put together the 21st 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, the Advisors Committee made of professors from our partner universities, and the Tokyo NODAI Committee for Global Education (国際教育専門委員会) for giving valuable academic guidance to the ISS presenters.

We would also particularly like to thank the chairpersons, general chairpersons, and all Tokyo NODAI student groups who tirelessly have dedicated themselves to preparing the 21st ISS, which is held for the first time in a hybrid system with all the uncertainties that come alongside with it.

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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