2.2 Activities related to output 2

Attachment-12

Presentation material in the workshop to review the planning phase and confirm immediate activities for the implementation phase

The Project for Promotion of Safe and Appropriate Use of Pesticides & Fertilizer, in the DSR of Sri Lanka

SESSION 2

CONSIDERATION OF PILOT ACTIVITIES FOR THE IMPLEMENTATION PHASE

Workshop on 31st of October, 2023

MAIN ACTIVITIES IN THE BEGINNING OF IMPLEMENTATION PHASE

Ideally completed by the end of this year, 2023!

No.1 The **List of existing training materials** and **collect local technologies**

Utilizing Existing Materials and Knowledges

Category	Training Materials, Manuals, Tools, etc.	Resource Institute
Pesticide Application	- Identification of Pests and Diseases of Mango, Papaya and Pineapple	NAICC
	- Good Agricultural Practices for Mango, Durian, Bitter Gourd, Snake Guard, Luffa, Long bean, Gotukola, Crops in Solanaceas Family	NAICC, AFACI
	- Pest Management Recommendations	ROP
Worker's Health	- National Occupational Safety and Health Policy	MOL&LR
Pest and Disease Control	- Integrated Pest Management (IPM) in Vegetable cultivation	NAICC, ATIN, AFACI
	- Management of Major Diseases in Tomato and Chilli in Greenhouses	NAICC
Fertilizer Application	- Site Specific Fertilizer Recommendation (SSFR) using Soil Test Kit and Plant Test Kit.(LaMotte Analysis Kit)	NAICC、FAO
	- Organic Vegetable Cultivation	NAICC
Record Keeping	- Production of Healthy and Safe Fresh Fruits and Vegetables	NAICC、AFACI

No.2 The selection of the **technology to test** in the pilot sites

Considering the Characteristics of each Area

Target Districts		Nuwara-eliya	Badulla	Mathale	Anuradhapura	Puttalam
Climate Zone		Wet Zone			Dry Zone	
Soil Condition		Red-yellow Podzolic soil		Reddish Brown Earths & Low Humic Gley Soils		Red Yellow Latosols
Category	Pesticide Application	Whole Target Districts				
	Workers' Health	Whole Target Districts				
	Pest and Disease Management	Wet Podzolic Area		Wet Grey Soil Area	Dry Grey Soil Area	Dry Latosol Area
	Fertilizer Application	Wet Podzolic Area		Wet Grey Soil Area	Dry Grey Soil Area	Dry Latosol Area
	Record Keeping	Whole Target Districts				
Technology Package		Wet Podzolic Area Package		Wet Grey Soil Area Package	Dry Grey Soil Area Package	Dry Latosol Area Package

No.3 The selection of **the pilot sites** in each target district and make **the plan of pilot activities (WG action plan)**

FORMATION OF WORKING GROUPS

	WG 1	WG 2	WG 3
Categories	**Pesticide**	**Fertilizer**	**Good Agricultural Practices**
Leading organization	ROP	HORDI	ETC (Agribiz?)
Collaborating organization	PDOA, HORDI, ETC, NAICC, Universities, PPS	PDOA, NAICC, ETC, Universities, FCRDC, NFS	PDOA, NAICC, HORDI, NAICC, MASL, ROP, SCS, Private sector
JICA project staff	JA - Nagata, Riera & Egusa NS - Agronomist, Dr. Keerthisena, Material Development	JA - Nagata, Riera & Egusa NS - Agronomist, Dr. Keerthisena, Material Development	JA - Aoyama, Kimura & Egusa NS - GAP extension, Dr. Keerthisena, Material Development

*WG: Working Group. JA: Japanese Advisors. NS: National Staff.

ACTIVITIES AND ROLE OF WG

The objective of this project is to strengthen capacity of stakeholders.

We work together to achieve the appropriate use of P&F

- Frequency of Meetings: Once a Month
- Number of Members: Approximately 5. Leading Organization will assign from collaborating organization according to the topics of work.
- Main Roles of WG :
  - ✓ The List of existing training materials and collect local technologies.
  - ✓ The selection of the technology to test in the pilot sites.
  - ✓ The selection of the pilot sites in each target district and make the plan of pilot activities (WG Action Plan)
  - ✓ Coordinate Pilot activities including pilot site.
  - ✓ Develop the Technology and Extension Packages.
  - ✓ Train the Trainers
  - ✓ Public Relation (campaign)
  - ✓ Material Creation (Manual, Poster)

DISCUSSION POINTS

*40 min. to discuss by each group

(1) **Issues** related to each WG

in different regions, climate and soil types.

(2) **Possible technologies** to solve the issues.

Existing materials and its usability

(3) **Potential pilot activities**

Which technology, Where, With whom

* it is very important to consider the budget, time and resource availability when consider the technology as pilot activities.

This group work is only to have idea of what we have to do next 2 months.
This group work is not to decide pilot technology and site yet.

WHICH TECHNOLOGY WE ARE FOCUSING ON?

Key points to consider

- ✓ The **Approaches** such as IPM for Pesticide, IPNS for Fertilizer, GAP for agricultural management have already existed.
- ✓ We require to consider the precise **Technologies** to solve the Major Issues.
- ✓ Considering **Characteristics** of each district, for example…
  - Pesticide: Wet or dry, crop type and pattern
  - Fertilizer: Soil types, slope (mountainous or flatland)
  - GAP: Crop type and pattern, field scale, social differences

HOW CAN WE DISSEMINATE IT?

Key points to consider

- ✓ There are many extension tools already.
- ✓ To reach the information to farmers, what else we can do?
- ✓ To achieve **Safe Crop Production**, **Occupational Safety** and the **Environmental Conservation**, what else we can do? Who and how do we need to approach?

PRESENTATION

*10 min. per group to present.

Discussion Points	The results of discussion
Issues in general and each region	1.Pesticide residues have often been detected in mangoes. (Dry lowland) 2..... 3.....
Possible Technologies to solve the issues	1.1 Inform the farmers that no pesticide spraying will be done one month prior to the harvest. 1.2 Cover the fruits by the bag to protect it from pests and pesticides. 2.1…… 3.1…… 3.2…..
Potential Pilot Activities	1.1 Put TV commercial or News during the one to two month prior to the harvest season to give the message “Do not spray to the Mango”. (Putalam) …..

The Project for Promotion of Safe and Appropriate Use of Pesticides & Fertilizer, in the DSR of Sri Lanka

Session 1: Reflection of the planning phase

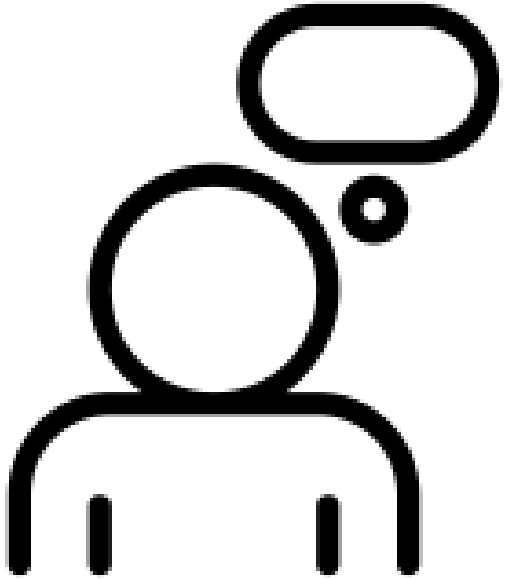
31 October, 2023

Agenda of session 1

1. Reflection of the planning phase
2. Two Action Plans elaborated in the detailed planning phase
3. To discuss & confirm the points necessary to update after 2.5 years

1. Reflection of the planning phase

Reflection of the planning phase



- **Period**: July 2020 - March 2021
- **Objective**:

To elaborate action plans for promoting safe and appropriate use of pesticide and fertilizer

- *Due to Covid-19, most of the activities were done on a remote basis.*
- *2.5 years have passed to start the implementation phase….*

Main stakeholders

ROP

HORDI

DOA



PDOA

District stakeholders

ETC

NAICC



Major activities done in the planning phase

July 2020

1. Fact-finding Study on the current situation & issues surrounding pesticides & fertilizer (in general)

In the pilot districts

2. Field Survey in each pilot sites to understand the current situation & issues in field

3. Introductory stakeholder meeting
To identify stakeholders in the target districts, and to discuss about current situation and issues, and their causes as a first step for elaborating action plan for the implementation phase

4. On-line Seminars for sharing the experiences in Japan

March 2021

5. Elaboration of Action Plans

2. Two Action Plans elaborated in the planning phase

Two Action Plans

Comprehensive Action Plan

- Multi-sectoral action plan to solve the issues relating to safe & appropriate use of pesticides & fertilizer at national level
- Period: **around 5 years**
- The plan includes the activities not only this project activities, but also necessary actions to be taken by concerning stakeholders with their own efforts.

Action Plan of the Implementation phase

- Action Plan of this project
- Period: **2.5 years** (= project period)
- This plan is a part of Comprehensive Action Plan

Review the CAP, reflecting the lessons learned through the project



Comprehensive Action plan

Comprehensive Action Plan(CPA)



CAP is a Roadmap to achieve the below Goal in short-mid-long term;

1) To increase occupational safety of farmers,
2) To mitigate health problem of rural population, reducing environment impact caused by agrochemical overuse/misuse,
3) To contribute to improve food safety and to enhance exports of vegetables and fruit by controlling overuse of agrochemicals

Overall responsible agency

- **DOA**, coordinating with other concerning actors

5 Components of Comprehensive Action Plan

NFS, 2021-2023

1.Improvement of fertilizer management system

HORDI, 2021-2024

2.Promotion of appropriate fertilizer application



To solve issues associating with fertilizer management

AgrBiz, 2021-2024

3. Enhancing safe & quality crop production

To solve issues associating with farmers' practice

ROP, 2021-2028

4.Strengthening of pesticide management system

ROP, 2021-2025

5.Strengthening of pesticides residue analysis & monitoring system



To solve issues associating with pesticide

Component 1: Improvement of Fertilizer Management System

Capacity to be: Necessary fertilizer is available for farmers to apply following to the recommendation
Objective: Establishment of database of fertilizer and strengthening of fertilizer analysis capacity
Overall responsible organization: NFS
Collaborating actors: DAD, SLSI, Private sector, ITI, HORDI, Research Institutes of DOA
Implementation Period: 2021-2023

【Output1】Elaborated database of available fertilizer

Survey on available fertilizers in market and in distribution, Elaboration / development of database, Create the system to update the database periodically

【Output2】Strengthened fertilizer analysis capacity

Simplification of analysis process , Incorporation of private sector, Training for analysts, Improvement of laboratory

【Output3】Improved fertilizer distribution system

Increase availability of straight fertilizers in the market , Preparation of guideline for fertilizer mixtures, Improvement of label of subsidized fertilizer, Improvement of storage & distribution system at ASC

Component 2: Promotion of Appropriate Fertilizer Application

Capacity to be: Farmers apply fertilizer upon soil condition, climatic condition referring to the recommendation

Objective: Promotion of appropriate fertilizer application

Overall responsible organization: Soil science division, HORDI

Collaborating actors: Research Institutes & soil testing laboratory of DOA, NAICC, ETC, private sector, SLSI, ITI, PDOA, Mahaweli

Implementation Period: 2021-2024

【Output1】Improved recommendations for fertilizer application according to soil & climate condition

Review and analysis of existing recommendation, standard of organic/mixtures & bio-fertilizer etc., Testing of Soil and development of recommendations

【Output2】Strengthened Soil analysis capacity

Simplification of analysis process , Incorporation of private sector, Training for analysts, laboratory Improvement

【Output3】Trained extension workers & private sector on fertilizer application

Elaboration of training program for appropriate fertilizer application, Training for extension workers & dealers (TOT)*)*

Component 3: Enhancing safe & quality of crop production

Capacity to be: Capacity to be: Safe & quality crop production is widely practiced among farmers

Objective: To elaborate technology & extension package for safe and quality crop production

Overall responsible organization: AgrBiz

Collaborating actors: ETC, PDOA, Mahaweli, farmers, NFS, ROP, HORDI, SCS, NAICC, univs, private sector

Implementation Period: 2021-2024

【Output1】Knowledge on extension packages on safe & quality crop production

Identification of existing materials / tools / protocols / systems, Study about safe & quality crop production and occupational safety through study tour to Japan / Thailand / Vietnam, etc.

【Output2】Improved technology package (tentative) for safe & quality crop production

Elaboration of contents and tools of the package

【Output3】Improved extension package (tentative) for safe & quality crop production

Elaboration of contents and tools of the extension package

【Output4】Validated technology and extension package

Implementation of extension service with utilizing the technology and extension package, Exchange of experiences among pilot sites diffusion, Finalization of guideline/package, reflecting the lessons learned through field practice

【Output5】Trained extension workers & private sector on extension package

Elaboration of training program on validated extension package for appropriate fertilizer and pesticide application island wide, Training for extension workers & dealers (TOT)

Component 4: Strengthening of pesticide management system

Capacity to be: Ensuring of availability of approved quality pesticides

Objective: To optimize pesticide management, control and use system

Overall responsible organization: ROP

Collaborating actors: HORDI(Central Lab), Pesiticide Importers, MOA, Custom, Import Controller, Pesiticide Importers, Sellers, Dealers, Minstry of Finance, ITI, SLSI, NAICC, ETC, PDOA, MASL, SEPC, CEA, Pesticide Industries, Ministry of Environment, Cement companies (for incineration), Approved recyclable waste collectors, Recyclers, Farmer Organizations Ministry of Environment, Central Environmental Authority, DAD

Implementation Period: 2021-2028

【Output1】Improved system for quality analysis of pesticides is established

【Output2】Efficient monitoring network from import to use is established

【Output3】Registered and legalized pesticide distribution system is established

【Output4】Strengthened Inspection & Prosecution system is established

【Output5】Comprehensive rules and guidelines for occupational safety and use are formulated & implemented

【Output6】Efficient system of post-consumer waste management and disposal is established

Component 5: Strengthening of pesticides residue analysis & monitoring system

Capacity to be: Facilitation of residue control in produce

Objective: To strengthen analysis and monitoring system of pesticides residue

Overall responsible organization: ROP (in close collaboration with MOH)

Collaborating actors: MOH, MOA, Department of Commerce, Exporters, NPQS, HORDI, AgrBiz, ETC, Research institutes of DOA, private laboratories, ITI, DOA

Implementation Period: 2021-2025

【Output1】Declared MRLs for all pesticide and crop combinations

【Output2】Agreed MRLs for destination countries

【Output3】Established pesticides residue analysis and monitoring system / program

(studying of good examples of other countries system, establish proper testing & monitoring program, Conducting coordinated supervised residue trials for setting PHIs, etc.)

【Output4】Established rules & guidelines for complying MRL

(Elaboration of guideline for improving regulatory framework at field level, doing campaign, monitoring and verification of MRLs at production, etc.)

【Output5】System for ensuring safe levels of pesticides in food

(Monitoring and verification of MRLs in produce, legal action to ensure safe levels of pesticides in food, etc.)

Action plan for the implementation phase

Component 3 was selected for the implementation phase

NFS, 2021-2023
1.Improvement of fertilizer management system

HORDI, 2021-2024
2.Promotion of appropriate fertilizer application



AgrBiz, 2021-2024
3. Enhancing safe & quality crop production

To solve issues associating with farmers' practice

ROP, 2021-2028
4.Strengthening of pesticide management system

ROP, 2021-2025
5.Strengthening of pesticides residue analysis & monitoring system



Component 3 was selected because;

- Who are suffering from chronic diseases caused by P&F?

  "Farmers (including farm labor)" and "rural population"

- Hence, the priority should be to improve *1) occupational safety, and 2) alleviation of environmental impact caused by P&F*. The results of which may contribute for improving food safety and enhancement of exportation.
- For this, *to improve awareness of farmers is most important*.
- The idea of the component 3 is to proceed in line with promotion of GAP which the DOA promotes.
- Other components are also very important, but containing the issues which cannot be handled by DOA, which cannot be solved with JICA Technical Cooperation in 2.5 years.

Enhancing safe & quality of crop production

Capacity to be: Capacity to be: Safe & quality crop production is widely practiced among farmers

Objective: To elaborate technology & extension package for safe and quality crop production

Overall responsible organization: DOA

Collaborating actors: ETC, PDOA, Mahaweli, farmers, NFS, ROP, HORDI, SCS, NAICC, univs, private sector

【Output1】Knowledge on extension packages on safe & quality crop production

(Identification of existing materials / tools / protocols / systems, Study about safe & quality crop production and occupational safety through study tour to Japan / Thailand / Vietnam, etc.)

【Output2】To improve technology package (tentative) for safe & quality crop production

(Elaboration of contents and tools of the package)

【Output3】To improve extension package (tentative) for safe & quality crop production

(Elaboration of contents and tools of the extension package)

【Output4】To validate technology and extension package

(Implementation of extension service with utilizing the technology and extension package, Exchange of experiences among pilot sites diffusion, Finalization of guideline/package, reflecting the lessons learned through field practice)

【Output5】To train extension workers & private sector on extension package

(Elaboration of training program on validated extension package for appropriate fertilizer and pesticide application island wide, Training for extension workers & dealers (TOT))



Tasks to do before starting the implementation phase

The tasks expected to do before starting the implementation phase

1. List of existing materials/tools for utilizing in technical package

To prepare the list of existing materials (document in paper, e-document, tool, etc.) which have been developed by DOA, Universities, other government and non-government offices, and other external projects and so on, and could be utilized for elaborating useful technical package. (by July 2021)

2. List of existing tools/protocols/system for utilizing in extension package

To organize the database of extension services, including human resource such as AI/TA, MASL, CAAb officers, TAAb officers, APRS, etc., covering sites, main services and major materials/manuals and tools(direct visit, using video, SNS, e-extension, etc.) to use by each actor. The issues on each service should be also analyzed for finding the points to improve during the implementation phase.

Menu of Technical package and Extension package (proposed in the planning phase)

Package	category	Menu
(Output 2) Technical package	GAP promotion	To upgrade existing GAP technology package/techniques
	Alternative method for Pest/disease control	To identify and validate alternative pest/ disease control methods (e.g. Biological control, resistant variety, control of soil moisture, etc.)
		To identify and validate organic pest control methods/ farming
	Identification of appropriate tools for analysis of soil, crop, and pesticide residue	To identify &and validate soil test kits/pesticide residue kits /plant test kits/ portable meters for soil & plant nutrient analysis
		To identify and validate new technologies for pest/ disease identification Ex: RAPID test kits
	Appropriate use of pesticide	To prepare pesticide manual in local languages
		To identify and validate pre- harvest intervals for selected crop/pesticide combinations
	Occupational safety	To upgrade occupational safety guideline, technical manual
		To identify adoptable PPE
	Laboratory capacity	To identify and validate laboratory technologies for soil and pesticide residue analysis (ex: Mancozeb analysis)
(Output 3) Extension package	GAP promotion	To upgrade existing GAP promotion package/techniques
	IPM in kind	To upgrade crop-clinic system
	Awareness campaign	To create campaign tools/package for famers and consumers, and doing campaign
	Introduction of simple tools for extension activities	To develop extension method for use of soil test kit/pesticide residue kit /PPE/ plant test kits/ portable meters for soil & plant nutrient analysis
		To promote alternative pest control method (e.g. Biological control, resistant variety, control of soil moisture, etc.)
	Digitalization	To develop and validate digital tools useful for farmers To introduce software for easy fertilizer/ pesticide application
	Appropriate use of pesticide	To introduce prescription-based pesticides
		To identify improved pesticide container/ waste collection mechanism
	System for enhancing better use of P&F	To develop provincial level minimum pesticide list/ fertilizer recommendation
		To introduce product and input quality monitoring
	Promotion of safe crop sales	To develop quality product outlets

Training materials, manuals, tools currently available

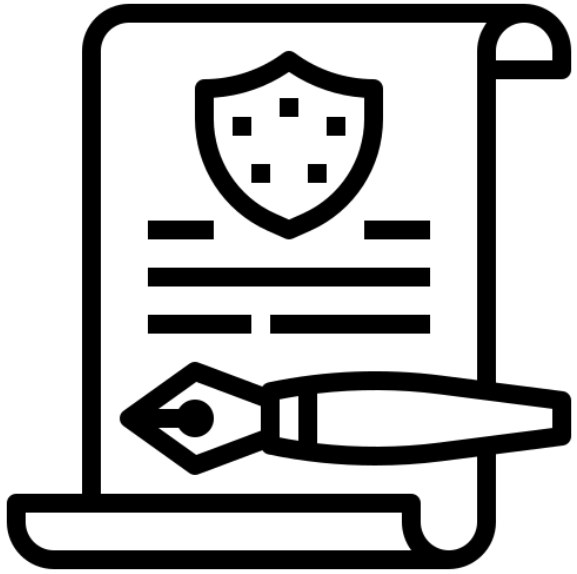
Category	Training Materials, Manuals, Tools, etc.	Resource Institute
Pesticide Application	- Identification of Pests and Diseases of Mango, Papaya and Pineapple	NAICC
	- Good Agricultural Practices for Mango, Durian, Bitter Gourd, Snake Guard, Luffa, Long bean, Gotukola, Crops in Solanaceas Family	NAICC, AFACI
	- Pest Management Recommendations	ROP
Worker's Health	- National Occupational Safety and Health Policy	MOL&LR
Pest and Disease Control	- Integrated Pest Management (IPM) in Vegetable cultivation	NAICC, ATIN, AFACI
	- Management of Major Diseases in Tomato and Chilli in Greenhouses	NAICC
Fertilizer Application	- Site Specific Fertilizer Recommendation (SSFR) using Soil Test Kit and Plant Test Kit.(LaMotte Analysis Kit)	NAICC、FAO
	- Organic Vegetable Cultivation	NAICC
Record Keeping	- Production of Healthy and Safe Fresh Fruits and Vegetables	NAICC、AFACI

3. Discussion points of Session 1

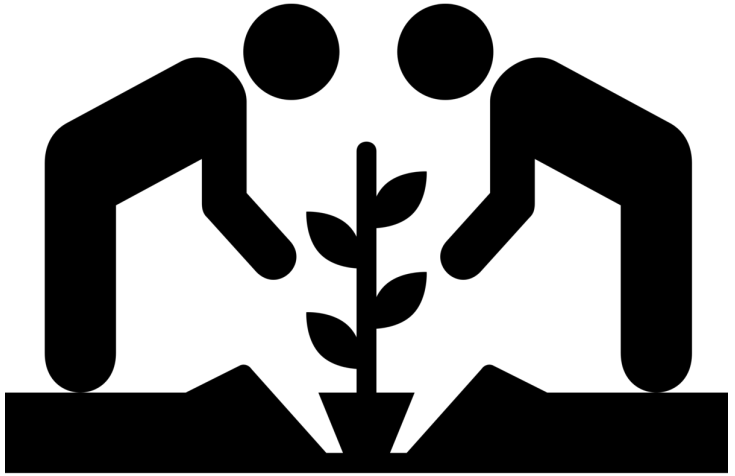
Discussion Points of the session 1

To update of the understanding of current situation & necessary actions/points to be considered under this project

Policy & Strategy Aspect



Field Practice Aspect



Priority Actions identified in the planning phase
(policy & strategy aspect)



- Control of illegal pesticides in sales outlets
- Updated of legal provisions
- Proper implementation of regulatory framework at field level
- Elaboration of occupational safety program
- Require border control facility for pesticides
- Regular pesticide residues analysis
- Improvement of packaging, labelling, storage, advertising, selling and utilizing of fertilizers
- To strengthen fertilizer sample analysis
- Elaborate proper fertilizer recommendations

Priority Actions identified in the planning phase
(policy & strategy aspect)

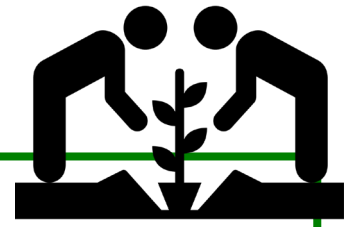


- ✓Any actions which are already out of date
- ✓Any actions which are necessary to include
- ✓Any other points to consider for doing project activities

Please also update the below points.

- ✓Update on pesticide policy, strategy & institution/Stakeholder
- ✓Update on fertilizer policy, strategy & institution/Stakeholder
- ✓Update on Good Agriculture Practice in Sri Lanka and extension fertilizer policy, strategy, system & institution / stakeholder
- ✓Any newly started projects regarding P&F, GAP, extension

Priority Actions identified in the planning phase (field practice aspect)



- To transfer technology for reducing use of P&F
- Instruction/guideline for proper use of P&F (safety use, storage & disposal way, etc.)
- GAP promotion
- Promotion of plant test-based fertilizer application
- Transfer knowledge on fertilizer application based on soil condition
- Quick detection techniques for residue testing & inadequate sample testing
- Function pest prediction system
- Introduction of smart technology
- Adequate administrative system & regulation for proper distribution (incl. straight fertilizer)
- Regular refresher system for extension workers, dealers, etc.
- Private sector involvement
- Research & distribution of resistant/tolerant germplasm/varieties
- Improve coordination & approach of agriculture extension service (among DOA, PDOA, MASL, etc.)

Priority Actions identified in the planning phase (field practice aspect)



- ✓Any actions which are already out of date
- ✓Any actions which are necessary to include
- ✓Any other points to consider for doing project activities

Please also update the below points.

- ✓Update on recent changes in farming practice relevant to pesticide and fertilizer use
- ✓Update on programs for Good Agriculture Practice
- ✓Update on guideline/ instruction/manual /tools etc. used for extension activities
- ✓ Other issues to be considered for project implementation

Let us discuss in group!



30minutes ⏱️

Discussion Results

Presentation & discussion in 1hour



- ✓
- ✓
- ✓
- ✓
- ✓

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மிகவும் நன்றி

Thank you very much!

ありがとうございました

Way forward from November to January 2024

1. Formation of working groups

- DOA to officially nominate core focal points of each working groups.
- Focal points to identify partner institutions appropriate for preparing manuals and pilot activities

2. Preparation of daft Working Group (WG) action plan by each working groups by December 15th 2023.

- First working group meetings to be held by November 17th
- Second working group meetings to be held by December 1st
- Third working group meetings to be held by December 15th

3. Joint working group workshop by December 22nd to present draft WG action plans of each working groups.

4. Approval of WG action plans by JCC on January 2024

Attachment-13

Guidelines for preparing WG Action Plans

Guideline to Develop Working Group Action Plan

DOA-JICA team

The Project for Appropriate and Safe Use of Pesticides and Fertilizers for Sri Lanka

Table of contents

(1) Project in Brief

(2) Development Flow of Technology and Extension Packages

(3) Formation of Working Groups (Tentative)

(4) Considerations for Working Groups

(5) Approach of Working Groups

(1) Project in Brief

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka

- Project Purpose:

  Capacity of the stakeholders and institutions is strengthened for promoting safe and quality crop production

- Project Outputs

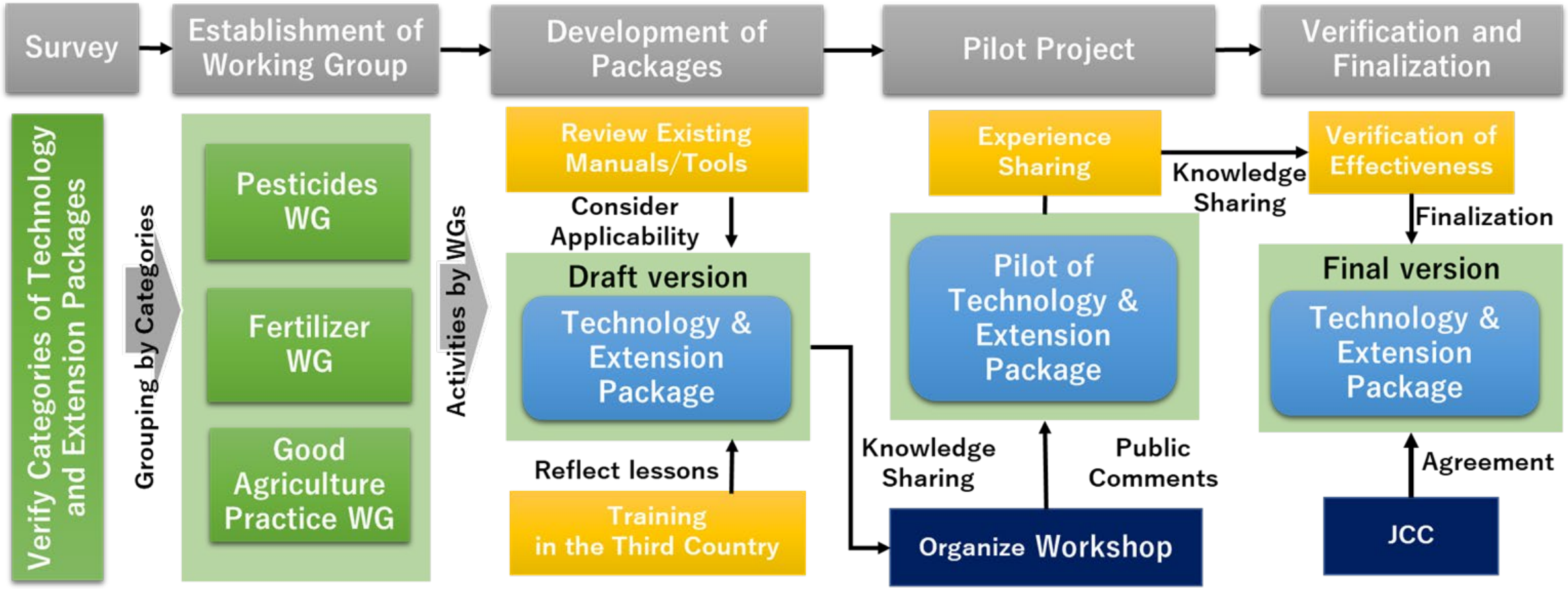
  1 – Comprehensive action plans and action plan for the implementation phase for promoting safe and appropriate use of pesticide and fertilizer are formulated

  2 - **Technology and extension packages** (tentative) for promoting safe and quality crop production are developed and validated

  3 - ....

  4 - …

(2) Development Flow of Technology and Extension Packages



(3) Formation of Working Groups

	WG 1	WG 2	WG 3
Category / Subject Area	Pesticide	Fertilizer	Good Agricultural Practices
Leading organization	ROP	HORDI	Agribiz
Collaborating organization	PDOA, HORDI, PPS, ARC, FRDI, ARS, etc.	RARDC, ETC, AgriBIZ, ARS, FRDI, DD, PDOA, NAICC, etc.	ETC, HORDI, SCS, DD, FRDI, PDOA, etc.
JICA project staff	JA - Nagata, Riera & Egusa NS - Agronomist, Dr. Keerthisena, Material Development	JA - Nagata, Riera & Egusa NS - Agronomist, Dr. Keerthisena, Material Development	JA - Aoyama, Kimura & Egusa NS - GAP extension, Dr. Keerthisena, Material Development

- *WG: Working Group. JA: Japanese Advisors. NS: National Staff.

(4) Considerations for Working Groups

- Agro ecological diversities
- Focus Area
- Available materials
- Results of field observation and discussion with AIs and farmers at the districts
- Activities of other donors

Agro-ecological diversities

Target Districts		Nuwara-eliya	Badulla	Mathale	Anuradhapura	Puttalam
Climate Zone		Wet Zone			Dry Zone	
Soil Condition		Red-yellow Podzolic soil		Reddish Brown Earths & Low Humic Gley Soils		Red Yellow Latosols
Category	Pesticide Application	Whole Target Districts				
	Workers' Health	Whole Target Districts				
	Pest and Disease Management	Wet Podzolic Area		Wet Grey Soil Area	Dry Grey Soil Area	Dry Latosol Area
	Fertilizer Application	Wet Podzolic Area		Wet Grey Soil Area	Dry Grey Soil Area	Dry Latosol Area
	Record Keeping	Whole Target Districts				
Technology Package		Wet Podzolic Area Package		Wet Grey Soil Area Package	Dry Grey Soil Area Package	Dry Latosol Area Package

Possible (JICA Team) Focus Areas

No.	Focus Area	Relevancy	WG in charge
1	Field Sanitation: Field Management to Prevent Pests and Diseases	GAP & IPM	WG 3
2	Effective Pesticide Spraying: Spraying the underside of leaves		WG 1
3	Preventing Seedling and Soil Contamination: Soil Disinfection and Crop Rotation	IPM	WG 1
4	Effective Use of Organic Materials: Use of Mature Compost	IPNS	WG 2
5	Ensure Ventilation: Clearing the space between rows and removing unnecessary leaves.	IPM	WG 1
6	Pesticide Spraying in the Early Stage of Development: Early detection and treatment of diseases	IPM	WG 1
7	Pesticide Residue Control: Refrain from spraying prior to harvest	GAP	WG 1
8	Adequate application of fertilizer at the right time: the amount needed when the crop needs it	IPNS	WG2
9	Bookkeeping: Confirmation of the number of fertilizers applied at the right time and the number of pesticide applications	GAP	WG 3
10	Wearing Protective Clothing: Raising awareness of pesticide toxicity	GAP	WG 3

Available materials

Existing Extension Materials, Manuals and Tools (examples)

Category	Training Materials, Manuals, Tools, etc.	Resource Institute
Pesticides	Identification of Pests and Diseases of Mango, Papaya and Pineapple	NAICC
	Pest Management Recommendations	ROP
	Management of Major Diseases in Tomato and Chilli in Greenhouses, in Banana, Mango, Papaya and Pineapple	NAICC
	Pest Management Decision Guides for Paddy, Chilli, Beans, Onion, Cabbage, Crops of Cucurbitaceae family, Peanut, Banana, other fruits	CABI and DOA
	Integrated Pest Management (IPM) in Vegetable cultivation Bio-Pesticides Training Module (Working Final) , Pesticide types and activity	NAICC, ATIN, AFACI, ROP, ITC
Fertilizers	Site Specific Fertilizer Recommendation (SSFR) using Soil Test Kit and Plant Test Kit.(LaMotte Analysis Kit)	NAICC、FAO
	Organic Vegetable Cultivation	NAICC
	A Successful Drip Irrigation System to meet the Needs of small Farmers for banana Cultivation	RARDC
	Integrated Plant Nutrient System (IPNS) – Training Manuals	DOA
	Micro Irrigation for Commercial Agriculture	DOA
	Preparing Organic Fertilizer	DOA
Good Agricultural Practices & Worker's health and food safety	Good Agricultural Practices for Mango, Papaya, Guava, Durian, Banana, Pineapple, Passion fruit, Bitter Gourd, Snake Guard, Luffa, Long beans, Gotu kola, Solanaceas Crops, Okra, Pesticide Recommendation	NAICC, AFACI
	National Occupational Safety and Health Policy Special instances of pesticide use, For a healthy food free from pesticide residues How to Minimize Pesticide Residues on Fresh Fruits and Vegetables	MOL&LR, ROP, ITC

Available materials

Existing Effective Techniques (examples)

Category	Effective Techniques	Research Institute
Pest and Disease Control	Introduction of resistant varieties New improved vegetable crops Plant protection to reduce damage of pest and disease	HORDI、FCRDI
	Integrated Pest Management (IPM) Introduction of crop rotation Biological pest control by introduction of natural enemy Disease control of plant viruses by utilizing pheromone trap Control of Melon fly, Leaf minor, yellowing cucumber leafy disease	HORDI、RUSL、FRDI、FCDRI
Fertilizer Application	Fertilizer inputs by soil test kit (FAO supported) Organic fertilizer and compost Cultivation methods of soil conditioning Appropriate application of fertilizer based on utilization and optimization of green house, herbicide, etc. Micro irrigation technology for commercial farms	HORDI、FCRDI、WUSL
Good Agricultural Practices	Gap certification guidelines, Protective kit, Record keeping including cost and profit calculation, Empty bottle & package management	ETC (Agri-Biz), SCS, ROP

Results of field observation and discussion with AIs and farmers at the districts

- Project Team visited all implementing districts in order to
  - inform (through presentation) district staff
  - obtain ideas (through group discussion) from district staff, and
  - observe / gather information on field situation (through field visits)
- Results are documented
- Documents are made available to Working Groups

Activities of other donors

- Many activities relevant to safe and appropriate use of pesticides and fertilizer being conducted by other donors
- Opportunity to supplement / not duplicate
- Some projects
  - Livelihood Enhancement of Small and Medium Scale Agri Producers through Strengthening Supply Chain Structure (SHEP) - JICA
  - FAO
  - ADB
  - KOICA

Project for Livelihood Enhancement of Small and Medium Scale Agri Producers through Strengthening Supply Chain Structure

Reference

Project Outline

Overall Goal:
The livelihoods of small and medium scale farmers in the target area are improved by widely strengthening supply chain structure.

Project Purpose:
The livelihoods of small and medium scale farmers targeted by the project are improved through strengthening related supply chain structure.

Output 4: The experience and knowledge gained through the project are shared widely in the country.

Output 2: Capacity of the target small and medium scale farmers in market-oriented agriculture is developed.

Output 3: The supply chain for horticultural crops in target area is strengthened.

Output 1: Action plan to strengthen the supply chain using market-oriented agricultural extension is formulated and agreed upon by the stakeholders.

Action plan "Market-oriented agricultural extension (SHEP)"

Action plan "Supply Chain Strengthening"

Post Project

2nd phase (Implementation) (3.5 years)

1st phase (Planning)

Project for Livelihood Enhancement of Small and Medium Scale Agri Producers through Strengthening Supply Chain Structure

Reference

Relevant Project Activities

Preparation of "**Crop handbook**" for the target farmers.

- farmer-friendly and simple with necessary image and illustrations to attract farmers.
- developed per selected crop.
- consists of two chapters:
    1) DOA' recommendation and
    2) JP horticulture expert's techniques.

(5) Approach of Working Groups for developing Action Plan

- Assessing and identification of focus areas relevant to WG
- Identification of key activities (in line with development flow)
- Identification of action steps for each activity
- Preparation of Working Group Action Plan

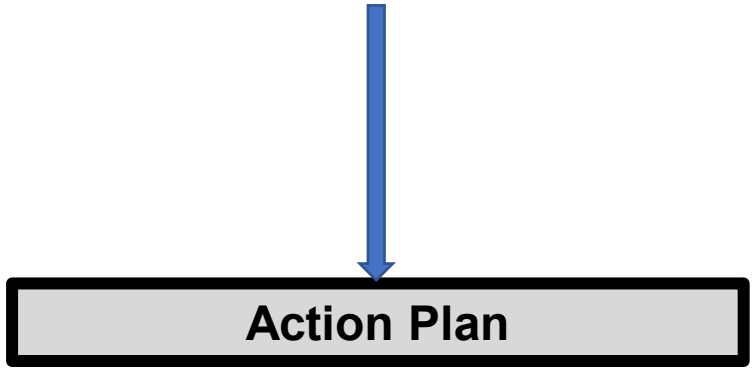
Proposed format for Working Group Action Plan

ACTION PLAN of PESTICIDE / FERTILIZER / GAP WORKING GROUP (for preparing Technology and Extension Packages as per DEVELOPMENT FLOW)				
KEY ACTIVITIES	KEY ACTION STEPS	RESPONSIBLE	TIME FRAME	NOTES
Focus Area : Field Sanitation - Field Management to Prevent Pests and Diseases				
Reviewing existing information (technique/s for focus area)	Collect available information			
	Critically evaluate available information			
Improve existing information	Update them			
Pilot testing	Prepare testing log sheet			
	Pilot test			
Focus Area :				

For Example

Formalities and Time Frame

1st meeting	Before 17th November
2nd meeting	Before 01st December
3rd meeting	Before 15th December
Joint Working Group workshop	Before 22nd December



By end of December

Implementation
(Jan 2024-Dec 2024)

Thank You

Attachment-14

Action Plans in each WG

ACTION PLAN of PESTICIDES WORKING GROUP (for preparing Technology and Extension Packages as per DEVELOPMENT FLOW)					
KEY ACTIVITIES	KEY ACTION STEPS	RESPONSIBLE OFFICERS (Leader is highlighted)	TIME FRAME	APPOX. COST (Rs. '000)	NOTES
Focus Area 1: Pest and disease identification, and control					
1. Development of user-friendly farmer guide booklets / cards with QR codes **Priority No. 2**	• Collection of photos and diagrams of causative agents and symptoms at different crop stages and pesticide recommendations • Designing and developing cards with QR code in local languages • Feeding of other information to a web page enabling to receive using QR code	Mrs. Akila Hadji Ms. K. Pushpanji Mrs. S. Hettiarachchi Mrs. P. Ranaweera Mrs. S. Fernando Mrs. S. Tennakoon Dr. J. Marasinghe	1 year	340	This is a pictorial guide for pest and diseases identification with QR code to get further information on control measures from a website. Information in existing materials is used for the development of guide and web page. Selected crops - tomato, brinjal, cabbage, potato, beans Selected pest & diseases - sucking pest complex, pod borer, caterpillar complex, Tuta, bacterial wilt, nematodes, late & early blight, viral diseases, fusarium wilt, club root disease, black rot, anthracnose, rust, angular leaf spot
2. Validation of rapid test kit for disease identification **Priority No. 4**	• Identification and purchasing of rapid test kit for identifying selected diseases • Field testing	Mrs. S. Fernando Ms. K. Pushpanji	1 year	470*	There is evidence of the availability of kits * To consider only if funds available Selected districts – Nuwaraeliya and Badulla
3. Testing of colour sticky traps as a scouting / monitoring method and intervals with respect to for selected pests **Priority No. 3**	• Literature survey for information gathering • Selection of scouting methods / tools for testing and development of testing protocols / design • Testing • Development of manuals / guidelines	Mrs. S. Hettiarachchi Mrs. Akila Hadji Mrs. P. Ranaweera	1 year	1,320	Need knowledge and available tools from Japan (e.g. sticky cards, traps) Selected crops - tomato, brinjal, cabbage Selected pests & diseases - Tuta, potato - tuber moth, potato - white grub, potato/tomato -early & late blight, sucking pests
Focus Area 2: Alternative pesticides and mixtures					
1. Upgrading of Pesticide Recommendation manual in user friendly manner **Priority No. 1**	• Translation of selected sections into Sinhala and Tamil • Inclusion of pictures of relevant pests and diseases • Type setting and preparing upgraded version	Dr. J. Marasinghe Mrs. Akila Hadji Ms. K. Pushpanji Mrs. S. Hettiarachchi Mrs. P. Ranaweera Mrs. S. Fernando Mrs. S. Tennakoon	1 year	270	Selected crop - tomato, brinjal, bean, cabbage, potato Selected pest & diseases - sucking pest complex, pod borer, caterpillar complex, Tuta, bacterial wilt, nematodes, late & early blight, viral diseases, fusarium wilt, club root disease, black rot, anthracnose, rust, angular leaf spot

2. Demonstration / validation of effectiveness of reported less effective pesticides in Kalpitiya **Priority No. 5**	● Conducting a survey for identifying famer perceived less effective pesticides ● Development of demonstration protocol ● Field demonstration / validation ● Preparation of manual	Mr. P. Nishantha	1 year	560	Demonstration is done with 1 farmer
Focus area 3: Pesticide residue control					
1. Testing of rapid test kit for detecting residues in vegetables and water **Priority No. 6**	● Identification of potential rapid test kit for pesticide residue screening ● Validation of test kit at the laboratory ● Verification of potential for use of test kit ● Preparation of manual	Mrs. C. Magamage Dr. J. Marasinghe	1 year	250	There is evidence on the availability in Japan, Korea and Thailand

ACTION PLAN of FERTILIZER WORKING GROUP

(for preparing Technology and Extension Packages as per DEVELOPMENT FLOW)

KEY ACTIVITIES	KEY ACTION STEPS	RESPONSIBLE OFFICER	TIME FRAME	APPOX. COST (Rs. '000)	NOTES
Focus Area 1: Soil type and area specific fertilizer recommendations for vegetables					
1. Development of area specific nutrient management packages for cabbage, capsicum and tomato **Priority No. 1**	• Collection of information on existing fertilizer recommendation and survey of farmers' fertilizer application practices (solid, liquid and mix fertilizers) (local and foreign)	Mrs. A. Mayakaduwa Mrs. P. Delpitiya Mrs. Renuka Silva Dr. M. Kodikara	1 year	1,300	Selected districts and crops – Badulla – Cabbage, tomato Kalpitiya – Cabbage, capsicum Treatments – New package, Current recommended package, Farmers practice
	• Preparation of suitable nutrient management packages and development of testing protocol / design				
	• Field testing				
	• Quality testing (contaminants) of inputs and produces				
	• Preparation of manuals and extension packages				
Focus Area 2: New rapid soil and leaf test methods for N, P, K management of vegetables and fruits					
1. Development of rapid method for N management **Priority No. 3**	• Identification of suitable digital test kits and suppliers (local and foreign) and purchasing of test kits	Mrs. Renuka Silva Mrs. P. Delpitiya Mrs. A. Mayakaduwa Dr. M. Kodikara	1 year	700	Selected crop – Tomato Selected districts for verification Nuwara Eliya, Badulla, Puttala (Kalpitiya area)
	• Development of correlation				
	• Calibration with field level measurements				
	• Development of recommendation				
	• Verification of potential for use of test kit				
	• Preparation of manuals				
2. Calibration of soil test kits for P, K fertilizer recommendation **Priority No. 4**	• Identification of suitable digital test kits (having capacity to test pH also) and suppliers (local and foreign) and purchasing of test kits	Mrs. Renuka Silva Mrs. A. Mayakaduwa Dr. M. Kodikara	1 year	1,000	Selected districts and crops Nuwara Eliya – Capsicum Badulla - Capsicum Puttalam (Kalpitiya area) - Capsicum
	• Calibration with field level measurements				
	• Development of recommendation using collected data and development of testing protocol / design				
	• Field testing				

Focus Area 3: Nutrient management package for protected agriculture crops for safe crop production					
1. Development of nutrient management packages for protected (green house) agriculture crops in NE/Badulla **Priority No. 2**	• Collection of information on existing nutrient management packages and survey of farmers' nutrient management practices (local and foreign)	Dr. M. Kodikara Mrs. A. Mayakaduwa Mrs. Renuka Silva	1 year	600	To be done in Research Stations as it is difficult to obtain farmer's green houses Selected locations RARDC, Bandarawela ARS, Seethaeliya Crops – Tomato, Capsicum
	• Preparation of suitable nutrient management packages for soilless and soil media and development of testing protocol / design				
	• Field testing				
	• Quality testing of produce				
	• Preparation of manuals				

ACTION PLAN of GAP WORKING GROUP (for preparing Technology and Extension Packages as per DEVELOPMENT FLOW)					
KEY ACTIVITIES	KEY ACTION STEPS	RESPONSIBLE OFFICER (Leader is highlighted)	TIME FRAME	APPOX. COST (Rs.'000)	NOTES
Focus Area 1: Workers personal safety (Protective clothing and awareness)					
1. Sensitization on safe use of pesticide and fertilizer: **Priority: 1**					
1.1. Sensitization campaign.	● TV advertisements ● Campaigns through extension materials (Posters / FB posts / short video clips) and street drama	Mr. L.K. Samantha Mrs. P. Thennakoon	1 year	1100*	* Except telecasting cost This activity includes sensitization as follows: - Stakeholders on safe use of pesticide and fertilizer in general - Importance of use of safety kits and - identification of appropriate safety kits - Farmers on safe disposal of packing materials of pesticide and fertilizer - Farmers on best practice of safe storage
1.2. Introduction of appropriate record-keeping system.	• Studying available record-keeping methods • Identification & development of alternative method and mode of record keeping • Development of testing protocol / design • Testing and validation of selected record keeping method and mode	Dr. (Mrs.) U.T. Erabadupitiya	6 months	200	
1.3. Identify, evaluate & recommend best personal protective equipment (PPE – safety kit) for hot & cooler regions.	• Use survey data to identify the percentage use of PPE • Introduction of an appropriate kit of PPE to selected farmers	Mr. A.S.M. Roshan			
2. Improvement of existing empty bottle collecting mechanism **Priority: 4**	● Designing & introducing incentive driven farm level collecting model / system ● Strengthening of village level collectors' capacity by providing poly-sack bags ● Preparation of instruction materials to farmers including leaflets / banners / field boards	Mr. L.K. Samantha	6 months	1000	This activity should be implemented in manageable scale within 1 year and consider receiving financial support from other relevant party such as Crop Life. In case of any budget deficit observed in any priority activity, the total allocation for this activity will be reduced accordingly.
Focus Area 2: Field sanitation					

1. Evaluation of pruning as a field sanitation technology for vegetables/ fruits **Priority: 2**	● Development of protocols ● Establishment of pilot plots ● Report writing & technical material development	Dr.Mrs. P.H. Ranaweera Mrs. C. Abhayagunasekara	6 months	300	Both the activities of the Focus Area-2 will be demonstrated within the same field (both pruning & crop waste/residue disposal). These 2 activities will be done within Matale District (giving priority to Brinjal
2. Evaluation of disposal method for infected plant parts **Priority: 2**	● Identification of methods and development of testing protocol / design ● Establishment pilot plots ● Demonstration and technical material development ● Identification & development of alternative method and mode of record keeping ● Development of testing protocol / design ● Testing and validation of selected record keeping method and mode	Ms. C. Abhayagunasekara Mrs. P.H. Ranaweera	1 year	300	-same as above-
Focus area 4: Non chemical methods of pest and disease management					
1. Promoting of non-chemical pest and disease control methods **Priority: 3**	● Development of demonstration protocol / design ● Farmer fields demonstration (yellow bulb system, single row cover)	Mr. P. Nishantha Mrs. A. Hadji. Mrs. S. Hettiarachchi	1 year	1000	Non chemical methods yellow lighting/bulb (pod borer) – brinjal, cabbage raised bed with silver mulch (root borne diseases)

Attachment-15

Proposal for Key Activities

Pesticides Working Group (WG1)

Proposals for Key Activities

P1. Upgrading of Pesticide Recommendation manual in user friendly manner

P2. Development of user-friendly farmer guide booklets / cards with QR codes

P3. Testing of color sticky traps as a scouting / monitoring method for selected pests

P1. Proposal for Key Activity

1. **Focused area:** Alternative pesticides and mixtures

2. **Key activity:** Upgrading of Pesticide Recommendation manual in user friendly manner **(2-1)**

3. **Justification / Purpose:** The Pesticide Recommendation manual comprises all pesticides recommended for all pests and diseases of crops in a compact form in English. If information suitable to identify these pests and diseases is included and translated into local languages it can be made more useful. Thus, the purpose is to enhance the ability to identify pests and diseases and get information on recommended pesticides of selected crops in a more user-friendly manner.

4. **Expected output:** User-friendly pesticide recommendation manuals in English, Sinhala and Tamil covering tomato, brinjal, cabbage, beans and potato. Other crops will be included later on under the government funds.

5. **Linkage with Project Output 3 activities:** Multiplication of manuals and using them in trainings as well as distribution to trainees (Master trainers, AIs and farmers)

6. **Key action steps:**
   1 Translation of selected section into Sinhala and Tamil
   2 Inclusion of pictures of relevant pests and diseases
   3 Type setting and preparing upgraded version

5. **Details of implementation of key action steps:**

Action step1 Translation selected section into Sinhala and Tamil

Brief description of implementation methodology including outputs, responsible officers and place of action
Sections relevant to pests and diseases of tomato, brinjal, cabbage, beans and potato with pesticide recommendations are extracted and translated into Sinhala and Tamil. Responsible officers will do Sinhala translation and a translator is hired for Tamil translation. Responsible officers – Dr. J. Marasinghe

Action step2 Inclusion of pictures of relevant pests and diseases

Brief description of implementation methodology including outputs, responsible officers and place of action
High resolution pictures of each pest and disease out of the pictures collected for Activity 1-1 are identified for each pest and disease. Responsible officers - Dr. J. Marasinghe, Mrs. A. Hadji (Tomato), Mrs. S. Fernando (Brinjal), Mrs. S. Hettiarachchi (Cabbage), Mrs. P. Ranaweera (Beans), Mrs. K. Pushpanji (Potato)

Action step3 Typesetting and preparing upgraded version

Brief description of implementation methodology including outputs, responsible officers and place of action
An appropriate design will be developed, contents (English and translated contents) will be typed set and proofread, appropriate pictures are inserted, and upgraded pesticide recommendation manuals in English, Sinhala and Tamil will be developed. Responsible officers – Mrs. J. Marasinghe, Mrs. S. Tennakoon

6. **Budget for implementation:**

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Translation of selected sections into Sinhala and Tamil						
Material cost						
Human resource cost	Tamil translation	1,000.00	50 pages	50,000.00		
Transportation cost	Fuel for short distances	2,000.00	15 trips	30,000.00		

			Sub Total	**80,000.00**		
Action Step2: Inclusion of pictures of relevant pests and diseases						
Material cost	Photos (from Act. 1-1)	0	100	0.00		
Human resource cost						
Transportation cost						
			Sub Total	**0.00**		
Action step3: Type setting and preparing upgraded version						
Material cost						
Human resource cost	Per-diem for ROs	2,500.00	14 persons (7 per. X 2 meetings)	35,000.00		
	Type setting (Sinhala)	500.00	50 pages	25,000.00		
	Type setting (Tamil)	500.00	50 pages	25,000.00		
	Type setting (English)	500.00	50 pages	25,000.00		
	Editing/proofreading	200.00	150 pages	30,000.00		
Transportation cost	Fuel for meetings	10,000.00	5 trips	50,000.00		
			Sub Total	**190,000.00**		
			Grand Total	**270,000.00**		

7. **Schedule of implementation: (To be done simultaneously with activity 1-1)**

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1 Translation of selected sections into Sinhala and Tamil															
Trans. into Sinhala			■	■	■	■									
Trans. into Tamil			■	■	■	■									
Action step2 Inclusion of pictures of relevant pests and diseases															
Picture identification						■									
Action step3 Typesetting and preparing upgraded version															
Designing & finalizing contents c							■								
Type setting							■	■							
Editing/proofreading								■	■						

End of notes

P2. Proposal for Key Activity

1. **Focused area:** Pest and disease identification, and control

2. **Key activity:** Development of user-friendly farmer guide booklets / cards with QR codes **(1-1)**

3. **Justification / Purpose:** Farmers are unable to correctly identify pests and diseases and also they are not well aware of the control measures recommended by the DOA. Thus, pictorial cards with essential control measures (i.e. pesticide recommendations) are useful guides for efficient pest control. Further, easy access to additional information relevant to identified pests will be important in this regard. Thus, pictorial cards with QR codes linking a web site that contains additional information will be very useful for farmers to easily identify pests and disease and get further information on preventive and control measures. In addition, information on the crop such as crop manuals prepared by SHEP can also be uploaded into this web site to improve the information accessibility.

4. **Expected output:** Sets of user-friendly pest management pictorial cards (possibly folded A4 size) with QR codes each for tomato, brinjal, cabbage, beans and potato in Sinhala and Tamil

5. **Linkage with Project Output 3 activities:** Multiplication of sets of pictorial cards and using them in trainings as well as distribution to trainees (master trainers, AIs and farmers); Uploading of crop handbooks developed by SHEP project to the web site

6. **Key action steps:**
   1 Collection of photos and diagrams of causative agents and symptoms at different crop stages and pesticide recommendations
   2 Designing and developing cards with QR code in local languages
   3 Feeding of other information to a web page enabling to receive using QR code

7. **Details of implementation of key action steps:**

Action step1 Collection of photos and diagrams of causative agents and symptoms at different crop stages and pesticide recommendations

Brief description of implementation methodology including outputs, responsible officers and place of action
The officers as well as NAICC have photos of causative agents and symptoms of pests and diseases at different crop stages. The photos of selected pests and diseases (sucking pest complex, pod borer, caterpillar complex, tuta, nematodes, late & early blight, bacterial wilt, viral diseases, fusarium wilt, club root disease, black rot, anthracnose, rust, angular leaf spot etc.) of tomato, brinjal, cabbage, beans and potato are obtained from these collections. New photos and diagrams are also collected. New photos may be taken by responsible officers / AIs with the help of NAICC's photographic team. There are recommendations in the Pesticide Recommendation manual. Additional information on pest and disease management, and crop management (SHEP crop handbooks etc.) is also collected. Responsible Officers – Mrs. A. Hadji (Tomato), Mrs. S. Fernando (Brinjal), Mrs. S. Hettiarachchi (Cabbage), Mrs. P. Ranaweera (Beans), Mrs. K. Pushpanji (Potato)

Action step2 Designing and developing cards with QR code in local languages

Brief description of implementation methodology including outputs, responsible officers and place of action
A page layout is prepared for entering information (photos on front page and chemical control measures on back page). Several photos of each pest/disease of each crop are included on the front page with a QR code. Respective pesticide recommendations already translated into Sinhala and Tamil under the Activity 2-1 are taken into the other page separately. Pages are typed set and proof read. Responsible Officers – Mrs. A. Hadji, Mrs. S. Tennakoon

Action step3 Feeding of other information to a web page enabling to receive using QR code

Brief description of implementation methodology including outputs, responsible officers and place of action
Additional information (on pest and disease management) collected is translated into Sinhala and Tamil and is fed into a website as subdomain in the DOA website in a form that can be accessed by smartphone using each QR code. Any other relevant information (e.g. GOVI Mithuru, SHEP crop handbooks) is also uploaded. Responsible Officer – Mrs. S. Tennakoon, Dr. J. Marasinghe

8. Budget for implementation:

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Collection of photos and diagrams of causative agents and symptoms at different crop stages and pesticide recommendations						
Material cost						
Human resource cost	Per-diem – NAICC Photographers	2,500.00	5 persons (1 per. X 5 visits)	12,500.00		
	Per-diem - R.O.'s	2,500.00	5 persons (1 per. X 5 visits)	12,500.00		
Transportation cost	Fuel – NAICC photographers	15,000.00	5 visits	75,000.00		
	Fuel - R.O's	10,000.00	5 visits	50,000.00		
			Sub Total	**150,000.00**		
Action Step2: Designing and developing cards with QR code in local languages						
Material cost						
Human resource cost	Per-diem – meeting for layout prep.	2,500.00	6 persons (6 per. x 1 meeting)	15,000.00		
	Type setting	500.00	50 pages	25,000.00		
Transportation cost	Fuel for meeting	10,000.00	5 trips	50,000.00		
			Sub Total	**90,000.00**		
Action step3: Feeding of other information to a web page enabling to receive using QR code						
Material cost						
Human resource cost	Translation into Tamil	1,000.00	50 pages	50,000.00		
	DOA website rearran gement (NAICC)	by IT officer	1 sub domain	00		
	Data entry	1,000.00	50 pages	50,000.00		
Transportation cost						
			Sub Total	**100,000.00**		
			Grand Total	**340,000.00**		

9. Schedule of implementation: (To be done simultaneously with activity 2-1)

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step 1 Collection of photos and diagrams of causative agents and symptoms at different crop stages and pesticide recommendations															
Collection of photos															
Collection of recomd's															
Action step 2 Designing and developing cards with QR codes in local languages															
Lay out preparation															
Type setting															
Editing/proofreading															
Action step 3 Feeding of other information to a web page enabling to receive using QR code															
Translation into Tamil															
DOA-Website rearrangement															
Data entry															
Proofreading															

End of notes

P3. Proposal for Key Activity

1. **Focused area:** Pest and disease identification, and control

2. **Key activity:** Testing of color sticky traps as a scouting / monitoring method for selected pests **(1-3)**

3. **Justification / Purpose:** Certain pests and diseases can easily be managed when their populations are monitored. Use of yellow sticky traps has been presented in several extension materials* without clear information. Purpose of this activity is to provide clear information on sticky traps for farmers to identify and predict the threat of pests enabling them to take control measures in time.

4. **Expected output:** Guideline / manual for farmers (recommendation) on use of sticky traps (containing information on all aspects such as making, establishing, counting of sticky traps) for determining time of pesticide application for most important pest of each cabbage, tomato and brinjal in Sinhala and Tamil.

5. **Linkage with Project Output 3 activities:** Multiplication of manual and using it in trainings as well as distribution to trainees (Master trainers, AIs and farmers); Incorporation of information on use of sticky traps into existing SHEP handbooks on tomato, brinjal and cabbage cultivation and use them as training materials in Sinhala and Tamil

6. **Key action steps:**
   1 Literature survey for information gathering
   2 Selection of scouting methods / tools for testing and development of testing protocols / design
   3 Testing
   4 Development of manuals/guidelines

7. **Details of implementation of key action steps:**

Action step1 Literature survey for information gathering

Brief description of implementation methodology including outputs, responsible officers and place of action
Literature is collected on available scouting methods suitable for diamond black moth (cabbage), tuta (tomato) and shoot pod borer & sucking pests (brinjal). Responsible Officer - Mrs. S. Hettiarachchi, Mrs. A. Hadji, Mrs. P. Ranaweera

Action step2 Selection of scouting methods / tools for testing and development of testing protocols / design

Brief description of implementation methodology including outputs, responsible officers and place of action
Based on the information and ability to get materials, scouting using sticky traps (yellow, blue, red, green and white) is selected and testing protocols are developed for cabbage in Nuwaraeliya, tomato in Badulla and brinjal in Matale collectively by all officers involved through an online discussion. Responsible Officers - Mrs. S. Hettiarachchi, Mrs. A. Hadji, Mrs. P. Ranaweera

Action step3 Testing

Brief description of implementation methodology including outputs, responsible officers and place of action
The methods (5 colors) are tested in 6 farm fields/cultivations in 6 locations (Magoda & Meepilimana in Nuwaraeliya - cabbage, Boralanda & Kahagolla in Badulla - tomato, and Walewela & Yatawatta in Matale - brinjal) according to the protocol developed (1000 m2 cultivation, 4 traps of each color (5) = 20 nos./field, weekly installation starting 2 weeks after planting for 10 times). Farm fields in different locations are selected to capture the presence of possible differences in pest populations. Farmers who plan to cultivate respective crops are selected. Farmers are expected to establish and manage the crop. Chemical pesticide application is not restricted. Once the trials are established, part of fertilizers required for cultivations is provided as an incentive. Pest count, natural enemy count and neutral insect count at order level are taken. Responsible Officers - Mrs. S. Hettiarachchi (Nuwaraeliya), Mrs. A. Hadji (Badulla) Mrs. P. Ranaweera (Matale)

Action step4 Development of manuals/guidelines

Brief description of implementation methodology including outputs, responsible officers and place of action
Guidelines for farmers (recommendation) based on the test results are prepared. Responsible Officers - Mrs. S. Hettiarachchi (cabbage), Mrs. A. Hadji (tomato) Mrs. P. Ranaweera (brinjal)

8. Budget for implementation:

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Literature survey for information gathering						
Material cost						
Human resource cost						
Transportation cost						
				Sub Total	**0.00**	
Action Step2: Selection of scouting methods / tools for testing and development of testing protocols / design						
Material cost						
Human resource cost						
Transportation cost						
				Sub Total	**00.00**	
Action step3: Testing						
Material cost	Sticky traps[@]	350.00	1,500 nos.	525,000.00		
	Fertilizers etc.	30,000.00	6 farms	180,000.00		
Human resource cost	Per-diem for R.O.s (field visits)	2,500.00	45 days (15 times x 3 districts)	112,500.00		
	Per-diem for S.O.s (field visits)	2,500.00	12 days (4 days x 3 districts)	30,000.00		
	Per-diem for F.O.s	2,000.00	12 days (4 days x 3 districts)	24,000.00		
Transportation cost	Fuel for R.O.s field visits	5,000.00	45 visits (15 times x 3 districts)	225,000.00		
	Fuel allows. for S.O.s	3,000.00	12 days (4 days x 3 districts)	36,000.00		
	Fuel allows. for F.O.s	3,000.00	12 days (4 days x 3 districts)	36,000.00		
				Sub Total	**1,168,500.00**	
Action step4 Development of manuals/guidelines						
Material cost	Refreshment (meetings)	700.00	9 persons (3 per. x 3 meetings)	6,300.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	6 persons (2 from outsations x 3 meetings)	15,000.00		
	Translation into Tamil	1,000.00	45 pages (3 crops x 15 pgs)	45,000.00		
	Type setting	500.00	45 pages	22,500.00		
Transportation cost	Fuel for meetings	10,000.00	6 persons (2 from outstations x 3 meetings)	60,000.00		
				Sub Total	**148,800.00**	
				Grand Total	**1,317,300.00**	

[@]4 nos. x 5 colors x 10 times x 2 farmers x 3 districts = 1,200 nos.

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Literature survey for information gathering															
Literature survey															
Action step2: Selection of scouting methods / tools for testing and development of testing protocols / design															
Online discussion															
Action step3: Testing															
Cabbage in Nuwaraeliya															
Farmer selection															
Crop establishment															
Crop maintenance															
Tomato in Badulla															
Farmer selection															
Crop establishment															
Crop maintenance															
Brinjal in Matale															
Farmer selection															
Crop establishment															
Crop maintenance															
Action step4: Development of manuals/guidelines															
Draft preparation															
Translation into Tamil															
Type setting															

End of notes

*** References**

1. Department of Agriculture (2011). Tomato Cultivation

Whitefly Management
Yellow traps with a sticky surface can be installed in the cultivation to gain insight into the whitefly population. Check for whitefly periodically from the time the plant has about three leaves. Generally, if there are about 10 adult whiteflies per plant, or if there is one larva or pupae, control methods should be followed. (Page Number: 42-43)

Leaf miner Management
Yellow polythene traps with sticky surfaces can be installed in the cultivation to gain a clear idea about the population of leaf miner. (Page Number: 45)

2. දේවිකා ද කොස්තා (2022). සාමෝධානිත ශාක රෝග පාලනය. 40pp

මිරිස් හා තක්කාලි වගාවන් සඳහා භාවිතා කල රෝග පාලන ක්‍රම

ක්‍රමය	විස්තරය	හේතුව
කහ පැහැති ප්ලාස්ටික් පතුරු වලින් සෑදූ ඇලෙන උගුල් භාවිතය	15×15 cm ප්‍රමාණයේ පතුරු වල වැස්ලින් තවරා පත්‍ර වියනට 15 cm පමණ උසින් එල්ලීම. වර්ග මීටර් 25 ක ක්ෂේත්‍රඵලයකට මෙවැනි උගුල් 4ක් පමණ එල්ලිය යුතුය	කෘමී පලිබෝධ ඝනත්වය සහ වයිරස් වාහකයන්ගේ ඝනත්වය අඩු කර ගැනීම.

(Page Number 31)

P4 - Proposal for Key Activity

1. **Focused area: Pest and disease identification, and control**

2. **Key activity:** Validation of rapid test kit for disease identification

3. **Justification / Purpose:** Using this rapid identification method, some plant diseases can be identified at early stages especially seed-borne virus diseases. This method also helps to differentiate diseases that might cause identification confusions leading to a more accurate diagnosis. These quick confirmations can be conveniently performed directly in the field too.

4. **Expected output:**
   Manuals on suitable immuno strips for selected major vegetable disease identification under field condition

5. **Linkage with Project Output 3 activities:** The manual will be multiplied and be used as a training material

6. **Key action steps**
   (1) Identification and purchasing of immuno strips for selected major vegetable diseases
   (2) Testing and validation them for the local conditions
   (3) Preparation of manuals

7. **Details of implementation of key action steps:**

Action step1: Identification and purchasing of immuno strips for selected major vegetable diseases

Brief description of implementation methodology including outputs, responsible officers and place of action
Suitable immuno strips for selected major vegetable diseases are identified through online literature search. After following the purchasing procedures, buy the immuno strips for selected major vegetable diseases. Responsible officers: Ms. Sobashini Fernando and Ms. K. Pushpanji

Action step2: Testing and validation them for the local conditions

Brief description of implementation methodology including outputs, responsible officers and place of action
After the collecting field samples, immune strip will be tested for selected major vegetable diseases and validation will be done. Responsible officers: Ms. Sobashini Fernando and Ms. K. Pushpanji

Action step3: Preparation of manuals

Brief description of implementation methodology including outputs, responsible officers and place of action
Recommendation report reflecting the results is prepared in Sinhala and Tamil. Responsible officers: Ms. Sobashini Fernando and Ms. K. Pushpanji

8. **Budget for implementation:**

Categories	Item/Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Identification and purchasing of immuno strips for selected major vegetable diseases						
Material cost	Immuno strips	100,000.00	2 sets	2000,000.00		
Human resource cost						
Transportation cost						
				Sub Total	**200,000.00**	
Action Step2: Testing and validation them for the local conditions						
Material cost						
Human resource cost	Per-diem for R.O.s	2,500.00	10 persons (2 per. x 5 visits)	25,000.00		
	Fuel for visits	10,000.00	5 visits	50,000.00		

Transportation cost						
			Sub Total	**75,000.00**		
Action step3: Preparation of manuals						
Material cost						
Human resource cost	Translation into Tamil	1,000.00	10 pages	10,000.00		
	Type setting	500.00	20 pages	10,000.00		
Transportation cost						
			Sub Total	**20,000.00**		
			Grand Total	**295,000.00**		

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Purchasing immuno strips for selected major vegetable diseases															
Identification															
Purchasing															
Action step2: Testing and validation them for the local conditions															
Sample collect. and testing															
Action step3: Preparation of manuals															
Draft preparation															
Translation-Tamil															
Type setting															

End of notes

P5 - Proposal for Key Activity

1. **Focused area: Alternative pesticides and mixtures**

2. **Key activity:** Demonstration / validation of effectiveness of reported less effective pesticides in Kalpitiya

3. **Justification / Purpose:** Recent feedback from

4. the local farming community has highlighted a decline in the effectiveness of the pesticides, leading to increase use of un-recommended / strong / illegal pesticides and potential economic hardships. Thus demonstration / validation of efficacy is essential in order to restore the farmers' confidence or to take appropriate future actions if found not effective.

5. **Expected output:**
   Evaluation report on reported less effective pesticides used on cabbage in Kalpitiya and proof of the most effective pesticide for cabbage

6. **Linkage with Project Output 3 activities:** The findings will be incorporated to SHEP manual on Cabbage and be used as a training material

7. **Key action steps:**
   (1) Conducting a survey for identifying farmer perceived less effective pesticides
   (2) Development of demonstration protocol
   (3) Field demonstration / validation
   (4) Preparation of recommendation

8. **Details of implementation of key action steps:**

Action step1: Conducting a survey on farmers

Brief description of implementation methodology including outputs, responsible officers and place of action
A questionnaire survey is conducted on 20 farmers to identify pesticides that are reported as less effective for cabbage caterpillar complex by farmers in Kalpitiya Responsible officers: Mr. P. Nishantha, Dr. J. Marasinghe

Action step2: Development of demonstration protocol

Brief description of implementation methodology including outputs, responsible officers and place of action
Pesticides that are suitable to be demonstrated are selected based on the survey results out of the recommended pesticides for cabbage caterpillar complex. The demonstration protocol is developed. Responsible officers: Mr. P. Nishantha, Dr. J. Marasinghe

Action step3: Field demonstration / validation

Brief description of implementation methodology including outputs, responsible officers and place of action
A farmer planning to start approx. 1000 m^2 cabbage cultivation is selected in Kalpitiya. He will be given seeds and fertilizers. Cultivation is divided into plots (preferably 5 m x 5 m size) ensuring to obtain sufficient number of plots to accommodate each pesticide three times. Pesticides are applied according to the DOA recommendation. Efficacy is evaluated by observing pest counts just before, 3 days after and 7 days after each application of pesticides for 2 times. Responsible officers: Mr. P. Nishantha, Dr. J. Marasinghe

Action step4: Preparation of recommendation

Brief description of implementation methodology including outputs, responsible officers and place of action
Recommendation report reflecting the results is prepared in English, Sinhala and Tamil. Responsible officers: Mr. P. Nishantha, Dr. J. Marasinghe

9. **Budget for implementation:**

Categories	Item/Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Conducting a survey on farmers						
Material cost						
	Per-diem for R.O.s	2,500.00	4 persons	10,000.00		

Human resource cost			(2 per. x 2 days)			
	Per-diem for DSOs	2,500.00	2 days	5,000.00		
	Per-diem for AIs	2,000.00	2 days	4,000.00		
Transportation cost	Fuel for R.O.s	20,000.00	2 visits	40,000.00		
	Fuel allow. for DSOs	3,000.00	2 days	6,000.00		
	Fuel allow. for AIs	3,000.00	2 days	6,000.00		
			Sub Total	**71,000.00**		
Action Step2: Development of demonstration protocol						
Material cost						
Human resource cost						
Transportation cost						
			Sub Total	**00**		
Action step3: Field demonstration / validation						
Material cost	Seeds, fert. etc.	100,000.00	1 farmer	100,000.00		
	Pesticides	10,000.00	1 farmer	60,000.00		
Human resource cost	Per-diem for R.O.s	2,500.00	16 persons (2 pers. x 8 days)	40,000.00		
	Per-diem for DSOs	2,500.00	8 days	20,000.00		
	Per-diem for AIs	2,000.00	8 days	16,000.00		
Transportation cost	Fuel for R.O.s	20,000.00	8 visits	160,000.00		
	Fuel allow. for DSOs	3,000.00	8 days	24,000.00		
	Fuel allow. for AIs	3,000.00	8 days	24,000.00		
			Sub Total	**444,000.00**		
Action step4: Preparation of recommendation						
Material cost						
Human resource cost	Translation into Tamil	1,000.00	10 pages	10,000.00		
	Type setting	500.00	20 pages	10,000.00		
Transportation cost						
			Sub Total	**20,000.00**		
			Grand Total	**535,000.00**		

10. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Conducting a survey on farmers															
Farmer survey															
Action2															
Action step2: Development of demonstration protocol															
Selection of pesti															
Protocol. devpt.															
Action step3: Field demonstration / validation															
Farmer selection															
Crop establishmer															
Crop maintenance															
Action step4: Preparation of recommendation															
Draft preparation															
Translation-Tamil															
Type setting															

End of notes

P6 - Proposal for Key Activity

1. **Focused area: Pesticide residue control**

2. **Key activity:** Testing of rapid test kit for detecting residues in vegetables and water

3. **Justification / Purpose:** Due to the high cost of analysis it seems that identifying a screening method for pesticide residue determination is very important. So, in this event, a pesticide test kit will be identified as a screening method.

4. **Expected output:** Recommendation on rapid test kit for determining pesticide residues.

5. **Linkage with Project Output 3 activities:** The manual will be multiplied and be used as a training material

6. **Key action steps:**
   (1) Identification of a potential test kit for pesticide residue screening
   (2) Validation of test kit at the laboratory
   (3) Verification of potential for use of test kit
   (4) Preparation of manual

7. **Details of implementation of key action steps:**

Action step 1: Identification of a test kit for pesticide residue screening

Brief description of implementation methodology including outputs, responsible officers and place of action
Potential test kit is identified through literature search conducted on line. Responsible officer: Mrs. C. Magamage

Action step 2: Validation of test kits at the laboratory

Brief description of implementation methodology including outputs, responsible officers and place of action
A mixture of appropriate pesticides is applied to 5 clean cabbage samples generating a series of known contaminated concentrations (Spiking). They are then screened by Test kit to determine the responsive level. Contaminated concentrations are verified by laboratory analysis with LC-MS/MS using the QuCHERS extraction method in the Central Analytical Laboratory of HORDI. Responsible officers: Mrs. C. Magamage and Dr. J. Marasinghe

Action step 3: Verification of potential for use of test kit

Brief description of implementation methodology including outputs, responsible officers and place of action
15 samples of farm produce (5 from each cabbage, chili and onion) are collected from Kalpitiya. Sample collection is done by trained personnel using suitable equipment and packing materials. Samples are transported to laboratory at HORDI under cooling conditions. They are screened with test kits in the laboratory. The contaminated samples will be analyzed as above. Result evaluation and risk analysis are performed. Responsible officers: Mrs. C. Magamage and Dr. J. Marasinghe

Action step 4: Preparation of manual

Brief description of implementation methodology including outputs, responsible officers and place of action
Manual on how to use the rapid test kit reflecting the test results is prepared in Sinhala and Tamil. Responsible officers: Mrs. C. Magamage and Dr. J. Marasinghe

8. Budget for implementation:

Categories	Item/Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Identification of a test kit for pesticide residue analysis						
Material cost	Test kits			00		
Human resource cost						
Transportation cost						
			Sub Total	**00**		
Action Step2: Validation of test kits at the laboratory						
Material cost	Lab chemicals			50,000.00		
Human resource cost						
Transportation cost						
			Sub Total	**50,000.00**		
Action step3: Verification of potential for use of test kit						
Material cost	Lab chemicals			150,000.00		
Human resource cost	Per-diem for ROs	2,500.00	2 persons (2 per. x 1 visit)	5,000.00		
Transportation cost	Fuel	20,000.00	1 visit	20,000.00		
			Sub Total	**175,000.00**		
Action step4: Preparation of manual						
Material cost	Refreshment (meetings)	700.00	4 persons (2 per. x 2 meetings)	2,800.00		
Human resource cost	Translation into Tamil	1,000.00	10 pages	10,000.00		
	Type setting	500.00	10 pages	5,000.00		
Transportation cost						
			Sub Total	**17,800.00**		
			Grand Total	**242,800.00**		

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Identification of a test kit for pesticide residue analysis															
Literature survey															
Identification															
Action step2: Validation of test kits at the laboratory															
Spiking/Screening															
Analysis															
Action step3: Verification of potential for use of test kit															
Sample collection															
Screening															
Analysis															
Action step4: Preparation of manual															
Draft preparation															
Translation-Tamil															
Type setting															

End of notes

Fertilizer Working Group (WG2)

Proposals for Key Activities

P1. Development of area specific nutrient management packages for cabbage, capsicum and tomato

P2. Development of nutrient management packages for protected (greenhouse) agriculture crops in NE/Badulla

P3. Development of rapid method for N management

P1. Proposal for Key Activity

1. **Focused area:** Soil type and area specific fertilizer recommendation for vegetables

2. **Key activity:** Development of area specific nutrient management packages for cabbage, capsicum and tomato **(1-1)**

3. **Justification / Purpose:** There are general fertilizer recommendations for many vegetables. Area specific nutrient management packages will help to improve fertilizer use as well as to increase yield/productivity through proper management of nutrients. Being Badulla and Kalpitiya major growing areas, and cabbage, tomato and capsicum major crops, development of area specific nutrient management packages for cabbage, tomato and capsicum is envisaged.

4. **Expected output:** Manuals containing specific nutrient management packages for cabbage and tomato in Badulla, and cabbage and capsicum in Puttalam.

5. **Linkage with Project Output 3 activities:** Incorporation of specific nutrient management packages into SHEP handbooks and use them as training materials (extension packages - cabbage, capsicum and tomato) in both Sinhala and Tamil languages[#]

6. **Key action steps:**
   1 Collection of information on existing fertilizer recommendation and survey of farmers' fertilizer application practices (solid, liquid and mix fertilizers) (Local and foreign)
   2 Preparation of suitable nutrient management packages and development of testing protocol / design
   3 Field testing
   4 Quality testing (contaminants) of inputs and produces
   5 Preparation of manuals and extension packages

7. **Details of implementation of key action steps:**

Action step1: Collection of information on existing fertilizer recommendation and survey of farmers' fertilizer application practices (solid, liquid and mix fertilizers) (Local and foreign)

Brief description of implementation methodology including outputs, responsible officers and place of action
The information on existing fertilizer recommendations will be collected through literature survey. Information on farmers' fertilizer application practices is collected by a questionnaire survey conducted with 15 farmers each in 2 pilot sites of Badulla and Kalpitiya (Boralanda ASC range and Kalpitiya ASC range respectively). Responsible Officers – Mrs. A. Mayakaduwa and Dr. M. Kodikara (Badulla), Mrs. P. Delpitiya and Mrs. Renuka Silva (Kalpitiya)

Action step2: Preparation of suitable nutrient management packages and development of testing protocol / design

Brief description of implementation methodology including outputs, responsible officers and place of action
Based on the information collected from literature, new fertilizer management packages and based on the information collected from the farmer survey, generalized farmers' fertilizer application packages for each cabbage and tomato in Badulla and each cabbage and capsicum in Puttalam are prepared separately. Protocol for testing is developed through a responsible officers' discussion. Responsible Officers - Mrs. Renuka Silva, Dr. M. Kodikara (Badulla), Mrs. A. Mayakaduwa and Mrs. P. Delpitiya

Action step3: Field testing

Brief description of implementation methodology including outputs, responsible officers and place of action
These 2 sets of packages (new fertilizer mgt package & generalized farmer's fertilizer application package) for each crop in each district are tested against site specific and current DOA recommended package with 3 farmers, utilizing 4 small plots (30 m2 plots) in Boralanda GN division / Boralanda AI range, Badulla and Mampuriya GN division / Nawakkaduwa AI range, Puttalam as applicable in altogether 12 trials/fields (2 crops x 2 districts x 3 farmers). Plant height and canopy size are determined 3 times during vegetative phase. Yield and yield components are also determined. Responsible Officers - Mrs. A. Mayakaduwa and Dr. M. Kodikara (Badulla), Mrs. P. Delpitiya and Mrs. Renuka Silva (Kalpitiya)

Action step4: Quality testing (contaminants) of inputs and produces

Brief description of implementation methodology including outputs, responsible officers and place of action
Inputs and produce of each treatment are tested (inputs-heavy metals, nitrate nitrogens & composition: produce-heavy metals, nitrate nitrogen) in the HORDI laboratory. Responsible Officers - Mrs. Renuka Silva

Action step5: Preparation of manuals and extension packages

Brief description of implementation methodology including outputs, responsible officers and place of action
Manuals (about 10 pages) for management of nutrients of cabbage and tomato in Badulla, and cabbage and capsicum in Kalpitiya reflecting the test results are prepared in Sinhala and Tamil. Responsible Officers - Mrs. A. Mayakaduwa (cabbage and tomato in Badulla), Mrs. P. Delpitiya (cabbage and capsicum in Kalpitiya)

8. Budget for implementation:

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Collection of information on existing fertilizer recommendation and survey of farmers' fertilizer application practices (solid, liquid and mix fertilizers) (Local and Japanese)						
Material cost	Refreshment (meetings)	700.00	4 persons (2 per x 2 times)	2,800.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 per x 2 times)	10,000.00		
	Per-diem for R.O.s (field visits for survey)	2,500.00	6 persons (2 dis x 3 times)	15,000.00		
	Per-diem for S.O./F.O.s (field visits for survey)	2,500.00	6 persons (2 dis x 3 times)	15,000.00		
Transportation cost	Fuel for meetings	10,000.00	2 meetings	20,000.00		
	Fuel for field visits	10,000.00	6 visits (2 dis x 3 times)	60,000.00		
	Fuel allowance for S.O./F.O.s	3,000.00	6 visits (2 dis x 3 times)	18,000.00		
			Sub Total	**140,800.00**		
Action Step2: Preparation of suitable nutrient management packages and development of testing protocol / design						
Material cost	Refreshment (meetings)	700.00	6 persons (3 per x 2 times)	4,200.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 per. x 2 meetings)	10,000.00		
Transportation cost	Fuel for meetings	10,000.00	2 meetings	20,000.00		
			Sub Total	**34,200.00**		
Action step3: Field testing						
Material cost	Seeds, fert., liquid fer.	25,000.00	12 fields	300,000.00		
	Consumables (net/stic	10,000.00	12 fields	120,000.00		
	Compensation	5,000.00	12 fields	60,000.00		
Human resource cost	Per-diem for R.O.s (field visits)	2,500.00	16 persons (8 days x 2 districts)	40,000.00		
	Per-diem for S.O.s (field visits)	2,500.00	8 days (4 days x 2 districts)	20,000.00		
	Per-diem for F.O.s (Field visits)	2,000.00	16 days (8 days x 2 districts)	32,000.00		
Transportation cost	Fuel for field visits*	15,000.00	10 visits	150,000.00		
	Fuel allowance for S.O.s	3,000.00	8 days (4 days x 2 districts)	24,000.00		
	Fuel allowance for F.O.s	3,000.00	24 days (12 days x 2 districts)	72,000.00		
			Sub Total	**818,000.00**		
Action step4: Quality testing (contaminants) of inputs and produces						
Material cost	Lab chemicals			200,000.00		
Human resource cost						

Transportation cost						
			Sub Total	**200,000.00**		
Action step5 Preparation of manuals and extension packages						
Material cost	Refreshment (meetings)	700.00	8 persons (4 x 2 meetings)	5,600.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 of RARDC x 2 meetings)	10,000.00		
	Translation - Tamil	1,000.00	30 pages (10 pages x 3 crops)	30,000.00		
	Type setting	500.00	30 pages	15,000.00		
Transportation cost	Fuel for meetings	15,000.00	2 meetings	30,000.00		
			Sub Total	**90,600.00**		
			Grand Total	**1,283,600.00**		

*Fuel cost for visiting Kalpitiya 20,000.00 and Badulla 5,000.00 = average 15,000.00

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Collection of information on existing fertilizer recommendation and survey of farmers' fertilizer application practices (solid, liquid and mix fertilizers) (Local and Japanese)															
Preparation of ques.															
Survey															
Action step2: Preparation of suitable nutrient management packages and development of testing protocol / design															
Prep mgt package															
Devpt of protocol															
Action step3: Field testing															
Cabbage in Badulla															
Field preparation															
Crop establishment															
Crop management															
Tomato in Badulla															
Field preparation															
Crop establishment															
Crop management															
Cabbage in Puttalam															
Field preparation															
Crop establishment															
Crop management															
Capsicum in Puttalam															
Field preparation															
Crop establishment															
Crop management															
Action step4: Quality testing (contaminants) of inputs and produces															
Analysis for contaminant															
Action step5 Preparation of manuals															

Draft preparation															
Translation															
Type setting															

Incorporation of information in nutrient management manuals into SHEP handbooks on cabbage, tomato and capsicum to be done by Project with separate budget below.

Human resource cost	Translation - Tamil (SHEP handbooks)	1,000.00	150 pages (50 pages x 3 crops)	150,000.00		
	Type setting	500.00	150 pages	75,000.00		

End of notes

P2. Proposal for Key Activity

1. **Focused area**: Nutrient management package for protected agriculture crops for safe crop production

2. **Key activity:** Development of nutrient management packages for protected (greenhouse) agriculture crops in NE/Badulla **(3-1)**

3. **Justification / Purpose:** Greenhouse cultivation has become very popular in upcountry areas. Environmentally sensitive and high value crops are grown in these greenhouses using varieties specifically developed for these conditions. In order to arrest the full potential of this farming it is essential to use precise practices. Lack of recommendations has posed problems for farmers specially on nutrient management. Farmers use different packages of fertilizer without proper estimation of nutrient requirements of such crops. Some fertilizers are not suitable for soil less culture while, on some occasions, different nutrient disorders are visible.

4. **Expected output:** Manual containing different growth media based nutrient management packages for tomato and capsicum grown in greenhouses of upcountry or improved / updated existing manual 'Growing Media and Nutrient Management in bell pepper and tomato in protected culture' with the information generated by this activity as well as with any other information available

5. **Linkage with Project Output 3 activities:** Use of the manual as a training material in both Sinhala and Tamil languages

6. **Key action steps:**
   1 Collection of information on existing nutrient management packages and survey of farmers' nutrient management practices (local and foreign)
   2 Preparation of suitable nutrient management packages for soilless and soil media and development of testing protocol / design
   3 Field testing
   4 Quality testing of produce
   5 Preparation of manuals

7. **Details of implementation of key action steps:**

Action step1: Collection of information on existing nutrient management packages and survey of farmers' nutrient management practices (local and Japanese)

Brief description of implementation methodology including outputs, responsible officers and place of action
Information on farmers' fertilizer application practices is collected by a questionnaire survey conducted with 10 greenhouse farmers in and around pilot sites of Badulla (8) and Nuwaraeliya (2). They are selected from a list of farmers obtained from relevant Segment ADA. Responsible Officers- Dr. M. Kodikara (Badulla), Mrs. A. Mayakaduwa (Nuwaraeliya)

Action step2: Preparation of suitable nutrient management packages for soilless and soil media and development of testing protocol / design

Brief description of implementation methodology including outputs, responsible officers and place of action
New nutrient management package and generalized farmers' package for each tomato and capsicum grown in soilless (coir dust) media, soil-based mixture and soil in green houses in upcountry areas are prepared. Protocol for testing is developed through a discussion. Responsible Officer – Dr. M. Kodikara, Mrs. A. Mayakaduwa

Action step3: Field testing

Brief description of implementation methodology including outputs, responsible officers and place of action
Identified nutrient mgt packages are tested in yala season against farmer's fertilizer application practice in 2 replicated trials (for tomato and capsicum) in green houses at RARDC, Bandarawela, and (farmer field) Seethaeliya and is evaluated by plant growth, yield, pest & diseases incidence and quality of produce in terms of total brix value. Responsible Officers - Dr. M. Kodikara (Bandarawela), Mrs. A. Mayakaduwa (Seethaeliya)

Action step4: Quality testing of produce

Brief description of implementation methodology including outputs, responsible officers and place of action
Produce of each treatment are tested for heavy metals (contaminants), nitrate, nutrient contents (NPK and micro nutrients) in the HORDI laboratory. Responsible Officers - Mrs. Renuka Silva

Action step5: Preparation of manuals

Brief description of implementation methodology including outputs, responsible officers and place of action
Manual on management of nutrients in tomato and capsicum in protected houses reflecting the test results are prepared in Sinhala and Tamil Responsible Officers - Dr. M. Kodikara, Mrs. A. Mayakaduwa, Mrs. Renuka Silva

8. Budget for implementation:

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Collection of information on existing nutrient management packages and survey of farmers' nutrient management practices (local and Japanese)						
Material cost						
Human resource cost	Per-diem for R.O.s (farmer visit for survey)	2,500.00	6 persons (2 persons x 3 visits)	15,000.00		
Transportation cost	Fuel for farmer visits	10,000.00	3 visits	30,000.00		
			Sub Total	**45,000.00**		
Action Step2: Preparation of suitable nutrient management packages for soilless and soil media and development of testing protocol / design						
Material cost	Refreshment	700.00	2 persons (2 meetings)	1,400.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	2 persons (1 from outstation x 2 meetings)	5,000.00		
Transportation cost	Fuel for meetings	5,000.00	2 meetings	10,000.00		
			Sub Total	**16,400.00**		
Action step3: Field testing						
Material cost	Seeds, fert etc.	50,000.00	2 greenhouses	100,000.00		
	Consumables pots, coir dust etc.	20,000.00	2 greenhouses	40,000.00		
Human resource cost	Per-diem for R.O.s (Seethaeliya trial/ greenhouse visit)	2,500.00	15 visits	37,500.00		
Transportation cost	Fuel for Seethaeliya trial/greenhouse visit	4,000.00	15 visits	60,000.00		
			Sub Total	**237,500.00**		
Action step4: Quality testing of produce						
Material cost	Lab chemicals			200,000.00		
Human resource cost						
Transportation cost						
			Sub Total	**200,000.00**		
Action step5: Preparation of manual						
Material cost	Refreshment (meetings)	700.00	6 persons (3 per x 2 meetings	4,200.00		

Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 from outstations x 2 meetings)	10,000.00		
	Translation - Tamil	1,000.00	30 pages	30,000.00		
	Type setting - Sinhala and Tamil	500.00	60 pages	30,000.00		
Transportation cost	Fuel for meetings	15,000.00	2 meetings	30,000.00		
			Sub Total	**104,200.00**		
			Grand Total	**603,100.00**		

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Collection of information on existing nutrient management packages and survey of farmers' nutrient management practices (local and Japanese)															
Preparation of quest.															
Survey															
Action step2: Preparation of suitable nutrient management packages for soilless and soil media and development of testing protocol / design															
Prep mgt package															
Devpt of protocol															
Action step3: Field testing															
Tomato in Badulla															
GH preparation															
Crop establishment															
Crop management															
Capsicum in Badulla															
GH preparation															
Crop establishment															
Crop management															
Tomato in Nuwara Eliya															
GH preparation															
Crop establishment															
Crop management															
Capsicum in N' Eliya															
GH preparation															
Crop establishment															
Crop management															
Action step4: Quality testing of produce															
Analysis for contaminant															
Action step5: Preparation of manuals															
Draft preparation															
Translation															
Type setting															

End of notes

P3. Proposal for Key Activity

1. **Focused area:** New rapid soil and leaf test methods for N, P, K management of vegetables and fruits

2. **Key activity:** Development of rapid method for N management **(2-1)**

3. **Justification / Purpose:** Application of N fertilizer based on leaf nitrogen level can greatly enhance the fertilizer use efficiency so the yields. However, a suitable digital test kit has not been recommended so far

4. **Expected output:** Manual on use of digital rapid leaf nitrogen test kit for N management

5. **Linkage with Project Output 3 activities:** The manual will be multiplied and be used as a training material

6. **Key action steps:**
   1 Identification of suitable digital test kits and suppliers (local and foreign) and purchasing of test kits
   2 Development of correlation
   3 Calibration with field level measurements
   4 Development of recommendation
   5 Verification of potential for use of test kit
   6 Preparation of manuals

7. **Details of implementation of key action steps:**

Action step1: Identification of suitable digital test kits and suppliers (local and foreign) and purchasing of test kits

Brief description of implementation methodology including outputs, responsible officers and place of action
Information is collected through on line search and a suitable rapid test kit is selected. It will be purchased with the use of project funds. Responsible Officers - Mrs. A. Mayakaduwa

Action step2: Development of correlation

Brief description of implementation methodology including outputs, responsible officers and place of action
Correlation is developed using leaf N measurements taken by test kit and leaf N content values determined by laboratory method of leaves with different leaf N status as created by applying different rates of N fertilizers for tomato plants grown in a greenhouse at HORDI. Responsible Officers - Mrs. Renuka Silva

Action step3: Calibration with field level measurements

Brief description of implementation methodology including outputs, responsible officers and place of action
It is calibrated by comparing performance of a crop applied with leaf N measurement-based N fertilizer against performance of crops applied with low, medium, high and recommended amounts of N fertilizers in the field at HORDI. Responsible Officers - Mrs. Renuka Silva

Action step4: Development of recommendation

Brief description of implementation methodology including outputs, responsible officers and place of action
Nitrogen fertilizer application recommendation for each site at Nuwara Eliya, Badulla and Puttalam (Kalpitiya area) is prepared. Responsible Officers - Mrs. Renuka Silva

Action step5: Verification of potential for use of test kit

Brief description of implementation methodology including outputs, responsible officers and place of action
Leaf nitrogen measurements (30 in each Nuwara Eliya, Badulla and Puttalam/Kalpitiya area) are taken using the test kit of tomato crops in farmer fields in order to verify whether there is variation in leaf nitrogen content in crops in districts so that there is opportunity to use this test kit. Responsible Officers - Mrs. Renuka Silva & Ms. P. Delpitiya (Puttalam), Mrs. A. Mayakaduwa (Nuwara Eliya), Dr. M. Kodikara (Badulla)

Action Step 6: Preparation of manuals

Brief description of implementation methodology including outputs, responsible officers and place of action
Manuals on how to use the rapid test kit reflecting the test results are prepared in Sinhala and Tamil Responsible Officers - Mrs. Renuka Silva, Ms. P. Delpitiya, Mrs. A. Mayakaduwa, Dr. M. Kodikara

8. Budget for implementation:

Categories	Item / Description	Unit price	Quantity	Budget	Expenditure	Remaining Budget
Action Step1: Identification of suitable test kits (having capacity to test pH also) and suppliers (local and foreign) and purchasing of test kits						
Material cost	Digital rapid test kit	350,000.00	1 unit	350,000.00		
Human resource cost						
Transportation cost						
			Sub Total	**350,000.00**		
Action Step2: Development of correlation						
Material cost	Seeds, fert etc.	30,000.00	1 greenhouse trial	30,000.00		
	Consumables	15,000.00	1 greenhouse trial	15,000.00		
	Lab chemicals for N analysis		36 samples	50,000.00		
Human resource cost						
Transportation cost						
			Sub Total	**95,000.00**		
Action step3: Calibration with field level measurements						
Material cost	Seeds, fert etc.	30,000.00	1 field trial	30,000.00		
	Consumables	15,000.00	1 field trial	15,000.00		
Human resource cost						
Transportation cost						
			Sub Total	**45,000.00**		
Action step4: Development of recommendation						
Material cost	Refreshment (meetings)	700.00	12 persons (4 per. x 2 meetings)	8,400.00		
Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 per. from outstations x 2 meetings)	10,000.00		
Transportation cost	Fuel for meetings	10,000.00	4 trips (2 per. from outstations x 2 meetings	40,000.00		
			Sub Total	**58,400.00**		
Action step5: Verification of potential for use of test kit						
Material cost						
Human resource cost	Per-diem for R.O.s (field visits)	2,500.00	12 persons (4 per x 3 visits)	30,000.00		
Transportation cost	Fuel for field visits	10,000.00	3 visits	30,000.00		
			Sub Total	**60,000.00**		
Action step5: Preparation of manuals						
Material cost	Refreshment (meetings)	700.00	8 persons (4 per. x 2 meetings)	5,600.00		

Human resource cost	Per-diem for R.O.s (meetings)	2,500.00	4 persons (2 from outstation x 2 meetings)	10,000.00		
	Translation - Tamil	1,000.00	15 pages	15,000.00		
	Type setting - Sinhala and Tamil	500.00	30 pages	15,000.00		
Transportation cost	Fuel for meetings	10,000.00	4 visits (2 from outstations x 2 meetings)	40,000.00		
			Sub Total	**85,600.00**		
			Grand Total	**694,000.00**		

9. Schedule of implementation:

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Action step1: Identification of suitable test kits (having capacity to test pH also) and suppliers (local and foreign) and purchasing of test kits															
Identification															
Purchasing															
Action step2: Development of correlation															
Establishment of expt															
Data collection															
Action step3: Calibration with field level measurements															
Establishment of expt															
Data collection															
Action step4: Development of recommendation															
Meetings for devt. of rec.															
Action step5: Verification of potential for use of test kit															
Taking mea. in N'eliya															
Taking mea. in Badulla															
Taking mea. in Puttalam															
Action step5: Manual preparation															
Draft preparation															
Translation															
Type setting															

End of notes

GAP Working Group

WG 3

Proposals for Key Activities

P1. Sensitization on safe use of pesticides and fertilizers

P2. Evaluation of the effect of field hygiene practices in pest and disease management

P3. Promoting non-chemical pest and disease control methods.
- Yellow lighting / bulb application for Moth repellence in Brinjal and Cabbage

1. Proposal for Key Activity

1. **Focused area:** Personnel safety.

2. **Key activity:** Sensitization on safe use of pesticides and fertilizers.

3. **Purpose / Justification:** To effectively sensitize the relevant stakeholders (mainly the farmers) on the importance of the safe use of pesticides and fertilizers with special focus on the following areas:
   3.1. Safe use of pesticides and fertilizers in general
   3.2. Importance of use of safety kits
   3.3. Proper disposal of packing materials of pesticides
   3.4. Best practice of safe storage of pesticides and fertilizers
   3.5. Importance of realistic farm record keeping

Justification: It has been widely understood that the importance of understanding about the harmful effects of the wrong use of pesticides and chemical fertilizers. Being aware about the real benefits of accurate use of pesticides & fertilizers as well as practicing accordingly play crucial role in Agriculture. To assure such level of sound understanding (mainly of farmers), carrying out effective sensitization using influential approaches have been identified as critical interventions to make sure the expected change (especially the attitude and practice change among the farmers).

4. **Expected output:**
   - Three (3) colour posters (one for each area – 3.1, 3.2 and 3.3) were designed, printed & displayed at selected public places (Agriculture related offices where farmers frequently visit – Eg. Agrarian Service Offices).
   - Colour leaflet (1) which includes key messages relate to 3.1 – 3.4 was design, printed & distributed among the farmers (during proposed awareness sessions & field days).
   - Twenty-Five (25) Face Book posts (at least 15 posts for 3.1 & rest for 3.2 – 3.5 appropriately) were designed and disseminated (via FB pages of DOA & ROP).
   - Five (5) stakeholder awareness campaign sessions were conducted (one in each project District).

5. **Linkage with Project Output 3 activities:**
   Selected materials / contents mentioned under (4) above are utilized as training material for TOT for master trainers and training for AIs.

6. **Key action steps:**
   1 Conduct rapid survey on use of safety kits by farmers and farmer record keeping.
   2 Study the Farmer Record Keeping Format & Process of SHEP & evaluate it based on the findings of the recent farmer survey to further improve it if needed.
   3 Develop and finalize the contents of the posters & leaflet, and the messages of the FB posts.
   4 Design the posters, leaflet, and FB posts with appropriate graphics.
   5 Review, edit, and finalize the materials (with the consent of relevant parties) & print posters & leaflet.
   6 Carrying out sensitization.

7. **Details of implementation of key action steps:**

Action Step 1- Conduct rapid survey on use of safety kits by farmers and farmer record keeping.

Brief description of implementation methodology including outputs, responsible

officers and place of action.

- Responsible officers are Dr. H.R.U.T. Erabadupitiya & Mr.A.S.M.Roshan.
- First the relevant areas of the Fact-finding Survey will be studied – based on the findings, avoiding repetitions of same nature questions, Questionnaire will be developed, reviewed and finalized.
- Questionnaire survey is conducted within the selected locations (mostly in vegetable cultivation hotspots) in Anuradhapura & Nuwara Eliya Districts.
- The respondents of the Questionnaire Survey will comprise of main types of pesticide users – mainly the full-time sprayers (sprayer labourers), farmers who do spraying wearing certain protective wears, farmers who do spraying without any sort of protective wears.
- Then, the respective Activity leaders will produce the report after analyzing the data and information collected.

Action Step 2- Study the Farmer Record Keeping Format & Process of SHEP & evaluate it based on the findings of the recent farmer survey to further improve it if needed.

Brief description of implementation methodology including outputs, responsible officers and place of action.

- Responsible officer is Dr.H.R.U.T. Erabadupitiya.
- After reviewing the existing farmer record keeping format, studying the relevant findings of the fact-finding survey of the SAFE project, and based on the recent learnings / observations of the WG members, a survey will be conduct to know why farmers do not / reluctant to do record keeping and what sort of record keeping format they like to use.
- Based on the findings of the farmer survey, a much user-friendly format will be developed (mainly referring the SHEP format) and evaluated for one farming season (3 months for short term crop/s & 5 months for other crops).
- Based on the evaluation results and the lessons learnt from field level observations and feedback sessions, final version of farmer-friendly record keeping format will be developed by the WG.

Action Step 3 - Develop and finalize the contents of the posters & leaflet, and the messages of the FB posts.

Brief description of implementation methodology including outputs, responsible officers and place of action.

- Main responsible officer is Mr. L.K. Samantha; the WG Leader.
- After reviewing the findings of the proposed field survey, feedback of field level stakeholders; the members of the WG-3 will have a brainstorming session to identify the most critical areas (topics) need to be addressed.
- Then the relevant content will be developed as team work of WG-3 and relevant member Experts of the WG-1 & WG-2.
- Gently discuss and agree with DOA & ROP to circulate the messages via their FB pages.

Action Step 4 - Design the posters, leaflet, & FB posts with appropriate graphics.

Brief description of implementation methodology including outputs, responsible officers and place of action.

- The responsible officer is Mr. L.K. Samantha.
- Draft poster designs, design/s for the leaflet & FB posts will be completed with the effective graphics maintaining the expected compatibilities for printing.
- Designing the posters, FB posts with appropriate graphics will be done by the identified staff at NAICC. Mr. K.A.U.N.N. Bandara, the IT Officer, NAICC will be the key staff who is responsible for designing the posters, leaflet and the FB posts with the relevant graphics, contents and colour matching under the guidance

& supervision of Mrs.G.S.P.Thennakoon.

Action Step 5 - Review, edit, and finalize the materials (with the consent of relevant parties) & print posters & leaflet.

Brief description of implementation methodology including outputs, responsible officers and place of action.
· Responsible officer is Mrs. G.S.P. Tennakoon. · Draft poster, leaflet designs & FB posts are reviewed, edited and finalized by the WG members led by Mrs.G.S.P.Tennakoon & Mr.L.K.Samantha.

Action Step 6 - Carrying out sensitization:

Brief description of implementation methodology including outputs, responsible officers and place of action.
· Responsible officer is Mr. L.K. Samantha. · Basically, the campaign will be carried out via District level awareness sessions and via the FB-based campaign mainly through DOA & ROP FB pages. · The key materials for the sensitization campaign would be posters which would be displayed at identified places such as Agrarian Service Centres, leaflet that would be distribute among farmers attend to the district level awareness sessions, and the FB posts circulate via FB. · The target audience for the district level awareness sessions would be mainly consisting of farmers; basically, the leaders of the Farmer Organizations of the District. As well, the District Secretary, Provincial Director-Agric., District Director-Agric, Asst. Commissioner – Dept. of Agrarian Development, all the AIs and Agrarian Development Officers will be invited for the session. The expected maximum total participation to a session is 100 individuals.

8. Summary budget allocation for implementation: (detailed version: Annex – i)

Action step	**Budget (Rs.)**
Action Step1: Conduct rapid survey on use of safety kits by farmers and farmer record keeping.	74,000.00
Action Step2: Study the Farmer Record Keeping Format & Process of SHEP & evaluate it based on the findings of the recent farmer survey to further improve it if needed.	210,000.00
Action Step3: Develop and finalize the contents of the posters & leaflet, and the messages of the FB posts.	-
Action Step4: Design the posters, leaflet, and FB posts with appropriate graphics.	-
Action Step5: Review, edit, and print the materials (with the consent of relevant parties) & print posters & leaflet.	423,000.00
Action Step6: Carrying out sensitization.	318,000.00
Grand total	**1,025,00.00**

Annex-i-Budget-P1-WG-3-Apr18.xlsx

9. Schedule of implementation:

2024-05	**Ja**	**Fe**	**Ma**	**Ap**	**Ma**	**Ju**	**Ju**	**Au**	**Se**	**Oc**	**No**	**De**	**Ja**	**Fe**	**Ma**
Action Step1: Conduct rapid survey on use of safety kits by farmers and farmer record keeping.															
Conducting survey															
Submission of survey findings															
Action Step2: Study the Farmer Record Keeping Format & Process of SHEP & evaluate it based on the findings of the recent farmer survey to further improve it if needed.															

2024-05	Ja	Fe	Ma	Ap	Ma	Ju	Ju	Au	Se	Oc	No	De	Ja	Fe	Ma
Study the SHEP record keeping format, propose required improvements if applicable & develop new format if relevant.															
Evaluate the SHEP record keeping format / improved version – with the farmers.															
Action Step3: Develop and finalize the contents of the posters & leaflet, and the FB posts.															
Working session -1															
Working session -2															
Working session -3															
Action Step4: Design the posters, leaflet, and FB posts with appropriate graphics															
Design the posters & the leaflet with appropriate graphics.															
Design the FB posts with appropriate graphics.															
Action Step5: Review, edit, and finalize the materials (with the consent of relevant parties) & print posters & leaflet.															
Reviewing & editing the materials.															
Printing the materials															
Action Step6: Carrying out sensitization.															
Sensitization campaign via DOA & ROP FB page.															
Sensitization campaign via District level awareness campaigns.															

Annex-ii-Field work schedule-P1-WG-3-Ap

End of notes

2. Proposal for Key Activity

1. **Focused area:** Field Sanitation.

2. **Key activity:** Evaluation of the effect of field hygiene practices in pest and disease management.

3. **Justification / Purpose:**
   Field sanitation is important in terms of reducing the amount of pesticide application. If proper field sanitation is not practiced, pests and diseases expand rapidly and widely. Among various field sanitation methods, appropriate pruning and disposal methods are considered as effective ones at field level. Because both of the methods are simple so that farmers can implement the methods by themselves on their field. The effectiveness of pruning and disposal methods as field sanitation have been tested in Sri Lanka, but farmers do not practice them effectively at their field level. Therefore, this activity is planned to be implemented and the purpose of the activity is as follow:
   - To test and evaluate how effective of practicing appropriate field hygiene practices including pruning techniques and safe disposal methods for infected parts of the crops to manage / prevent pests and diseases.
   - To ensure the sustainable field hygiene to minimize the incidence as well as growth of pests and disease outbreak which lead to minimum requirement of pesticide applications.

4. **Expected output:**
   - Updated SHEP manual of Brinjal – with the recommendations regarding effective field hygiene practices including pruning and disposal of infected plant parts in case of managing / preventing pests & diseases.
   - Updated existing booklet on Guava farming published by the DOA with the recommendations regarding effective field hygiene practices including pruning and disposal of infected plant parts in case of managing / preventing pests & diseases.

5. **Linkage with Project Output 3 activities:**
   Updated SHPE – Hand Book on Brinjal & Guava farming Booklet of the DOA are utilized as training material for TOT for master trainers and training for AIs.

6. **Key action steps:**
   1 Development of protocols.
   2 Establishment of demonstration plots & carry out the evaluation.
   3 Technical / extension material development.

7. **Details of implementation of key action steps:**
   Action step 1: Development of protocols.

Brief description of implementation methodology including outputs, responsible officers and place of action.
· The protocol is prepared (Annex-i) based on following contents: - Purpose - Target district - Target crops - Methodology - Detail of testing - Qualification of testing farmers - Evaluation method
· Tentative protocol is shown in the attachment.
· Responsible WG member for field sanitation of Brinjal: 1. Dr. (Mrs.) Pradeepa Ranaweera, ADA/R, HORDI (Activity leader).
· Responsible WG member for field sanitation of Guava: 1. Mrs. C. Abhayagunasekara, DDR, FRDI (Activity leader).

   Action Step 2: Establishment of demonstration plots & carry out the evaluation.

Brief description of implementation methodology including outputs, responsible officers and place of action.
· Preparation of field testing is proceeded based on the protocol developed.

- WG responsible officer communicates with District Support Officer (DSO) at least once a week to discuss current progress of testing and the next necessary actions.
- AI /TA works at farmer's field based on DSO's directions.
- Assumed maximum field visiting is expected to be done once a month by DSO and WG responsible officer and fortnightly by the respective AI/TA for field work as well as for monitoring (see the field work schedule in Annex – iii).
- Simple notebooks are distributed to farmers for their record keeping of agricultural works.

Action Step 3 : Technical / extension material development.

Brief description of implementation methodology including outputs, responsible officers and place of action.

- Relevant Technical Specialist of the WG and if applicable, together with Subject Matter Specialists (SMOs) update SHEP manual on Brinjal and the DOA booklet on Guava based on the result of this activity.

8. Summary budget allocation for implementation: (detailed version: Annex – ii)

Action step	**Budget (Rs.)**
Brinjal (Mathale):	
Action Step1: Development of protocols	N/A
Action Step2: Establishment of testing plots & carry out the evaluation *(for testing 2 plots of 0.25 Ac)*	285,600.00
Action step3: Technical / extension material development	10,000.00
Grand total	**295,000.00**
Guava (A'pura):	
Action Step1: Development of protocols	N/A
Action Step 2: Establishment of demonstration plots & carry out the evaluation	292,000.00
Action step3: Technical / extension material development	15,000.00
Grand total	**307,000.00**

Annex-ii-Budget-P2-WG3-Apr-17th.xlsx

9. Schedule of implementation:

2024-05	**Ja**	**Fe**	**Ma**	**Ap**	**Ma**	**Ju**	**Ju**	**Au**	**Se**	**Oc**	**No**	**De**	**Ja**	**Fe**	**Ma**
1 Development of protocols															
1.1 Working session-1															
1.2 Working session-2															
2 Establishment of demonstration plots & carry out the evaluation.															
2.1 Awareness sessions for the field staff & respective regional stakeholders.															
2.2 Farmer / field selection.															
2.3 Procure the required materials to be given to the selected farmers.															
2.4 Field establishment under technical guidance.															
2.5 Training, supervision, and															

evaluation.															
3 Technical / extension material development.															
3.1 Develop draft technical materials.															
3.2 Review / edit, further improve, technically validate, & finalize technical materials.															
3.3 Combining technical material with existing SHEP manual of Brinjal.															

Annex-i-Draft Protocol-P2-WG-3-Ap

Annex-iii-Field work schedule-P2-WG-3-Ap

End of notes

3. Proposal for Key Activity

1. **Focused area:** Non-chemical methods of pest and disease management.

2. **Key activity:** Promoting non-chemical pest and disease control methods.
   - Yellow lighting / bulb application for Moth repellent in Brinjal and Cabbage.

3. **Justification / Purpose:**

Non-chemical method is important as alternative method of applying pesticides. If farmers practice non-chemical methods, they can reduce the amount of pesticide application, which relates to health and economic benefits to farmers. Among various non-chemical methods, yellow bulb lighting application (to control the damage of LEC & DBM in Cabbage as well as the damage of Shoot Borer & Pod Borer in Brinjal) is considered for testing at field level. However, the importance of proper field testing of the said technology for those specific crops to evaluate their effectiveness against the identified pests has been identified especially the Moths. Therefore, this activity is planned to be implemented and the purpose of the activity is as follow:

- To test and evaluate how effective of practicing yellow bulb lighting to prevent from the damages done by the Moths in the selected crops as a non-chemical method.

4. **Expected output:**

- SHPE – Hand Books on Brinjal & Cabbage farming are updated with the recommendations on how to do yellow lighting to control the respective pests.

5. **Linkage with Project Output 3 activities:**

Updated SHPE – Hand Books on Brinjal & Cabbage farming is utilized as training material for TOT for master trainers and training for AIs.

6. **Key action steps:**

1 Development of demonstration protocol and design.
2 Farmer's fields demonstration.
3 Technical / extension material development.

7. **Details of implementation of key action steps:**

1 Development of demonstration protocol and design.

Brief description of implementation methodology including outputs, responsible officers and place of action.

· The protocol is prepared (Annex – i) based on following contents:
  - Purpose
  - Target district
  - Target crops
  - Methodology
  - Detail of testing
  - Qualification of testing farmers
  - Evaluation method

· Tentative protocol is shown in the attachment.

· WG Responsible officers are as follows:

· Activity Leader: Mr. K.W.P. Nishantha, Add. Director, PPS, Peradeniya.

2 Farmer's field demonstration.

Brief description of implementation methodology including outputs, responsible officers and place of action.

· Preparation of field testing is proceeded based on protocol developed in previous key action step.

· Followings are the farmer field testing trails implemented in each Districts:

Field testing plot in Badulla District:

· Yellow light application in Cabbage: 1 treatment plot & 1 control plot in Boralanda.

Field testing plot in Puttalama District:

- Yellow lighting / bulb for Brinjal: 1 treatment plot & 1 control plot in Naawakkaaduwa.
- Responsible officer of the WG communicates with & instructs District Support Officer (DSO) at least once a week to guide & discuss current progress of testing and next necessary actions & etc.
- AIs /TAs go to the field and work at testing farmer's field based on DSO's directions.
- Field visit schedule is in Annex - iii

3 Technical / extension material development.

Brief description of implementation methodology including outputs, responsible officers and place of action.

- Relevant Technical Specialist of the WG and if applicable, together with Subject Matter Specialists (SMOs) will work on developing the expected technical / extension materials.
- Mr.Samantha will lead the extension material development process with the technical inputs given by the respective Activity Leaders of the WG; with the participation of Mrs.Thennakoon, NAICC.
- Relevant Farming Guide Books developed by the SHEP (on Brinjal & Cabbage) will be updated with respective technical / extension contents on the proposed non-chemical methods.

8. Summary budget allocation for implementation: (detailed version: Annex – ii)

Action step	**Budget (Rs.)**
Action Step1: Development of protocols.	N/A
Action Step2: Establishment of demonstration plots & carry out the evaluation *(Yellow lighting applications)*	800,000.00
Action step3: Technical / extension material development	148,000.00
Grand total	948,000.00

Annex-ii-Budget-P3-WG3-Apr19th.xlsx

9. Schedule of implementation:

2024-05	**Ja**	**Fe**	**Ma**	**Ap**	**Ma**	**Ju**	**Ju**	**Au**	**Se**	**Oc**	**No**	**De**	**Ja**	**Fe**	**Ma**
1 Development of demonstration protocol and design.															
1.1. Working session-1															
1.2. Working session-2															
2 Farmer's fields demonstration.															
2.1. Awareness sessions - field staff & regional stakeholders.															
2.2. Farmer / field selection.															
2.3. Procure the required materials.															
2.4. Field establishment.															
2.5. Training, supervision, and evaluation.															
3 Technical / extension material development.															
3.1. Develop draft technical / technical materials.															

3.2. Review / edit, further improve, validate, & finalize the technical materials.															

Annex-iii-Field work schedule-P3-WG3-Api

Annex-i-Draft Protocol-P3-WG-3-Ap

https://docs.google.com/document/d/1YlKsoXo2BDK3KrFOw9_sAUsnA413yQB1/edit?usp=drive_link&ouid=100683962605236366494&rtpof=true&sd=true

End of notes

Attachment-16

The results of collection on existing extension materials

NO	Title	Contents	Year of issue	Concerned department or institute	Notes
Manuals					
1	GAP for Banana (*Musa)* Cultivation	GAP Standards for Banana Cultivation Introduction History of Land and Land Management Farm Structure and their management Planting Activities Integrated Pest Management Management of Pesticides Farm management References Certification Activities Internal Checklist	2016	Department of Agriculture (DOA) Under Ministry of Agriculture	This book was written to achieve, 1. To Estabilishing standards to support the production and handling of crops in accordance with Good Agricultural Practice. 2.The purpose of this is to make producers, Product handlers, trainers and those interested in this field aware of the importance of those standards in preparing safety and quality products under good agricultural practices and align them for that and This book content 50 Page
2	Good Agriculture Practice for Guava (*Psidium guajava*) Cultivation	GAP Standards for Guava Cultivation Introduction History of Land and Land Management Farm structure and their management Planting Activities Integrated Pest Management Management of Pesticides Farm management References Certification Activities Internal Checklist	2016	Department of Agriculture (DOA) Under Ministry of Agriculture	This book was written to achieve, 1. To Establishing standards to support the production and handling of crops in accordance with Good Agricultural Practice. 2.The purpose of this is to make producers, Product handlers, Trainers and those interested in this field aware of the importance of those standards in preparing safety and quality products under good agricultural practices and align them for that and This book content 70 pages
3	How to Minimize Pesticide Residues on Fresh Fruits and Vegetables?	**Minimize Pesticide Residues** 1. Introduction 2. Residues 3.Maximum Residue Limits (MRLs) 4. EU MRLs of Pesticides 5. Codex MRLs Of Pesticides 6.How to Minimize the Pesticide Residues **Guideline of Safe use of Pesticides** 1.Program for Pest Control 2.Farm Staff training 3.Record Keeping 4.Storage & handling of Pesticides 5. Systematic application of pesticides 5.1 Before application 5.3 In application 5.3 After application 6. Controlling residues of pesticides	May-16	Department of Agriculture (DOA), Standard and Trade Development Facility, International Trade Center	This booklet is written to educate the farmers on proper use of pesticides and assist in reducing the pesticide residue levels on fruits and vegetables produced in the country. And this book content 28 pages.
		1. Introduction 1.1 Objectives 1.2 Vigna unguiculate 1.3 Definitions 2. Land and Structure of Farm Management 2.1 History of Land & Land Management 2.2 Structure of Farm Management 3. Planting Practice 3.1 Use Quality Seeds for Suitable Species 3.2 Land Preparation and Field Planting 3.3 Weed control 3.4 Fertilizer Application 3.5 Water irrigation and water management 4. Pest Management 4.1 Pest & Diseases Management 4.2 Diseases Management 4.3 Pesticide Management			This book was written to achieve, 1. To Establishing standards to support the production and handling of crops in accordance with Good Agricultural Practice. 2.The purpose of this is to make producers, Product

4	GAP forLong Beans (*Vigna unguiculate)* Cultivation	4.3.1 Precaution to be taken when using Pesticides 4.3.2.Recommendent Pesticides for Pest 5. Harvesting Yield and Post-Harvest Technology 5.1 Yield Harvesting 5.2 Selection and Grading 5.3 Packaging 5.4 Identification 5.5 Transportation 5.6 Storage 6. Farm Management 6.1 Person Health of workers 6.3 Equipment Packing Container and Packing Materials 6.4 Building and Other Structures 6.5 Documents and Reports 6.6. Re- Examination of Good Agricultural Practices 7. Step to be Followed in certification Process 8.Check List of Internal Audit 9.Reference Books	2018	Department of Agriculture (DOA) Under Ministry of Agriculture	handlers, trainers and those interested in this field aware of the importance of those standards in preparing safety and quality products under good agricultural practices and align them for that and This book content 38 Pages
5	GAP for Gotukola (*Centella asiatica*) Cultivation	GAP Standards for Gotukola Cultivation Introduction History of Land and Land Management Farm structure and their management Planting Activities Integrated Pest Management Management of Pesticides Farm management References Certification Activities Internal Checklist	2016	Department of Agriculture (DOA) Under Ministry of Agriculture	This book was written to achieve, 1. To Establishing standards to support the production and handling of crops in accordance with Good Agricultural Practice. 2.The purpose of this is to make producers, Product handlers, trainers and those interested in this field aware of the importance of those standards in preparing safety and quality products under good agricultural practices and align them for that and This book content 62 Pages
6	GAP for Papaya(*Carica papaya)*Cultivation	GAP Standards for Papaya Cultivation Introduction History of Land and Land Management Farm structure and Their management Planting Activities Integrated Pest Management Management of Pesticides Farm Management Reference Books Certification Activities Internal Checklist	2016	Department of Agriculture (DOA) Under Ministry of Agriculture	This book was written to achieve, 1. To Establishing standards to support the production and handling of crops in accordance with Good Agricultural Practice. 2.The purpose of this is to make producers, Product handlers, Tainers and those interested in this field aware of the importance of those standards in preparing safety and quality products unde good agricultural practices and align them for that and This book content 60 Pages
7	GAP for Solanaceas Crops Cultivation	'-do-	'-do-	'-do-	'-do- Solanaceas crops are Chilli, Capsicum, Tomato, Potato, Brinjal. This book content 99 pages.
8	GAP for Okra(*Abelmoschus esculentus*) Cultivation	'-do-	'-do-	'-do-	'-do- This book content 34 pages
9	GAP for Pineapple (*Ananas Comosus*) Cultivation	'-do-	'-do-	'-do-	'-do- This book content 69 Pages
10	GAP for Passion fruit (*Passiflora edulis*) Cultivation	'-do-	'-do-	'-do-	'-do- This book content 63 pages
11	Integrated Plant Nutrient System (IPNS) - Training Manuals	1.Soil, Soil Fertility, and Plant nutrients 1.1 soil 1.2 Soil Generation 1.3 Soils of Sri Lanka 1.4 Plant Nutrients 2. Use of balanced fertilizers, soil tests, economics of fertilizer use 2.1 Uses of Balance Fertilizers 2.2 Testing soil 2.3Economic of fertilizer use	2019	Department of Agriculture	This book was written to achieve, Integrated plant Nutrition Systems (IPNS) was used to provide basic knowledge for plant nutrient management related to sustainable maintenance of different cropping systems in different agro-ecological zones of Sri

		3.Intergrated use of organic and inorganic fertilizer and Application 4. Intergrated Plant nutrition process for vegetables, other field crops, fruit crops, roots and tubers 5. Intergrated Plant Nutrition			Lanka. Encouraging farmers to use integrated plant nutrition to increase productivity and maintain soil fertility in an environmentally friendly manner.
12	Crop Cultivation in Protected House	1. Introduction 2.Types of Protected house 3. Designing and Construction of Protected House 4. Recommended Protected House for Different climate zone 5. Recommended poly houses for selected crop groups 6. Cultivation technichs for protected houses 7. Advanced nursery methods for protected culture 8. Cultivation in protected houses 9. Irrigation and Fertigation 10. Pruning and training of plants 11. Pest Management in protected house 12. Crop cultivation with poly mulch 13. Hydroponics 14. Harvesting and post harvest technology 15. Farm commercialization for current and future needs	2013	Department of Agriculture (DOA)	
13	Manual for Crop Cultivation in Protected House	1. Introduction 2. Construction of protected house 3. Cultivation establishment 4. Growing media and Nutrient management 5. Pest and diseases Management 6. Automation 7. Information about suppliers	2022	Department of Agriculture (DOA) With JICA	
14	Growing Media and Nutrient Management	Identification of fertilizer deficiency Characteristic of soil deficiency Nitrogen Deficiency P Deficiency S Deficiency Ca Deficiency Mg Deficiency Fe Deficiency	2023	Department of Agriculture (DOA) with KOPIA	
15	Farmer Handbook of Potato Cultivation	Soil and climatic requirements Variety Land preparation Seed potato requirement Planting Irrigation Fertilizer application Weed control Harvesting Harvest Disease control Pest control Introduced Japanese technologies used for tomato cultivation	2023	Department of Agriculture (DOA) with JICA under SHEP Project	
16	Farmer Handbook for brinjal Cultivation	Soil and climatic requirements Variety Seeds requirement Nursery management Land preparation Transplanting Irrigation Fertilizer application Weed control Installing supporting pillars Harvesting Disease Pest control Introduced Japanese technologies used for tomato cultivation intro	2023	Department of Agriculture (DOA) with JICA under SHEP Project	
17	Farmer Handbook for Beans Cultivation	Soil and climatic requirements Variety Land preparation Seeds requirement Planting Irrigation Fertilizer application Providing supportive poles/ trellising Weed control Harvesting Harvest Disease control Pest control Introduced Japanese technologies for beans cultivation		Department of Agriculture (DOA) with JICA under SHEP Project	
		Introduction			

18	Preparation of Organic fertilizers	1. Compost Fertilizer 2. Green Manure for cultivation field 3. Animal manure for the fertile farm field 4. Application of straw as organic fertilizer to crops 5. Vermicompost 6. Liquid vermi fertlizer (vermi wash) 7. liquid compost (compost tea) 8. Fish extract for crop cultivation 9. jeevamrut (organic liquid fertilizer) 10.Fruit tonic fertilizer 11. Rice husk charcoal 12. Biochar	2021	Department of Agriculture	
19	Guava Cultivation	Introduction Nutritional Value Medicinal Value Climate Requirements Soil Requirements Recommended Varieties Planting Materials Spacing Land Preparation Seedling Plantation Fertilizer Application Irrigation Weed Control Training and pruning Fruit thinning Fruit bagging Pest control Disease control Yield Harvesting Storage Packaging and transportation Guava production Export market Labour requirement	2011	Department of Agriculture	
20	A Handbook for Tomato Cultivation	**1. What is GAP?** What is GAP Gap standards GAP core values Different types of hazards that may occur in the crop production pr **2. How to Produce tomatoes according to GAP** Selection of farmer land and maintenance in a good way Select the quality seeds and seedling Soil management in accurately Pest and disease management Managing a clean farming field Harvesting and post-harvest management Farm record keeping Worker health and welfare **3. How to get GAP certificate** Steps for getting GAP certification How can I obtain a basic education in GAP? How can test soil and water analysis data? How do I register for traceability management of agricultural produ How can one apply for a GAP certificate? How is the on-site inspection done? How is follow-up management done?		Deparment of Agriculture	
Guidelines					
21	Pest Management Decision Guides	Major Diseases of Agricultural Crops and Their Management 1.Paddy 2.Chilli 3.Beans 5.Onion 6. Cabbage 6.Crops of Cucurbitaceae Family 7.Peanuts 8. Banana 9.Other Fruits 10. Other crops	2017	CABI and Department of Agriculture	In this book, to identify the problem, it clear photos,the measures to be followed for the prevention of the problem(Prevention), monitoring of the Problem (monitoring) methods of controlling the problem in an environmentally friendly manner by prioritizing integrated Pest Management (Green Direct Control) and their restrictions. By using green and yellow in a traffic signal system for non-chemical and chemical control methods respectively, the user can get an idea of whether it is risky or not

22	Fertilizer Recommendations for Horticultural Crops	1.Low country vegetables 2. Up country vegetables 3. Potato 4. Root & Tuber Crops 5. Fruits 6.Floricultural crops	2010	Department of Agriculture	Guidelines for using soil amendments, organic manure and chemical fertilizers
	Pest Management Recommendations	Pest management in agriculture Introduction to use of pesticides Nozzle choice for application of pesticides International formulation coding system Insecticides Fungicides	2015	Department of Agriculture	Including recommended pesticides and Guidelines for pesticidides
24	Pesticides Recommendations	Herbicides Preface Contributions Introduction Adoptation of pesticides Pesticide Registration Pesticides Application in the Field Crops Nozzle Choice for Pesticides Application Safe and Effective Application of Pesticides Pesticide Safety Recomendatios Rice Vegetable Field crop Fungicides Herbicides Cashew Coconut Export Agriculture Cashew Floriculture Crops Sugarcane	2019	Department of Agriculture	Including recommended pesticides and Guidelines for pesticidides application, Nozzle selection.

Attachment-17

Test report of testing of novel (foreign / Japanese) scouting / monitoring methods and intervals with respect to selected pests （WG1-P3）

Key Activity: Testing of color sticky trap as a monitoring / scouting method for selected pest in brinjal

Responsible Officer: P.H. Ranaweera (ADA/R), HORDI, Gannoruwa

Location: Walewela, Matale District

Objective: Improving the pest monitoring and integrated pest management strategies in brinjal

Methodology: This study evaluated the effectiveness of color sticky traps in attracting insect pests of brinjal. Target pests were common pests i.e. aphids, whiteflies, thrips and leafhoppers. The experiment was conducted in a Randomized Complete Block Design with four replications, using five types (color) of sticky traps: green, white, blue, yellow and red in two farmer fields / locations. Sticky traps were installed 15 cm above the crop canopy and collected 24 hours after installation at weekly intervals. Each sticky trap was covered with transparent polythene and transported to the laboratory. Captured insects were identified using standard procedures in the laboratory. Number of target pests and number of non-target insects (neutral and beneficial) were counted. Crop was managed according to farmer practice including insecticide application.

Results: A total of 8,171 insects were captured across all colors in Location 1, with 35.9% identified as pests, 6.2% as beneficial natural enemies, and 57.8% as neutral insects. In Location 2, total 8,804 insects were recorded, of which 41.4% were classified as pests, 6.5% as natural enemies, and 52.1% as neutral insects.

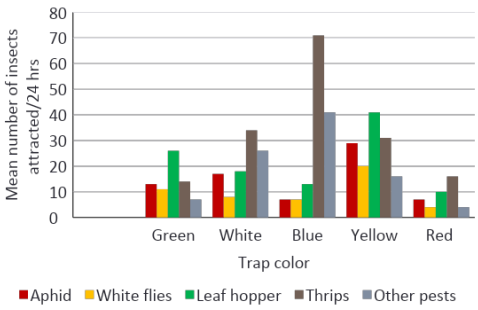


Fig. 1: Mean number of insects attracted to different color sticky traps in Location 1

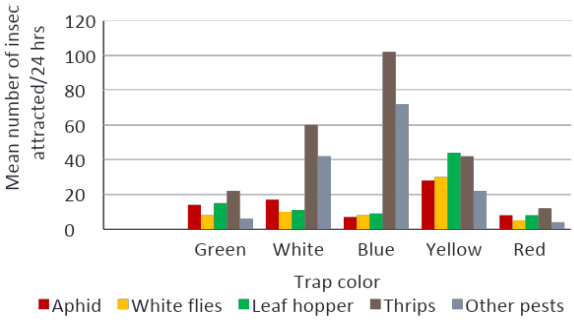


Fig. 2: Mean number of insects attracted to different color sticky traps in Location 2

Conclusion: Yellow sticky traps were most effective for monitoring whiteflies, aphids, and leafhoppers. It also attracted a large number of beneficial and neutral insects. Considering hopper burn as a key pest issue in brinjal, green or white traps could serve as alternative monitoring tools for leafhoppers while minimizing negative impacts on natural enemies.

Way forward: Further studies will be carried out for sticky traps

Utilizing Colored Sticky Traps for Monitoring Brinjal Pest Complex in the Walawela Area, Matale District

Background

Brinjal (*Solanum melongena*) is a critical vegetable crop in many regions, including Sri Lanka, but its production is often threatened by a wide range of insect pests if not managed properly, can lead to substantial yield losses (Kodithuwakku et al., 2021). Integrated Pest Management (IPM) strategies emphasize the importance of timely pest monitoring to minimize the use of chemical pesticides and reduce environmental impact. Sticky traps are commonly used as a surveillance tool in IPM programs (Dearden et al., 2024), but the effectiveness of these traps depends largely on the color used (Lashari et al., 2022), as different pests exhibit varying degrees of attraction to specific colors. Despite the widespread use of colored sticky traps, there is limited research on the optimal color choices for monitoring the diverse pest complex associated with brinjal crops.

The lack of comprehensive studies evaluating pest responses to various colored traps in the brinjal pest complex creates a gap in knowledge that could result in inefficient pest monitoring and management. Therefore, it is essential to analyze which colors are most effective in attracting specific brinjal pests to improve pest monitoring accuracy. Addressing this gap could lead to more target and effective pest control measures, helping farmers reduce crop losses and pesticide use, ultimately contributing to more sustainable brinjal production.

General Objective

To evaluate the effectiveness of various colored sticky traps in attracting different insect pests associated with brinjal, in order to enhance pest monitoring and improve integrated pest management (IPM) strategies for brinjal cultivation.

Specific Objectives

1. To compare the attractiveness of different colored sticky traps (yellow, blue, green, white and red) to the various pest species commonly found in brinjal fields.
2. To understand the effect of different colored sticky traps on attraction of beneficial insects/ neutral insects in brinjal fields

Study Area

The study was conducted in the Walawela area of the Matale District, (7° 31' 19" N and 80° 35' 53" E), situated in Sri Lanka's Central Province (Figure 1 &2). Matale is renowned for its diverse agricultural activities, particularly the cultivation of vegetables like brinjal that one of the main crops in the region. The research was conducted in two farmer fields located in the Walawela area. The fields, situated approximately 1 to 1.5 kilometers apart, share similar climatic conditions.



Figure 1: Location 1- AMAPB Dehigashinne (farmer)



Figure 2: Location 2- BP Sri Nimal Silva (farmer)

Experimental Design

In this study, treatments were arranged using a Randomized Complete Block Design (RCBD), with approximately 50 plants per plot. Treatments were replicated four times.

Treatments

The experimental treatments consist of five (5) different colored sticky traps

- T1- Green
- T2- White
- T3- Blue
- T4- Yellow
- T5- Red



Monitoring and Recording Pest Captures

Sticky traps were installed 15 cm above the plant canopy. The traps were collected after 24 hours, and the study was conducted over a 6-week period, with new sticky traps installed weekly. After collection, each trap was covered with transparent polythene to protect the insects attached and to preserve the trap's sticky surface. The different colored sticky traps were then brought to the laboratory for insect identification and counting. Identification was carried out using insect identification keys and pictorial keys.

Pest observation and Counting

Pests were observed under the microscope, and major brinjal pests such as aphids, whiteflies, thrips, and leafhoppers, were identified. Additionally, other pest species like flea beetle, melon flies and Leaf miners were also identified as other pests**.** All the pest attached to the both sides (30 cm x 21 cm) of the traps were counted

Observing beneficial insects (Natural Enemies) and Neutral insects

In addition to counting pests, the study recorded the presence of beneficial insects and neutral insects (Insects that were neither pests nor natural enemies). Each colored sticky trap was first examined for beneficial insects, such as predators and parasitoids, and then neutral insects were identified and recorded up to their "order" level for unfamiliar insects. All natural enemies and neutral insects attached to both sides of (30 cm x 21cm) the traps were counted to ensure accurate data collection. The insects that could not be identified directly were preserved in 70% ethanol for later identification.

Data Analyzing

The pests, natural enemies, neutral insects and the colors that attracted the highest number of insect to the different colored sticky traps in location one and two were statistically analyzed using a chi-square test. This analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 25.

Total insects attracted to sticky traps in Location 1 and Location 2

In this study, five different colored sticky traps; green, white, blue, yellow, and red were evaluated for their effectiveness in capturing major pests of brinjal, including the shoot and fruit borer, whiteflies, leafhoppers, thrips, and aphids, across two locations over a six-week period. Insect captures were recorded once a week. In Location 1, a total of 8,171 insects were captured across all colors. Of these, 35.9% were identified as pests, 6.2% as beneficial natural enemies, and 57.8% as neutral insects. In Location 2, a total of 8,804 insects were recorded, with 41.4% classified as pests, 6.5% as natural enemies, and 52.1% as neutral insects. However, despite being a major pest of brinjal, the shoot and fruit borer was not attracted to any of the sticky traps in either location throughout the six-week evaluation period. Among the pest species that were effectively captured, the most common were whiteflies, leafhoppers, thrips, and aphids. Additionally, other pests such as leaf miners, flea beetles, and fruit flies were also recorded in the traps.

Percentages of total insects captured on different color sticky traps over 6-week period in Location 1 and Location 2

Percentage of total number of insects captured during 6-week period for each color; green, white, blue, yellow, and red was evaluated in Location 1, the highest percentage of insects attracted to the yellow color traps (25.2), followed by blue (21.9), green (20.1), white (18.3), and red (14.5) (Figure 3). The differences in insect attraction (number of insects) among the various colored traps in Location 1 were statistically significant ($\chi^2 = 262.535$, df = 4, p = 0.001), indicating a clear variation in the attractiveness of the different colors in attracting insects.

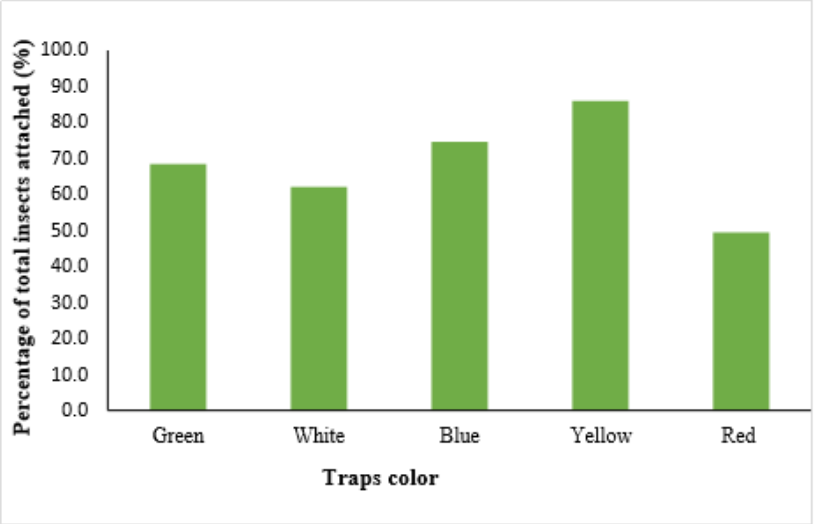


Figure 3: Percentages of total insects captured for different color sticky traps in Location 1

Similarly, percentage of total number of insects captured 6-week period in each specific color in Location 2 also recorded, the highest attraction was recorded from yellow (26.0%) color followed by blue (23.2%), white (19.6%), green (17.9%), and red (13.3%) (Figure 4). The variation in the number of insects attracted to each color was also statistically significant in Location 2. ($\chi^2 = 423.193$, df = 4, p = 0.001). Across both locations, the yellow-colored sticky traps consistently exhibited the highest insect attraction, including pest insects, natural enemies as well as neutral insects compared to the other colors. This suggests that yellow color sticky traps may be the most attractiveness for insect populations in brinjal fields, outperforming other colors in terms of overall attractiveness.

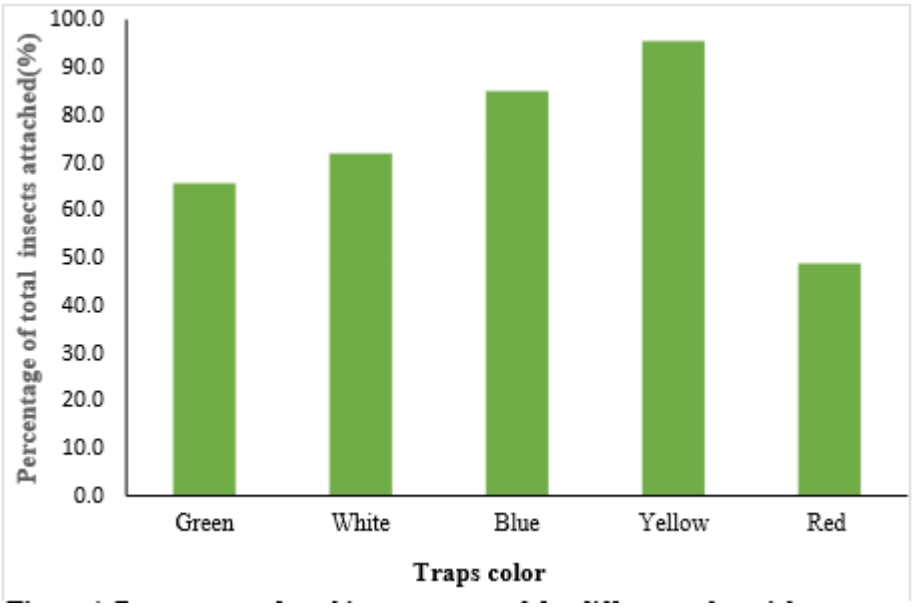


Figure 4: Percentages of total insects captured for different color sticky traps in Location 2

Effect of trap color on total insect catch, pests, beneficial insects, and neutral insects in Location 1 and Location 2 during 6-week period

In both Location 1 and Location 2, each color trap attracted the highest percentage of neutral insects compared to pests and beneficial insects (natural enemies) except blue color in location 1 and 2 and white color in location 2.

Table 1: The relative proportion of pests, beneficial insects (natural enemies) and neutral insect caught in different color traps

Trap color	Total catch	Percentage of catch (%)			Levels of Significance
		Pests	Beneficial insects	Neutral insects	
Location 1					
Green	1641	25.6	3.5	70.9	$p<0.05$
White	1491	41.0	6.1	52.9	$p<0.05$
Blue	1791	46.5	7.8	45.7	$p<0.05$
Yellow	2062	40.1	8.3	51.6	$p<0.05$
Red	1186	20.7	3.9	75.5	$p<0.05$
Location 2					
Green	1574	25.7	4.4	69.8	$p<0.05$
White	1726	48.3	8.6	43.1	$p<0.05$
Blue	2040	58.2	5.9	35.9	$p<0.05$
Yellow	2293	43.3	7.9	48.8	$p<0.05$
Red	1171	19.1	4.7	76.2	$p<0.05$

Mean number of insects attracted in different color sticky traps per week in Location 1

In location 1, mean number of insects attracted in different color traps per week was recoded and Yellow traps were most effective for capturing white flies (20), Aphids (29) and Leafhoppers (41), while Blue traps attracted the highest number of Thrips (71) and other pests (41) (Table 2). Green traps showed a significant capture of Leafhoppers (26) and the highest count of neutral insects (194), indicating a strong general attraction. White traps were particularly effective for Thrips (34) and attracted a moderate number of beneficial insects (131). Red traps attracted the lowest number of most insect categories, except for neutral insects (149). These findings align with the results of Liburd et al. (2000), Vaishampayan et al. (2019) and Zulkifli et al., (2024), who reported that insects such as aphids, whiteflies, and thrips are often more attracted to yellow and blue colors. This makes yellow and blue sticky traps especially effective for monitoring these pest species. The Chi-square test results for all categories are statistically significant ($p < 0.05$), indicating that trap color significantly affects insect capture rates, with the highest significance observed in Thrips ($\chi^2 = 63.217$, $p = 0.001$) and other pests ($\chi^2 = 48.447$, $p = 0.001$).

Table 2: **Mean number of insects attracted in different color traps per week in Location 1**

Trap color	Pests				Other pests	Beneficial insects	Neutral insects
	Aphid	White flies	Leaf hopper	Thrips			
Green	13	11	26	14	07	10	194
White	17	08	18	34	26	15	131
Blue	07	07	13	71	41	23	136
Yellow	29	20	41	31	16	29	177
Red	07	04	10	16	04	08	149
Chi square value	χ^2 = 8.920, df = 4, p = 0.03	χ^2 = 22.680, df = 4, p = 0.001	χ^2 = 28.574, df = 4, p = 0.001	χ^2 = 63.217, df = 4, p = 0.001	χ^2 = 48.447, df = 4, p = 0.001	χ^2 = 18.471, df = 4, p = 0.001	χ^2 = 18.737, df = 4, p = 0.001

Mean number of insects attracted in different color traps per week in Location 2

In location two, mean number of insects attracted in different color traps per week (four cards) was recorded. Comparably in location 2 also showed the highest number of Aphids (28), Whiteflies (30), and Leafhoppers (44), attracted to yellow color traps indicating their strong attractiveness to these pests (Table 3). Blue traps were most effective for Thrips, capturing 102 individuals, and also attracted a considerable number of other pests (72). Green traps showed a balanced attraction across all categories but had the highest count of neutral insects (183), indicating a strong general attractiveness. Red traps, in contrast, attracted fewer insects overall, with the lowest captures in most categories.

Table 3: Mean number of insects attracted in different color traps per week in Location 2

Trap color	Pests				Other pests	Beneficial insects	Neutral insects
	Aphid	White flies	Leaf hopper	Thrips			
Green	14	08	15	22	06	12	183
White	17	10	11	60	42	25	124
Blue	07	08	09	102	72	20	122
Yellow	28	30	44	42	22	30	186
Red	08	05	08	12	04	09	149
Chi square value	χ^2 = 19.378, df = 4, p = 0.001	χ^2 = 23.000, df = 3, p = 0.001	χ^2 = 52.483, df = 4, p = 0.001	χ^2 = 106.454, df = 4, p = 0.001	χ^2 = 110.301, df = 4, p = 0.001	χ^2 = 15.979, df = 4, p = 0.001	χ^2 = 24.914, df = 4, p = 0.001

The Chi-square test results for all insect categories (Table 3) are statistically significant ($p < 0.05$), highlighting that trap color significantly influences insect capture rates. The highest significance was observed in the categories of other pests ($\chi^2 = 110.301$, df = 4, $p = 0.001$) and Thrips ($\chi^2 = 106.454$, df = 4, $p = 0.001$). This analysis is crucial for designing effective

pest management strategies that optimize the use of colored traps to monitor and control specific insect populations while minimizing non-target captures.

The beneficial and neutral insects attracted to five different color sticky traps in Location 1 and Location 2

The significance of beneficial insects lies in their ability to reduce pest populations, pollinate plants, and recycle nutrients by decomposing plant and animal matter. Number of beneficial insects attracted to various color traps varied across the orders Hymenoptera **(**wasps), Diptera (flies)**,** Coleoptera (beetles**)**, and Araneae (spiders) in Location 1 and Location 2. However, a few spiders were attracted to traps in both locations. Yellow traps attracted the highest number of beneficial insects, while red traps attracted the fewest.

This study investigated the attraction of neutral insects for different color sticky traps across two locations. The attracted neutral insects were belonging to orders Lepidoptera and Coleoptera. The highest preference was for yellow and green color traps compared to other colors evaluated. Most house flies and mosquitoes, belonging to the order Diptera, along with a few fire beetles (Coleoptera) and Lepidopterans, were attracted to the different color traps as neutral insects. This suggests that color plays a critical role in attracting beneficial insects and neutral insets in both locations.

Conclusions

A total of 8,171 insects were captured across all colors in Location 1, with 35.9% identified as pests, 6.2% as beneficial natural enemies, and 57.8% as neutral insects. In Location 2, total 8,804 insects were recorded, of which 41.4% were classified as pests, 6.5% as natural enemies, and 52.1% as neutral insects. Across both locations, yellow-colored sticky traps consistently attracted higher number of insects, including pests, natural enemies, and neutral insects, compared to other colors. Yellow traps were particularly effective at capturing whiteflies, aphids, and leafhoppers, while blue traps attracted the most thrips and other pests (flea beetle which are not major pests of brinjal). Green traps captured a significant number of leafhoppers and had the highest count of neutral insects, indicating a strong general attraction. White traps were notably effective for thrips and attracted a moderate number of beneficial insects. Red traps attracted the fewest insects overall, except for neutral insects. Chi-square test results for all insect categories were statistically significant ($p < 0.05$), indicating that trap color significantly influenced insect capture rates. Thus, Yellow sticky traps were the most effective for capturing leafhoppers, whiteflies, and aphids, excluding thrips. However, it also attracted the largest number of beneficial and neutral insects. In brinjal cultivation, hopper burn was the primary pest issue, apart from shoot and fruit borer (*Leucinodes orbonalis*). As a result, green or white sticky traps could be considered as alternatives to monitor or reduce leafhopper populations while minimizing the impact on beneficial insects.

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Key Activity: Testing of color sticky trap as a monitoring / scouting method for selected pest in tomato

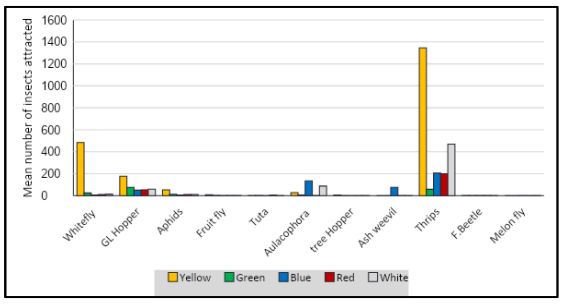
Responsible Officer: Dr. T.K.A.I. Hadji (ADA/R), RARDC, Bandarawela

Location: Boralanda & Kahaththewela, Badulla District

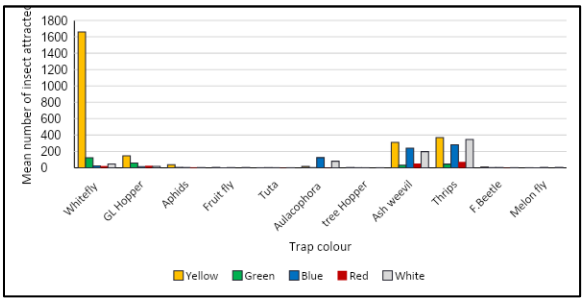
Objective: Improving the pest monitoring and integrated pest management strategies (IPM) in tomato

Methodology: The study evaluated the effectiveness of color sticky traps in attracting insect pests of tomato. The target pests were whitefly, green leaf hopper (GL hopper), aphids, fruit fly, tuta and others. The experiment was conducted in a Randomized Complete Block Design with four replications using five types (color) of sticky traps: green, white, blue, yellow and red in two farmer fields / locations. Sticky traps were installed 15 cm above the tomato crop canopy and collected after 24 hours at weekly intervals for 8 weeks starting from planting. Each trap was covered with transparent polythene after collection to preserve insects and transported to the laboratory. Captured insects were identified using standard taxonomic keys. Number of target pests, number of neutral insects and number of beneficial insects were counted. Crop was managed according to farmer practice including insecticide application.

Results: The yellow sticky trap captured highest number of pests among all colors with an average of 483.75, 177 and 53 whiteflies, GL hoppers and aphids respectively in Boralanda. Count of tuta (a significant tomato pest) was low compared to other pests with yellow sticky trap capturing only 0.75 individuals on average. Among other pests, yellow traps captured substantial number (1346.75) of thrips. Similarly, the yellow sticky traps captured highest number of pests among all colors with an average of 469.5, 169.25 and 47.5 whiteflies, GL hoppers and aphids respectively in Kahaththewela, Thrips were highly prevalent, with 1290.75 individuals recorded on the yellow trap.



Mean number of insects attracted to different color sticky traps in Boralanda



Mean number of insects attracted to different color sticky traps in Kahaththewela

Conclusion: Yellow sticky traps were highly effective in capturing whiteflies, green leafhoppers, aphids, and thrips. Attraction of tuta was poor to any trap color highlighting the need for other monitoring method for this pest. Differences between the two fields were minimal indicating that consistency of the effectiveness of sticky traps across different farming situations.

Way forward: Further studies will be carried out for sticky traps.

REPORT

Key Activity: Testing of colour sticky traps as scouting / monitoring method for selected pests

Title: Attraction of Pest Insects, Neutral Insects and Natural Enemies to Coloured Sticky Traps in Tomato in Badulla district

Abstract

This study investigated the effectiveness of different coloured sticky traps in monitoring insect pest populations in tomato fields located in Boralanda and Kahaththewela, Sri Lanka. The experiment utilized a randomized complete block design (RCBD) and evaluated the average number of key insect pests, including Whitefly, Green Leafhopper (GL Hopper), Aphids, Fruit Flies, *Tuta absoluta*, and others, trapped across different treatments. Results indicate significant differences in pest attraction across trap colours, with the yellow traps being particularly effective for Whitefly and Thrips.

Introduction

Tomato (*Solanum lycopersicum*) is a crucial crop in Sri Lanka, particularly in districts such as Badulla, where vegetable farming is a key livelihood. However, tomato production faces constant threats from a variety of insect pests, which can drastically reduce yield and quality. Among the various insect pests affecting tomato, virus vectors such as whiteflies, aphids, leafhoppers, and thrips, along with the tomato leaf and fruit miner and fruit borer, pose significant threats. Tobacco whitefly (*Bemisia tabaci*) is a major vector of tomato yellow leaf curl virus, while thrips (*Thrips palmi*) transmit tomato spotted wilt virus, aphids spread cucumber mosaic virus, and leafhoppers are responsible for curly top virus. These viral diseases substantially impact tomato growth and yield, making the management of virus vectors crucial to successful cultivation. The most common practice for insect pest management among farmers is the application of synthetic insecticides. However, environmental contamination and human health concerns have prompted the search for alternative strategies.

Sticky traps have been proposed as a sustainable option for managing populations of small flying insect pests such as whiteflies, aphids, thrips, and leafhoppers, both in open fields and protected environments. In addition to pest management, sticky traps are also widely used to monitor insect populations in the field. Sticky traps are non-selective, capturing not only target pests but also beneficial insects like pollinators, parasitoids, and predators, as well as neutral insects. The effectiveness of these traps depends on various factors, including trap colour and height. While insect responsiveness to colour is well known for certain species, such as the attraction of many insects to yellow, the response of other insect species to different colours is less understood. In Sri Lanka, yellow and blue sticky traps are commonly used to target whiteflies and thrips. However, in other countries, traps of different colours, such as red, green, and white, are also utilized. Understanding the species-specific attraction to different colours is important for insect pest monitoring in the fields. This could lead to the

more selective use of traps, minimizing harm to beneficial insects while effectively managing pest populations. This study aims to evaluate the efficacy of different coloured sticky traps in two tomato fields; Boralanda and Kahaththewela tomato fields by assessing the attraction of different insect species to five (yellow, blue, red, green and white) colours.

Materials and Methods

Study Locations:

The study was conducted from June 2024 to August 2024 in two tomato fields, Boralanda and Kahaththewela, located in the highlands of the Badulla district. Relatively cooler temperatures and high humidity characterize these fields, favouring tomato growth but also attracting pests. The two locations have similar climatic conditions but slightly different agroecological factors influencing pest populations. The extent of tomato fields was approximately ¼ acre in each field. In both fields the tomato variety Padma was planted. The traps were installed two weeks after field planting in both locations.



Figure 1: Installation of traps in tomato field

Experimental Design:

To minimize environmental variability, a randomized complete block design (RCBD) with four replicates was employed in both fields. The traps were placed in blocks, with each block containing sticky traps of different colours. In the middle of the plot, a wooden stake was installed to hang the traps. The treatments (coloured traps) included Yellow, Blue, White, Green, and Red, and they were installed 15cm above the canopy level. The traps were kept in the field for 24 hours and insect data were collected. The traps were installed in weekly intervals in the fields for 8 times.

Data collection:

Pests Monitored: Insect pests, natural enemies, and neutral insects that were attracted to each sticky trap were counted. The sticky traps were examined in the fields itself and insects were identified and counted using a hand lens in the field. Upon identification and counting, the insects were classified as pest species, natural enemies and neutral insects. The identification was done using taxonomic keys based on the morphological characters, published images and related literature.

Results and Discussion

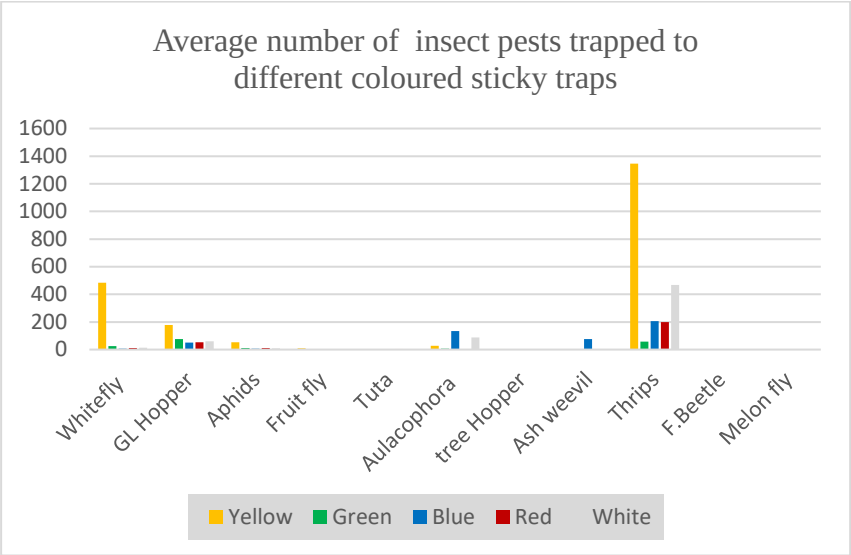


Figure 2: Average number of insect pests trapped to different coloured sticky traps from 20.06.2024 to 07.08.2024 in Boralanda

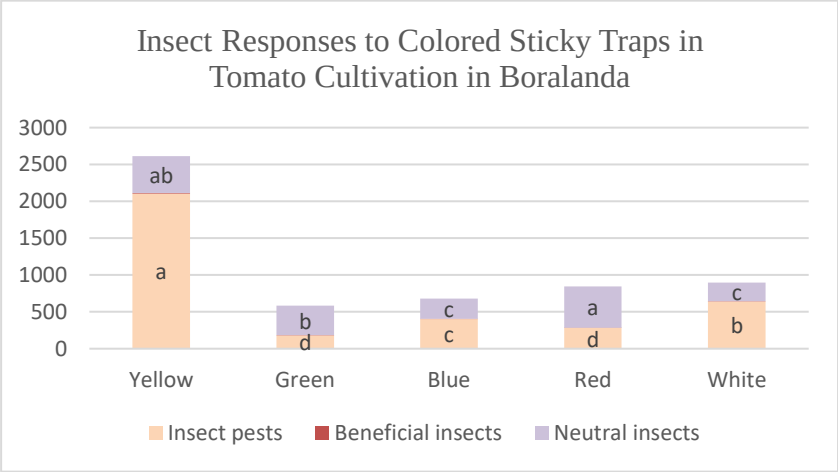


Figure 3: Average number of insect pests, beneficial insects and non-target insects trapped to each coloured sticky trap in Boralanda

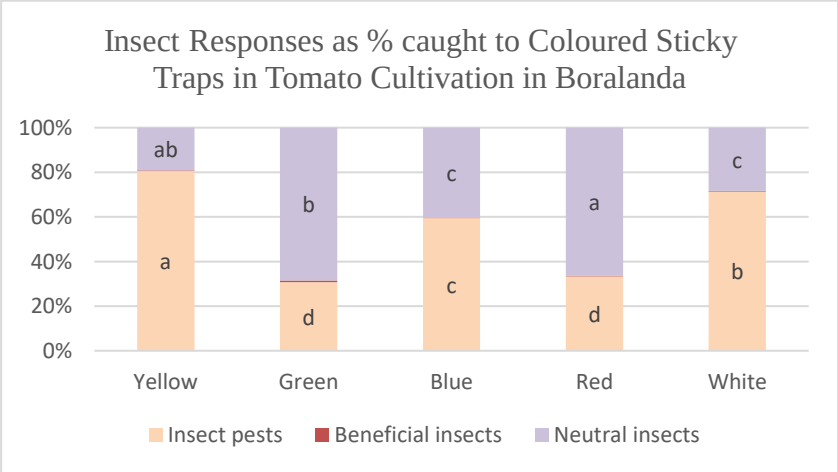


Figure 4: Insect responses as % caught to different coloured sticky traps in tomato cultivation in Boralanda

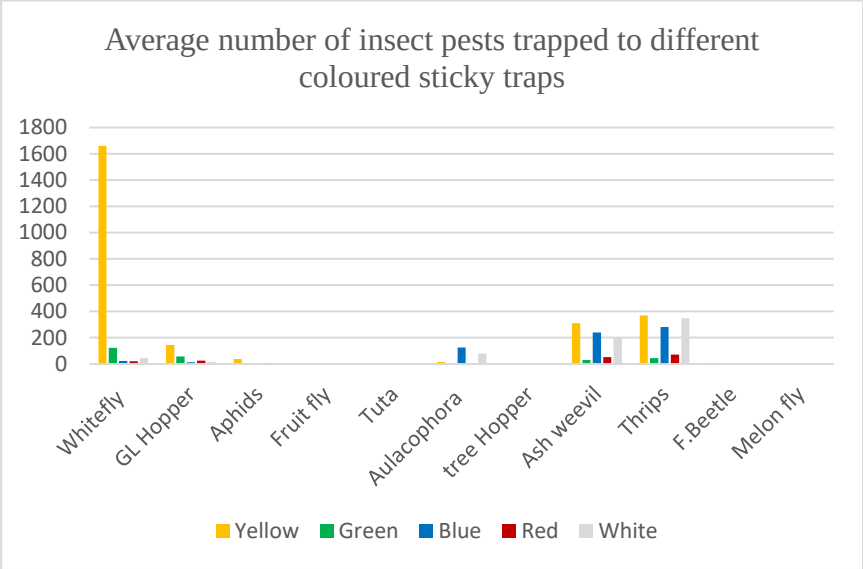


Figure 5: Average number of insect pests trapped to different coloured sticky traps from 20.06.2024 to 07.08.2024 in Kahaththewela

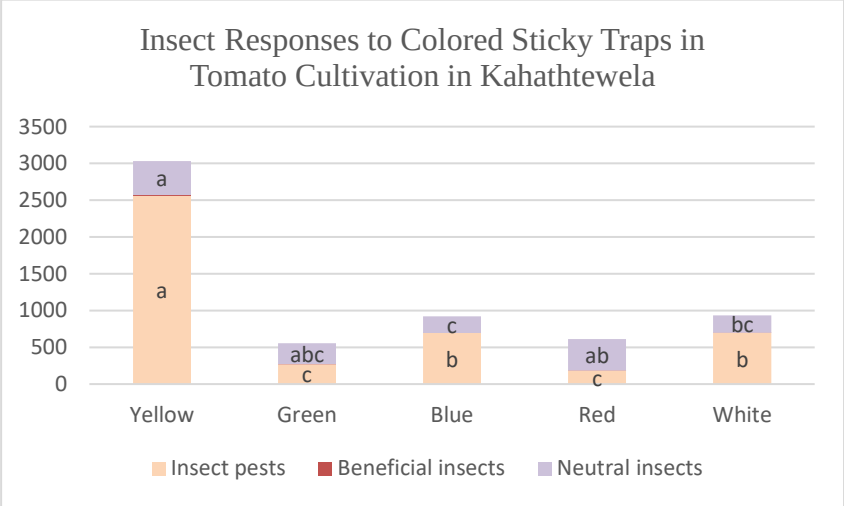


Figure 6: Average number of insect pests, beneficial insects and non-target insects trapped to each coloured sticky trap in Kahaththewela

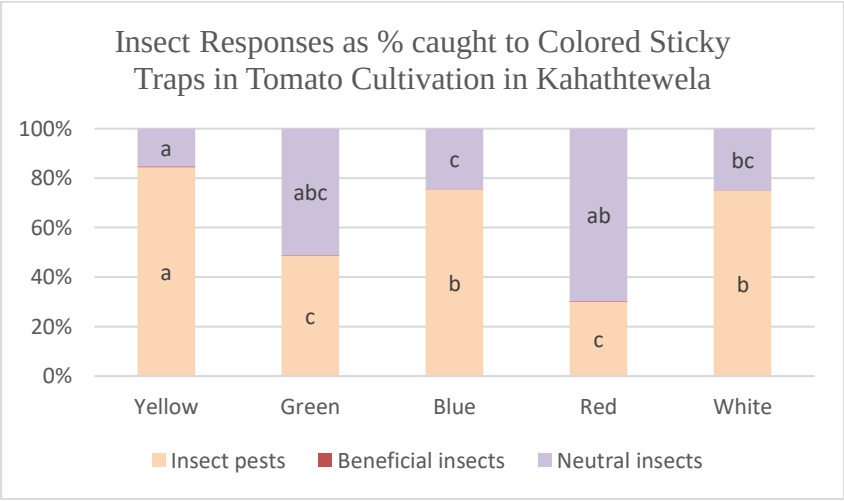


Figure 7: Insect responses as % caught to coloured sticky traps in tomato cultivation in Boralanda

Boralanda Field:

The yellow sticky traps were the most effective in capturing Whiteflies, with an average of 483.75a whiteflies per trap. GL Hoppers also exhibited a preference for yellow traps, with 177a individuals captured. Aphids showed a significant attraction to the traps, with 53a caught. Other pest species, such as Thrips, were captured in substantial numbers on the yellow traps (1346.75a). The following key observations were made: Whitefly populations were highest on yellow traps compared to other colors, thrips showed a strong preference for yellow traps, *Tuta absoluta* (a significant tomato pest) had lower trap numbers, with yellow traps capturing only 0.75bc individuals on average.

Kahaththewela Field:

Similarly, in Kahaththewela, the yellow sticky traps proved to be the most effective for attracting Whiteflies, with an average of 469.5a individuals. Green Leafhoppers were also most frequently found on yellow traps (169.25a). The number of Aphids trapped was comparable to the Boralanda field, at 47.5a. Thrips were highly prevalent, with 1290.75a individuals recorded on the yellow traps.

Differences between the two fields were minimal, indicating that the attraction patterns of insect pests to coloured traps are consistent across different agroecological zones. However, the numbers of *Tuta absoluta* remained low across both fields, suggesting that sticky traps may not be the most effective monitoring tool for this specific pest.

Conclusion

This study demonstrates that yellow sticky traps are highly effective in capturing Whiteflies, Green Leafhoppers, Aphids, and Thrips in tomato fields across both Boralanda and Kahaththewela. However, for pests like *Tuta absoluta*, other monitoring methods may need to be integrated since sticky traps recorded low numbers.

Key Activity: Testing of color sticky trap as a monitoring / scouting method for selected pest in cabbage

Responsible Officer: H.A.S.N. Hettiarachchi (ADA/R), ARS, Seethaeliya

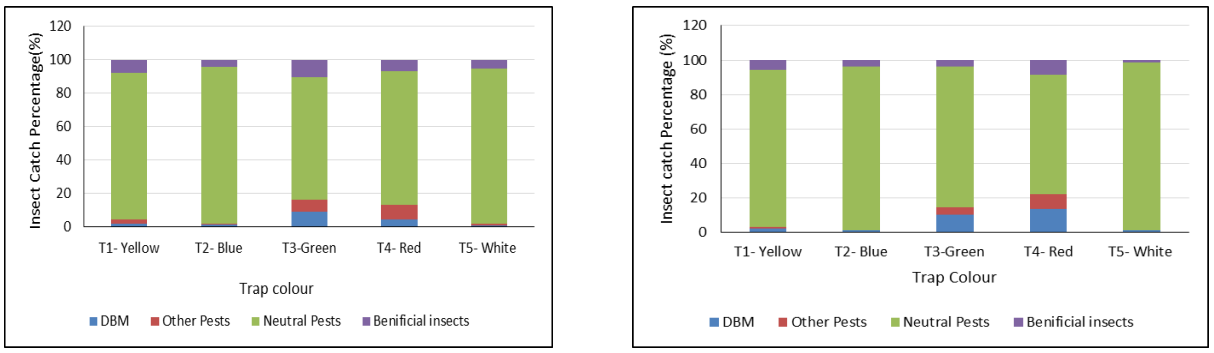
Location: Seethaeliya & Meepilimanna in Nuwaraeliya

Objective: Improving the pest monitoring and integrated pest management strategies in cabbage

Methodology: The study evaluated the effectiveness of color sticky traps in attracting important insect pest of cabbage. Target pest was diamond black moth (DBM). The field experiment was conducted in a Randomized Complete Block Design (RCBD) with four replications using five types (color) of sticky traps: yellow, red, blue, green, and white in two farmer fields / locations. Sticky traps were installed 15 cm above the cabbage crop canopy and collected after 24 hours at weekly intervals for 8 weeks starting from planting. Each trap was covered with transparent polythene after collection to preserve insects and transported to the laboratory. Captured insects were identified using standard taxonomic keys. Number of target pest, number of non-target pests, number of neutral insects and number of beneficial insects were counted. Crop was managed according to farmer practice including insecticide application.

Results: Total of 7,452 insects was captured comprising of 2.79% DBM, 3.38% other pests, 87.43% neutral insects and 6.38% beneficial insects in Seeethaeliya location. The total insect catches and percentages by trap type were: Yellow = 1,351 and 18.19%, Blue = 1,632 and 21.95%, Green = 776 and 10.41%, Red = 1,507 and 20.23%, and White = 2,172 and 29.20%.

Total of 10160 insects were captured comprising of 3.03% DBM, 1.49% other pests, 91.73% neutral insects and 3.74% beneficial insects in Meepilimanna location. The total insect catches and percentages by trap type were: Yellow = 2,268 and 22.32%, Blue = 2,740 and 26.96%, Green = 1016 and 10.00%, Red = 708 and 6.96%, and White = 3,428 and 33.74%.



Insect catch percentages in Seethaeliya and Meepilimanna locations

Conclusion: Green and red sticky traps are most effective for capturing diamondback moth, while red traps demonstrate greater efficacy in capturing other pest insects. White sticky traps attract the highest number of neutral insects. In contrast, yellow and blue sticky traps are more effective in attracting beneficial insects compared to the other color sticky traps

Way forward: Further studies will be carried out for sticky traps

REPORT

Key Activity: Testing of colour sticky traps as scouting / monitoring method for selected pests

Title: Development of sticky trap as a decision making tool for the management of leaf eating caterpillar on cabbage in Nuwara eliya

Objectives

To identify the effective trap colour for introducing sticky trap as a monitoring tool to manage Diamondback moth

Methodology

Two farmer fields were selected at Meepilimana and SeethaEliya. All the management practices were done according to the farmer practice and no restrictions to apply insecticides. Yellow, red, blue, green and white colour sticky trap were established at the planting day at canopy level.
Treatments

T1- Yellow colour sticky trap
T2- Red colour sticky trap
T3- Blue colour sicky trap
T4- Green colour sticky trap
T5- White colour sticky trap

Data were collected over eight weeks. Number of target pests, number of non-target pests, number of neutral pest and /beneficial insects/natural enemies trapped 24 hrs after trap establishment.

Results

Location: SeethaEliya farmer field

In this study, a total of 7,452 insects were captured using sticky traps of five different colours. The insects were categorized into four groups: diamondback moth (2.79%), other pest insects (3.38%), neutral insects (87.43%), and beneficial insects (6.38%). The total insect catches by colour were: Yellow (1,351; 18.19%), Blue (1,632; 21.95%), Green (776; 10.41%), Red (1,507; 20.23%), and White (2,172; 29.20%) (Figure 01).

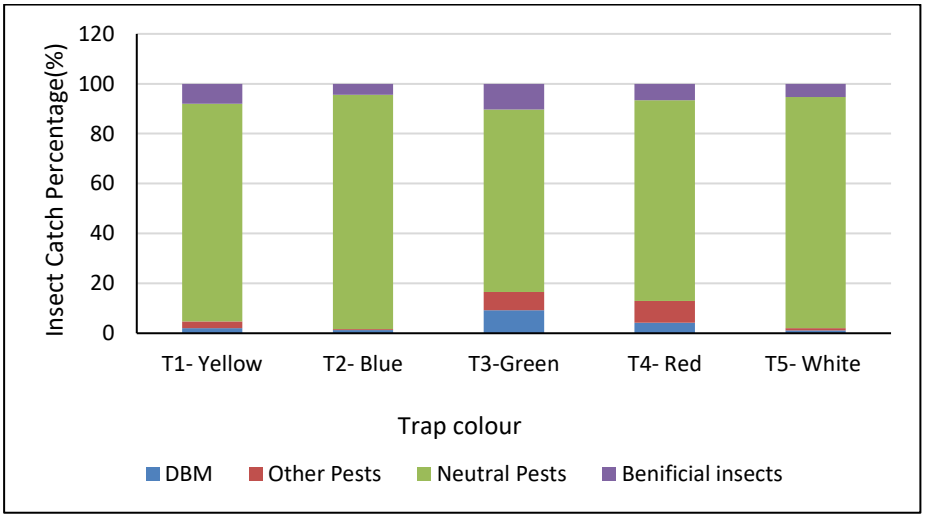


Figure 1: Response of diamondback moth, other pest, neutral and beneficial insects to different colours as the percent caught in colour sticky trap in cabbage field, SeethaEliya

Insect Group Responses to Trap Colors

Diamondback Moth (DBM)

The data indicate that trap colour had a significant effect on the capture of diamondback moth. Traps with green and red colours attracted significantly more DBM compared to yellow, blue, and white traps (Table 01).

Table 01: Mean number of Diamond back moth, other insect pests, neutral insects and beneficial insects caught in different colour trap in cabbage field, SeethaEliya

Treatments	Diamondback moth	Other Pests	Neutral Pests	Beneficial insects
T1- Yellow	7 b	9 b	296 b	27 a
T2- Blue	5 b	2 b	384 b	18 a
T3- Green	18 a	14 b	142 c	20 a
T4- Red	16 a	33 a	303 b	25 a
T5- White	6 b	5 b	504 a	29 a
CV	20.30	62.53	23.52	39.71

Mean in a column followed by the same letters are not statistically significant at 5% level DMRT

Non target/ Other Pest Insects

The category of other pests mainly consisted of thrips and flea beetles, with occasional captures of melon fly, planthopper, aulacophora beetle, and leaf miners. Among the treatments, the red-colored sticky traps captured a significantly higher number of other pest insects (thrips) compared to the other colours. No significant differences were found between yellow, blue, green, and white traps for capturing other pests.

Neutral Insects

For neutral insects, which comprised the largest portion of the total insect count, the white-coloured sticky traps captured significantly more individuals compared to all other treatments.

On the other hand, green-coloured sticky traps captured the fewest neutral insects, making them the least attractive to this non-target group.

Beneficial Insects

Regarding beneficial insects, no significant differences were observed between the trap colours. All treatments were showed similar attraction in capturing beneficial insects.

Location: Meepilimana farmer field

In this study, a total of 10160 insects were captured using sticky traps of five different colours. The insects were categorized into four groups: diamondback moth (3.03%), other pest insects (1.49%), neutral insects (91.73%), and beneficial insects (3.74%). The total insect catches by colour were: Yellow (2,268; 22.32%), Blue (2,740; 26.96%), Green (1016; 10.00%), Red (708; 6.96%), and White (3,428; 33.74%) (Figure 02).

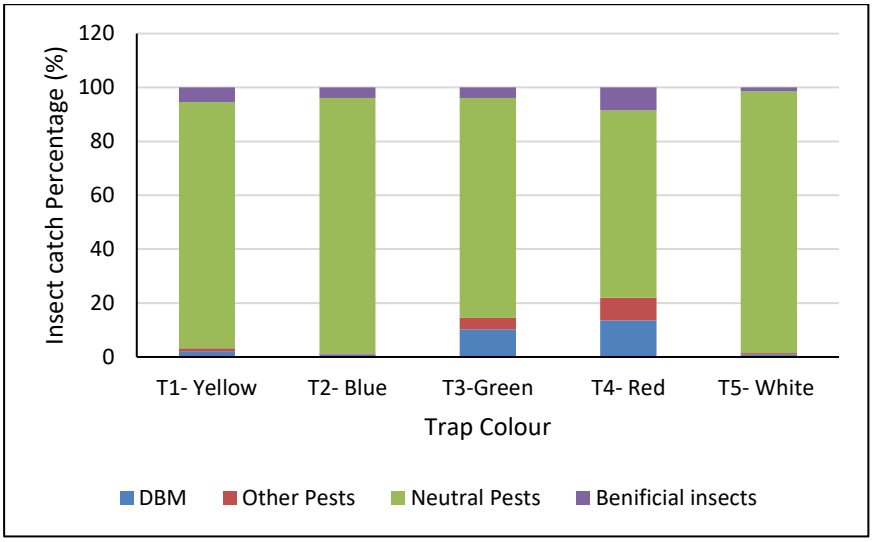


Figure 2: Response of diamondback moth, other pest, neutral and beneficial insects to different colours as the percent caught in colourd sticky trap in cabbage field, SeethaEliya

Insect Group Responses to Trap Colors

Diamondback Moth (DBM)

The data indicate that trap color significantly affects the capture rates of diamondback moths (DBM). In particular, green and red traps attracted a markedly higher number of DBM compared to yellow, blue, and white traps (Table 02).

Non-target/Other Pest Insects

The red color trap attracted the highest number of pests (15), with no significant differences observed when compared to the green and yellow traps. Conversely, the blue and white sticky traps captured a significantly lower number of pests, and their catches were statistically similar to each other.

Table 2: Mean number of Diamond back moth, other insect pests, neutral insects and beneficial insects caught in different colour trap in cabbage field, Meepilimana

Treatments	Diamondback moth	Other Pests	Neutral Pests	Beneficial insects
T1- Yellow	12 b	6 ab	518 b	31 a
T2- Blue	7 b	2 b	649 b	27 ab
T3-Green	24 a	11 ab	207 c	10 c
T4- Red	26 a	15 a	123 d	15 bc
T5- White	8 b	4 b	833 a	12 c
CV	43.08	47.35	14.87	47.10

Mean in a column followed by the same letters are not statistically significant at 5% level DMRT

Neutral Insects

The white color trap captured the highest number of neutral pests (833 individuals), significantly surpassing all other color traps. The blue color sticky trap recorded the second highest count, with 649 individuals. In contrast, the red color sticky trap exhibited the lowest count of neutral insects.

Beneficial Insects

The yellow color sticky trap attracted the highest number of beneficial insects (31 individuals), followed by the blue color sticky trap with 27 individuals. The red and white sticky traps demonstrated lower levels of attraction, while the green sticky trap attracted the fewest beneficial insects, totaling 10 individuals.

Conclusion

This study illustrates that trap color significantly influences the capture rates of various insect groups. Green and red traps are most effective for controlling diamondback moths, while red traps demonstrate greater efficacy in capturing other pest insects. White traps attract the highest number of neutral insects. In contrast, yellow and blue traps are more effective in attracting beneficial insects compared to the other color traps. These findings underscore the importance of selecting appropriate trap colors to optimize pest management strategies and enhance the conservation of beneficial insect populations.

Repeating the experiment would be beneficial to confirm the results obtained in this study.

Attachment-18

Test report of validation of rapid test kit for disease identification （WG1-P4）

Key Activity: Validation of rapid test kit for disease identification

Responsible Officer: Mrs. M.S.W. Fernando (PAS) and Ms. K. Pushpanjie (ADA)

Location: HORDI, Gannoruwa

Objective: Efficient management of viral diseases in key vegetable crops through early detection and differentiation of virus

Methodology: The study involved validation of immuno strips as a rapid test kit for selected plant viral diseases. Plant samples from plants showing various virus disease symptoms were collected from field grown bean, tomato and cucurbit (pumpkin, zucchini, salad cucumber, snake gourd) crops in Badulla, Nuwaraeliya, Kandy and Matale districts representing diverse farming situations. Samples were screened based on visual symptoms again in order to further verify for relevant diseases. The selected samples were tested using 5 types of immuno strips namely BYMV, CGMMV, ZYMV, TSWV and ImmunoComb (Make - Agdia ImmunoStrip) for respective diseases following the procedure recommended by the relevant immuno strip producer. Samples were categorized as positive, negative or symptomatic. Immuno strip accuracy was validated by comparing sample results with sample symptomatology.

Results: CGMMV, ZYMV and TSWV immuno strips successfully detected respective viruses providing clear positive or negative results. BYMV and ImmunoComb immune strips did not produce positive results indicating their unsuitability for virus detection.

Conclusion: The CGMMV, TSWV and ZYMV immuno strips are suitable for field-level identification of respective plant viruses.

Recommendation / Way forward: Introduction and promotion of use of validated immuno strips in national plant protection programs and farmer level diagnosis.

Project Report:

Rapid Detection of Plant Viruses Using Immuno Strips

1. Title

Rapid Detection of Selected Plant Virus Diseases Using Immuno Strips as a Quick Field Diagnostic Tool

2. Working Group

Working Group – 01 (Pesticide)

Focused Area: Disease identification

3. Responsible Officers

• M.S.W. Fernando (P.A.S.)

• K. Pushpanjie (A.D.A.)

4. Objectives

• To validate and introduce immuno strips as a rapid field detection method for selected plant viral diseases.

• To enable early detection and differentiation of viruses in key vegetable crops.

5. Justification

Traditional methods of virus detection are often time consuming and lab dependent. Immuno strips allow for on site, early detection of viral diseases, enabling prompt and accurate management decisions. These tools can help reduce misdiagnosis in diseases with similar symptoms, thus supporting better disease control.

6. Methodology

Immuno strips were purchased for detection of the following major vegetable viruses (25 strips per virus type):

- BYMV – Bean Yellow Mosaic Virus
- CGMMV – Cucumber Green Mottle Mosaic Virus
- ZYMV – Zucchini Yellow Mosaic Virus
- TSWV – Tomato Spotted Wilt Virus
- Immuno comb: TSWV, INSV, TSV

Virus-infected plant samples were collected from field-grown vegetable crops including:
• Beans

• Tomato
• Cucurbitaceous crops (Pumpkins, Zucchini, Salad cucumber, Snake gourd, etc.)

The following steps were carried out:
• Sample collection



• Field testing using immuno strips



• Categorization into positive, negative, and symptomatic samples



• Validation of strip accuracy for field conditions

7. Results

Immuno strips successfully detected selected viruses in tomato, cucurbitaceous crops, and beans. The test proved to be effective under field conditions, providing clear positive or negative results.

Table 1: Results and used strips within the collected samples

Type of strip used	Amount of strips received	Amount of Strips used	Positive resulted strip number	Negative resulted strip number
BYMV – Bean Yellow Mosaic Virus	25	20	-	20
CGMMV – Cucumber Green Mottle Mosaic Virus	25	25	21	4
ZYMV – Zucchini Yellow Mosaic Virus	25	25	23	2
TSWV – Tomato Spotted Wilt Virus	25	25	18	7
Immuno comb: TSWV – Tomato Spotted Wilt Virus	25	25	15	10
INSV – Impatiens Necrotic Spot Virus		25	-	25
TSV – Tobacco Streak Virus		25	-	25

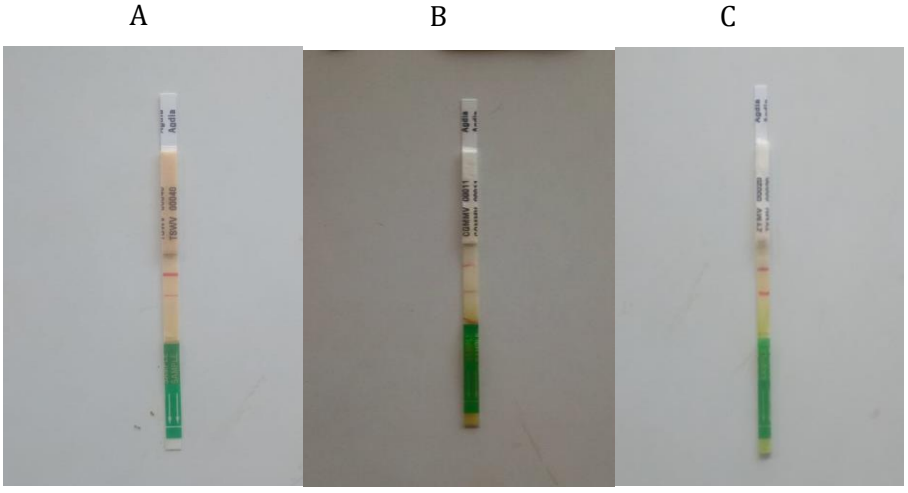


Figure: Positive resulted Strips A) TSWV, B) CGMMV, C) ZYMV

With the results, Bean Yellow Mosaic Virus had not shown any positivity for BYMV, INSV, and TSV strip while others gave positive results indicating the common presence of CGMMV, TSWV, and ZYMV in Sri Lanka. There were no incidences of INSV and TSV reported in Sri Lanka. Morphological symptoms may mislead the BYMV in Sri Lanka.

8. Conclusions and Recommendations

- The tested immuno strips (CGMMV – Cucumber Green Mottle Mosaic Virus, TSWV – Tomato Spotted Wilt Virus, ZYMV – Zucchini Yellow Mosaic Virus and Immunocombe strips) are suitable for field-level identification of selected plant viruses.
- It is recommended to introduce and promote the use of validated immuno strips in national plant protection programs and farmer level diagnostic kits.

9. Output

• A validated field level rapid detection tool for major vegetable viruses was introduced.
• This initiative will support integrated disease management (IDM) strategies and reduce improper pesticide use due to misdiagnosis.

Attachment-19

Questionnaire survey report of validation of effectiveness of reported less effective pesticides in Kalpitiya
（WG1-P5）

Key Activity: Validation of the effectiveness of reported less effective pesticides in Kalpitiya

Responsible Officer: Dr. J. Marasinghe (PAS)

Location: Kalpitiya, Puttlam district

Objective: Restoring the farmers' confidence on recommended pesticides for cabbage, and/or taking appropriate measures if they are found to be ineffective

Methodology: The study involved surveying of farmers to identify farmer perceived less effective pesticides for cabbage caterpillar complex in Kapitiya. Information on the pesticides recommended for the control of the relevant pest by the Department of Agriculture was collected. A questionnaire was prepared to include as many relevant aspects to the use of pesticides and the survey was conducted on 25 farmers in 3 Agriculture Instructor's divisions (Nawakkadu, Norochchola & Kandakuliya).

Results: The Department of Agriculture has recommended 16 insecticide-active ingredients for cabbage caterpillar management. According to the information gathered from the Office Registrar of Pesticides, 12 of the pesticides (75%), were imported (one, locally manufactured) to Sri Lanka in 2023. The farmer survey revealed that 81.25% of recommended insecticides were available/ or used for cabbage caterpillar control. The information related to the availability of usage of certain pesticides that were not imported during 2023, could be due to recalling the early uses by the farmer.

The farmers were satisfied with the products; Chlorantraniliprole 200 g/l SC, Spinetoram 25% WG, etofenprox, and Indoxacarb 150 g/l EC. More than 50% of the farmers used them. Most of the farmers agreed that these pesticides were effective, however, several indicated, that they used more than the label's recommended amount for application. Azadirachtin was not recommended as an effective pesticide by the few farmers who used it. Farmers' perception of the IGR (insect growth regulators) was that they were less effective because the caterpillars stayed alive even after the next few days of application. Further, the majority of the farmers used illegal pesticide products mainly because of low price.

It was revealed that Kalpitiya farmers had a special plan for pesticide application for cabbage caterpillar control. Their target was prevention, rather than control. Accordingly, during the first 3 weeks of the cultivation, they applied pesticides less frequently or once a week. Several said that spinosad and indoxacarb were suitable for immature crops. After 3 weeks or at fruit set, the frequency of application was increased. For some pesticides, the dose was 5- 20 ml/ tank, higher than the DOA recommendations. When caterpillars were found after treatment, additional sprays were practiced. It was understood that for the mature crop, the frequency of application was increased for 5-day intervals with extra sprays whenever necessary. Up to a maximum of 20 applications per crop cycle was reported. All the farmers used battery-operated power sprayers with holo-cone nozzles, and nozzles with 4 holes.

Conclusion: Farmers expect the crop to be entirely free from pests, and therefore haphazardly apply pesticides (higher dosage and frequency). Thus, the pesticide product effectiveness cannot be rightly validated but the DOA recommended pesticides are suitable to control the pest.

Recommendations: An alternative pest management recommendation following the current DOA recommendations but with necessary modifications needs to be introduced for cabbage cultivation in the Kalpitiya area. Farmer awareness on pesticide usage to address misuse and regulatory actions to control illegal pesticide trade in the area are necessary.

P5 - Proposal for Key Activity

1. Focused area: Alternative pesticides and mixtures
   Demonstration / validation of the effectiveness of reported less effective pesticides in Kalpitiya

2. **Justification / Purpose:**
   Recent feedback from the discussions had with the farmers in Kalpitiya: The local farming community has highlighted a decline in the effectiveness of the pesticides, leading to increased use of un-recommended / stronger /illegal pesticides and potential economic/ environmental hardships. Thus, demonstration/validation of the efficacy of recommended pesticides is essential to restore the farmers' confidence, and/or to take appropriate measures if products are found to be ineffective.

3. **Expected output:**
   - Evaluation report on reported less effective pesticides used on cabbage in Kalpitiya and proof of the most effective pesticides for cabbage
   - Awareness making on the appropriate use of pesticides

4. **Key action steps:**
   (1) Surveying farmers to identify farmer-perceived less effective pesticides
   (2) Development of demonstration protocol for bio-efficacy testing of recommended insecticides
   (3) Field demonstration/validation
   (4) Preparation of recommendation report

8. Details of the implementation of key action steps:

Action step1: Surveying farmers

Brief description of implementation methodology including outputs, responsible officers, and place of action
A questionnaire survey is conducted on 20 farmers in Kalpitiya to identify pesticides that are reported as less effective for cabbage caterpillar complex control Responsible officers: Mr. P. Nishantha, Dr. J. Marasinghe

Results:

A survey was carried out among 25 farmers in 3 AI divisions (Nawakkadu, Norochchola & Kandakuliya) in Kalpitiya to collect information on pesticide usage in cabbage cultivation. Accordingly, 25 farmers (10, 7 & 8 respectively) were interviewed. Farmers who cultivated cabbage within the previous 2 years were 60%.

The Department of Agriculture has recommended 16 insecticide-active ingredients for cabbage caterpillar management (Table 1). According to the information gathered from the Office Registrar of Pesticides, 12 of the pesticides (75%), were imported (one, locally manufactured) to Sri Lanka in 2023. The farmer survey revealed that 81.25% of recommended insecticides were available/ or

used for cabbage caterpillar control. The information related to the availability of usage of certain pesticides that were not imported during 2023, could be due to recalling the early uses by the farmer.

Table 1. Details of pesticide recommendations, availability and usage -Kalpitiya cabbage

Insecticide Active Ingredient recommended by the DOA	**Trade Name**	**Importation in 2023**	**Availability in Kalpitiya according to farmer survey**	**Rank according to the use frequency/ preference**
Etofenprox 100 g/l EC	Trebon	Yes	Yes	3 (73.3%)
Emamectin benzoate 5% SG	Rader Emamectin Benzoate	Yes	Yes	4 (66.7%)
Chlorfluazuron 50 g/l EC	-	No	Yes	8 (6.7%)
Bistrifluron 100 g/l EC	Hanaro	Yes	No	
Tebufenozide 200 g/l SC	Mimic 20 F	Yes	Yes	8 (6.7%)
Chromafenozide 50 g/l SC	-	No	No	
Chlorantraniliprole 200 g/l SC	Coragen	No	Yes	1 (100 %)
Azadirachtin A- 7.5 g/l EC	Lak-gro neem	Locally manufactured	Yes	8 (13.3%)
Azadirachtin 50 g/l EC	-	No	Yes	8 (13.3%)
Lufenuron 50 g/l EC	Lufenuron 5 % EC	Yes	No	
Novaluron 100 g/l EC	Rimon 10 EC (Novaluron 100 g/l EC)	Yes	Yes	7 (20.0%)
Flubendiamide 24% WG	Belt Flubendiamide	Yes	Yes	6 (26.7%)
Flubendiamide 20% WG	Takumi 20WG (Flubendamide)	Yes	Yes	6 (26.7%)
Indoxacarb 150 g/l EC	Avaunt	Yes	Yes	4 (66.7%)
Spinosad 25 g/l SC	Success	Yes	Yes	5 (33.3%)
Spinetoram 25% WG	Radiant	Yes	Yes	2 (86.7%)

The information gathered by the farmers indicated that they are satisfied with the products; Chlorantraniliprole 200 g/l SC, Spinetoram 25% WG, etofenprox, and Indoxacarb 150 g/l EC. More than 50% of the farmers used them. Most of the farmers agreed that these pesticides are effective, however, several indicated, that they use more than the label's recommended amount for application. Azadirachtin was not recommended as an effective pesticide by the few farmers who used it. Farmers' perception of the IGR (insect growth regulators) was that they are less effective because the caterpillars stay alive even after the next few days of application. Further, the majority of the farmers interviewed were using illegal pesticide products. They have reasoned it as due to the comparatively cheaper cost and effectiveness.

It was revealed that Kalpitiya farmers have a special plan for pesticide application for cabbage caterpillar control. Their target is prevention, rather than control. Accordingly, during the first 3 weeks of the cultivation, they apply pesticides less frequently or once a week. Several said that spinosad and indoxacarb are suitable for immature crops. After 3 weeks or the fruit is set the frequency of application is increased. For some pesticides, the dose is 5- 20 ml/ tank, higher than the DOA recommendations. It was observed that when sachets are available with fixed weights/ volumes per tank, they tend to follow the recommendations. However, if caterpillars are found after treatment, additional sprays are practiced. It was understood that for the mature crop, the frequency of application is increased for 5-day intervals with extra sprays whenever necessary. It was reported up to a maximum of 20 applications per crop cycle. Accordingly, it is expected that the frequency and the dose of pesticide usage on cabbage will be higher than recommended by the DOA.

In addition, all the farmers use battery-operated power sprayers with holo-cone nozzles, and nozzles with 4 holes.

Conclusions

The farmer survey concluded the following facts.

- The pesticide product efficacy cannot be evaluated appropriately using survey data, as the use pattern by Kalpitiya farmers, is different from the recommendation made by the Department of Agriculture.
- Most of the DOA-recommended insecticides for cabbage caterpillar control, are available in Kalpitiya area.
- There are several recommended pesticides frequently used by farmers.
- Farmers expect the crop to be entirely free from pests, and therefore haphazardly apply pesticides to prevent the pest entrance.
- Generally, the frequency of application and the dosage of pesticides are higher than recommended by the DOA.
- Although, pesticide use is less (once a week) on young crops, the frequency (3–5-day intervals) and the dosage (higher than the label recommendation) increase on mature crop.
- There is a tendency in farmers to use the recommended doses when the products are available in sachets.
- Most of the farmers are unaware of the mode of action of the pesticide and neglect the preharvest intervals

- Every farmer uses a battery-operated power sprayer whereas, the pesticide recommendations are given for knapsack sprayers
- The illegal pesticide trade also happens in the Kalpitiya area and the price difference is the main reason for the farmers to approach such products

Recommendations

- Considering the pesticide use pattern in the Kalpitiya area, a pesticide demonstration package needs to be introduced for cabbage cultivation in the Kalpitiya area, following the DOA recommendations but with necessary modifications.
- The package should accommodate different mode pesticides in alternate terms maintaining a minimum recommended interval between the applications.
- It must consider the pesticide use for the nursery and also, near the harvesting of the crop, applications must ensure pre-harvest intervals
- Also, the study needs to be compared with traditional farmer practices, for evaluating the economic benefits.
- Parallel to the farmer field demonstrations, a pesticide screening trial must be established at the Agriculture Research Station in Kalpitiya, to evaluate the bioefficacy of each recommended pesticide recommended by the DOA for cabbage caterpillar control.
- Farmer awareness on pesticide usage is recommended
- Regulatory actions are necessary to control illegal pesticide trade in the area

Dr. J.P. Marasinghe

Principal Agriculture Scientist (Toxicology)

Attachment-20

Test report of testing of rapid test kit for detecting residues in vegetables and water （WG1-P6）

Key Activity: Testing of pesticide residues and heavy metals in water in Kalpitiya

Responsible Officer: Mrs. C. Magamage (PAS)

Location: HORDI, Gannoruwa

Objective: Provision of developing situation on pesticide residues and heavy metals in water in Kalpitiya

Methodology: The study involved testing of water samples for pesticide residues and heavy metals in Kalpitiya. A total of 50 water samples were collected with details of the sampling location. Samples included both agricultural and drinking water. If the collected water samples were clear, sample extraction processes were not performed. The samples were analyzed using LC-MS/MS for 15 pesticides. Direct analysis was performed using LC-MS/MS and Acetonitrile (HPLC Grade) was used as the mobile phase for the equipment. Limit of the quantification (LOQ) for pesticide residue analysis was reported as 0.005 mg/kg.

For heavy metal analysis, water samples were digested using Trace-Selected Grade Nitric Acid, free from heavy metals. The analysis focused on Arsenic, Cadmium, Mercury and Lead.

Results: Only Acephate was detected as contaminated pesticide in water samples and the average amount detected was 0.049 mg/kg. As these levels are below safer levels, there is no any effect due to this contamination.

LOQ of the heavy metal analysis is given below.

Heavy metal and LOQ	**Percentage of the negative samples (%) (<LOQ)**	**Percentage of the positive samples (%)**			
		(LOQ – 0.1 ppm)	**0.1 – 0.5 ppm**	**0.5 - 1 ppm**	**1 - 2 ppm**
As LOQ – 0.002 ppm	-	15	32.5	25	27.5
Cd LOQ – 0.007 ppm	97.5	2.5	-	-	-
Hg LOQ – 0.005	100	-	-	-	-
Pb LOQ – 0.012	52.5	-	47.5	-	-

Conclusion: While contamination of water with pesticides is not a serious issue, contamination with heavy metals is a serious issue in Kalpitiya.

Further sample analysis and further evaluations to confirm these results are needed.

Progress of the SAFE project

Focused area: Pesticide residue control

1. **Key activity:** Testing a rapid detection kit for pesticide residues in vegetables and conducting water analysis for pesticide residues and heavy metals (WG1P6)
2. **Justification / Purpose:**

   In Sri Lanka due to high potential of pest and disease attacks, farmers are used to spray pesticides continuously. Further illegal pesticides are also readily available in the country and cheaper than that of the registered pesticides. Considering cost effectiveness, farmers intend to use those low cost illegal pesticides. Some of these pesticides are highly toxic and already banned in the country. Further the selected area of this project is Kalpitiya and its sandy soil has a high leaching potential, making it essential to conduct water analysis for pesticide residues and heavy metals.

   As considering the heavy cost of the pesticide residue analysis, it is better to identify a pesticide screening method using rapid test kits.

3. **Key action steps:**
   1. Sample analysis for food contaminants;
      a) Sample collection
      b) Sample analysis for pesticide residues and heavy metals
      c) Data analysis and reporting
   2. Identification of rapid test kit for residue screening

   Both agricultural and drinking water were tested for contaminants. If the collected water samples were clear, sample extraction processes were not performed. The samples were directly analyzed using LC-MS/MS. Direct analysis was performed using LC-MS/MS and Acetonitrile (HPLC Grade) was used as the mobile phase for the equipment. Limit of the quantification (LOQ) for pesticide residue analysis was reported as 0.005 mg/kg.

   For heavy metal analysis, water samples were digested using Trace-Selected Grade Nitric Acid, free from heavy metals. The analysis will focus on Arsenic, Cadmium, Mercury, and Lead.

   Number of samples analysed: 50 water samples.

   The main theme of his component of the project was identification of a rapid test kit for pesticide residue screening. Under this component two test kits were evaluated. Relevant progress report is attached herewith for more information.

4. **Progress of the activities:**

A total of 50 water samples were collected for pesticide residues and heavy metal analysis. All the samples were collected from Kalpitiya district and details of the sampling location were noted.

Pesticide analysis:

Accordingly, 15 pesticides were analysed at the Central Analytical Laboratory. LOQ of these pesticides were 0.005 mg/kg. Only Acephate was detected as contaminated pesticide and the average amount detected was 0.049 mg/kg. As these levels are below safer levels and there is no any effect due to this contamination. Results of the samples are given below.

Pesticide	Percentage of positive samples (%)
1. Acephate	2
2. Phymetrozine	0
3. Thiamethoxam	0
4. Carbendazim	0
5. Imidacloprid	0
6. Acetammiprid	0
7. Metalaxyl	0
8. Fenobucarb	0
9. Azoxystrobin	0
10. Fipronil	0
11. Phenthoate	0
12. Quinalphos	0
13. Tebuconozole	0
14. Diazinon	0
15. Profenofos	0

Heavy metal analysis:

LOQ of the heavy metal analysis is given below. It seems most of the samples were contaminated with heavy metals. Further it reveals that almost all the samples were contaminated with arsenic. Further sample analysis and further evaluations to confirm these results are needed.

		Percentage of the positive samples (%)			
Heavy metal and LOQ	**Percentage of the negative samples (%) (<LOQ)**	**(LOQ – 0.1 ppm)**	**0.1 – 0.5 ppm**	**0.5 - 1 ppm**	**1 - 2 ppm**
As LOQ – 0.002 ppm	-	15	32.5	25	27.5
Cd LOQ – 0.007 ppm	97.5	2.5	-	-	-
Hg LOQ – 0.005	100	-	-	-	-
Pb LOQ – 0.012	52.5	-	47.5	-	-

Champa Magamage
Principal Agriculture Scientist

Attachment-21

Test report of development of nutrient management package for most important vegetables （WG2-P1）

Key Activity: Development of area specific nutrient management packages for Cabbage in Badulla

Responsible Officer: Dr. Amoda Mayakaduwa, HORDI, Gannoruwa

Location: Boralanda, Badulla district

Objective: Develop comprehensive manuals providing precise nutrient management guidelines and to determine appropriate fertilizer requirements based on regional variations in soil type and environmental conditions

Methodology: The study involved testing of four fertilizer packages: DOA recommended (DOA), soil test-based (STB), improved DOA recommended (IDOA) and farmer practice (FP) packages for cabbage grown in major vegetable growing season in Boralanda. Specific differences in type of fertilizer, quantity of fertilizer, time of application and times of application were seen among packages. Packages were employed in 5 m × 5 m plots located adjacent to each other as a set/replicate with total area 100 m^2. Three sets were established in 3 farmer fields situated in one vegetable growing tract in Boralanda. Cabbage variety Sisiro was used at a spacing of 40 cm × 30 cm. All cultural practices were performed similarly in all plots except fertilizer application by the farmers as per the instructions given by the technical staff at Agricultural Research Station at Seethaeliya. Plant height, plant width, head characteristics and marketable yield were measured.

Results: Plant growth in IDOA package produced the tallest plants at both 6 and 10 weeks after planting, while the FP package resulted in the widest plant canopy. The IDOA package consistently outperformed other fertilizer packages in head characteristics, including head height, width, core length, and average head weight. Marketable head weight was highest under IDOA and FP packages. The mean marketable yields were 77.0 t/ha for IDOA, 77.67 t/ha for FP, 67.87 t/ha for DOA and 63.87 t/ha for STB packages.

Conclusion: Improved fertilizer management practice significantly boost the productivity, potentially through optimized nutrient application and timing and the farmer practice, closely resembles the improved fertilizer management package

Way forward:

Key Activity: Development of area specific nutrient management packages for Tomato in Badulla

Responsible Officer: Dr. Amoda Mayakaduwa, HORDI, Gannoruwa

Location: Boralanda, Badulla district

Objective: To create comprehensive manual that provide precise nutrient management guidelines and identification of the appropriate amount of fertilizer based on regional differences such as soil type and environment

Methodology: The study involved testing of four fertilizer packages: DOA recommended (DOA), soil test-based (STB), improved (IDOA) and farmer practice (FP) packages for tomato grown in major vegetable growing season in Boralanda. Specific differences in type of fertilizer, quantity of fertilizer, time of application and times of application were seen among packages. Packages were employed in 5 m × 5 m plots located adjacent to each other as a set/replicate with total area 100 m^2. Three sets were established in 3 farmer fields situated in one vegetable growing tract in Boralanda. Tomato variety Padma was used at a spacing of 80 cm × 40 cm. All cultural practices were performed similarly in all plots except fertilizer application by the farmers as per the instructions given by the technical staff at Agricultural Research Station at Seethaeliya. Plant height, plant width and marketable yield were measured.

Results: Farmer practice (FP**)** package consistently produced the tallest plants at both 6 and 10 weeks after planting (WAP), while the improved DOA (IDOA) package also showed strong growth, particularly at 10 WAP. FP package showed the greatest plant widths at 10 WAP (90.77–95.13 mm), followed by IDOA package. The DOA and STB packages recorded comparatively lower widths.

Marketable yield also varied significantly among packages. The IDOA package consistently achieved the highest marketable yields followed closely by FP package. The STB package performed relatively better at farmer field 2. The mean marketable yields were 107.9 t/ha for IDOA, 100.3 t/ha for FP, and 97.7 t/ha for DOA packages, indicating the superior performance of IDOA and FP packages in enhancing crop productivity.

Way forward:

REPORT

Key activity: Development of area specific nutrient management packages for cabbage and tomato in Badulla

1. Introduction

The cultivation of vegetables is a vital component of agricultural systems, directly impacting food security and farmers' livelihoods. Among the many of vegetables grown, cabbage and tomato stand out as major crops in the Badulla region.

While general fertilizer recommendations provide a foundational guideline for vegetable cultivation, they often lack the specificity needed to address the unique challenges and opportunities presented by different growing environments. Soils can vary significantly in their nutrient composition, pH levels, moisture retention, and other characteristics that influence plant health and productivity. Therefore, a blanket fertilizer recommendation does not effectively support optimal growth for specific crops in particular regions.

To address these limitations, the development of area-specific nutrient management packages is essential. These tailored packages will incorporate detailed analyses of local soil types, climate conditions, and the specific nutrient needs of major crops such as cabbage and tomato. By understanding the distinct requirements of these vegetables in the context of the Badulla area, it is possible to enhance fertilizer application strategies. This will not only lead to more efficient use of fertilizers but also ensure that plants receive the right nutrients at the right time, ultimately improving crop yield and productivity. This initiative aims to create comprehensive manuals that provide precise nutrient management guidelines, ensuring that farmers have access to the best practices for their specific regions. Through this targeted approach, expect to empower local farmers, increase overall agricultural productivity, and promote responsible nutrient management in vegetable cultivation.

2. Expected output

Manuals containing specific nutrient management packages for cabbage and tomato in Badulla district

3. Materials and Methods

3.1 Location

The experiments were conducted at the farmer fields of Boralanda Agrarian Service region which belongs to Badulla district. The three farmer fields were selected for each cop.

3.2 Crop/Variety

Cabbage variety “Sisiro” was selected for the experiments which is most popular variety in among the farmers in Boralanda area. It is a hybrid variety of cabbage known for its robust growth and high yield potential. It features a compact head with tightly packed leaves, making it ideal for both local consumption and market sale. The leaves are dark green, exhibiting excellent resistance to common pests and diseases.

Tomato variety “Padma 108 F1” was selected for the experiments which is most popular variety in among the farmers in Boralanda area. It is a high-yielding hybrid tomato variety recognized for its bright red color and firm texture. This variety is particularly suited for fresh consumption and processing, making it versatile for various culinary application.

3.3 Treatments

The experiments were conducted with four different treatments.

T1: Current Department of Agriculture Recommendation (DOA); This treatment involves following the standard fertilizer guidelines provided by the Department of Agriculture.

T2: Soil Test-Based Fertilizer Recommendation (STB); In this treatment, fertilizer recommendations were based on detailed soil testing conducted on the farmer field.

T3: Improved (Suggested) Fertilizer Management Package (IDOA); This treatment incorporates an improved/suggested fertilizer management package. It includes enhanced practices for cabbage based on the findings from farmer survey conducted and for tomato latest research conducted by DoA. The package may consist of specific fertilizer types, application rates, timing, and techniques designed to maximize nutrient availability and uptake.

T4: Farmer Practice (FP); This treatment refers to the conventional practices done by the farmers, which may vary widely based on individual experience. Farmer practices often reflect traditional knowledge and may include variations in fertilizer types, application methods, and timings. While these practices can be effective, they may not always be aligned with optimal nutrient management strategies, potentially affecting crop yields and soil health. This treatment serves as a benchmark to evaluate the effectiveness of more structured recommendations.

3.4. Crop establishment

3.4.1 Cabbage

The three experiments were conducted in farmer fields at Boralanda. The experiment was established in plots of 5m × 1m and the total area for each treatment was 25m^2. Crop spacing was 40cm × 30cm for cabbage. The seeds of cabbage were allowed to germinate in a nursery and four week-old healthy seedlings were transplanted in beds.

Description of treatments for Cabbage:

T1 - Current DOA recommended package (DOA)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Poultry manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	270	-	-	270
3	Urea (kg/ha)	-	110	110	110	330
4	MOP (kg/ha)	-	75	-	75	150

T2 - Soil test-based fertilizer package (STB)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Poultry manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	90	-	-	90
3	Urea (kg/ha)	-	110	110	110	330
4	MOP (kg/ha)	-	75	-	75	150

T3 - Improved (Suggested) Fertilizer Management Package (IDOA)

	Fertilizer	Time of application						Total
		Before planting	Basal	1WAP	3WAP	5WAP	7WAP	
1	Poultry manure (t/ha)	10	-	-	-	-	-	10
2	TSP (kg/ha)	-	270	-	-	-	-	270
3	Urea (kg/ha)	-	50	75	70	70	70	330
4	MOP (kg/ha)	-	75	-	-	-	75	150
5	$CaNO_3$ spray - 0.5% (3WAP, 6WAP)							

T4 - Farmer Practice (FP)

The following data was collected during the experiment.

1. Initial Soil conditions (pH, EC, Avail. K, Avail. P, OM)
2. Whole plant height (cm) - 6WAP,10WAP
3. Whole plant diameter (cm) - 6WAP,10WAP
4. Head height (cm) after half cutting
5. Head width (cm) after half cutting
6. Core length from head bottom (cm) after half cutting
7. Average head weight
8. Total Yield (t/ ha)

3.4.2 Tomato

The three experiments were conducted in farmer fields at Boralanda. The experiment was established in a plot of 5m × 5m and the total area for each treatment was 25m^2. Crop spacing was 80cm × 40cm for tomatoes. The seeds of tomato were allowed to germinate in a nursery and three week old healthy seedlings were transplanted in a bed.

Description of treatments for Tomato

T1 - Current DOA recommended package (DOA)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Poultry manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	215	-	-	215
3	Urea (kg/ha)	-	65	65	65	195
4	MOP (kg/ha)	-	50	-	50	100

T2 - Soil test-based fertilizer package (STB)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Poultry manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	71	-	-	71

3	Urea (kg/ha)	-	65	65	65	195
4	MOP (kg/ha)	-	50	-	50	100

T3 - Improved (Suggested) Fertilizer Management Package (IDOA)

	Fertilizer	Time of application						Total
		Before planting	Basal	2WAP	4WAP	6WAP	8WAP	
1	Poultry manure (t/ha)	10	-	-	-	-	-	10
2	TSP (kg/ha)	-	215	-	-	-	-	215
3	Urea (kg/ha)	-	40	75	58	58	58	288
4	MOP (kg/ha)	-	25	40	45	45	45	200
5	K44 (3WAP, 6WAP)							
6	$Ca(NO_3)_2$ spray - 0.5% (Starting from 50% flowering 2 week interval)							
7	PBRH – 125 g/hill							

T4 - Farmer Practice (FP)

The following data was collected during the experiment.

1. Initial Soil conditions (pH, EC, Avail. K, Avail. P, OM)
2. Whole plant height (mm) - 6WAP, 10WAP
3. Whole plant diameter (mm) - 6WAP, 10WAP
4. Weight of fruits (g)
5. Length of fruits (cm)
6. Width of fruits (cm)
7. Thickness of fruit skin
8. Total marketable yield (t/ ha)
9. Quality of fruits

Data analysis was done using Statistical Analysis System (SAS Inc., Software package, 9.4 version). Mean separation was done using Duncan's Multiple Range Test (DMRT).

4. Results and discussion

4.1 Cabbage

4.1.1 Initial Soil conditions

The analysis of the chemical characteristics of soils across three experimental sites, is shown in Table 1. It reveals important insights into the soil health and fertility of the area. The pH values indicate that all sites are slightly acidic, therefore it was decided to add lime to adjust the pH of the sites before the crop establishment. The levels of available phosphorus varied among the farmers. However, it was higher than the agronomic critical levels and reduce the amount of P fertilizer application for the T2 treatment, soil test based recommendation.

Table 1: Chemical characteristics in the experimental sites

Soil property	**Content**		
	Farmer 1	**Farmer 2**	**Farmer 3**
pH (1:1) H_2O	5.27	5.15	5.12
EC (dS/m)	0.112	0.103	0.06

Available P (mg kg^{-1})	104.9	90.6	118.6
Exchangeable K (mg kg^{-1})	104.9	90.6	118.6
Organic matter %	1.3	1.1	1.6

4.1.2 Whole plant height (cm)

The data presented in Figure 1 reflects the effects of various treatments on whole plant height across three farmers at two growth stages, 6 weeks after planting (WAP) and 10 WAP. The IDOA treatment consistently produced the tallest plants at both 6 and 10 WAP, indicating its potential as the most effective treatment for enhancing plant growth. While all treatments showed improvement from 6 to 10 WAP, the variation in plant height emphasizes the importance of treatment selection in achieving optimal growth outcomes.

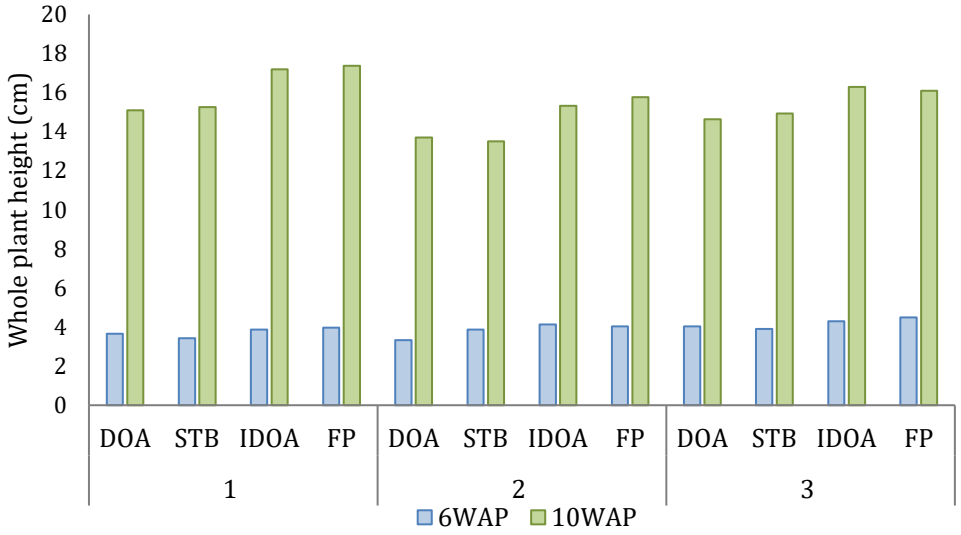


Figure 1: Effect of fertilizer management packages on whole plant height of cabbage

4.1.3 Whole plant width (cm)

The data presented the effects of different treatments on whole plant width among the three farmers at two growth stages (Figure 2). The FP treatment consistently produced the widest plants at 10 WAP, with measurements ranging from 50.70 mm to 55.73 mm. IDOA also demonstrated strong performance, particularly in Farmers 1 and 3, where it was nearly as wide as FP. Overall, these results suggest that both FP and IDOA treatments are effective in promoting plant width. This highlights the potential for these treatments to enhance overall plant structure, which may contribute to improved yield potential.

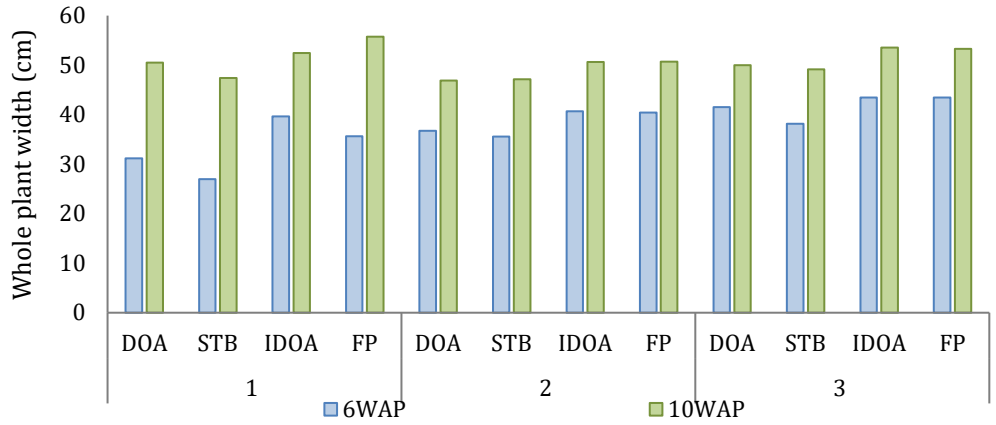


Figure 2: Effect of fertilizer management packages on whole plant width of cabbage



Cabbage plants of different treatments at vegetative stage

Notably, the IDOA treatment recorded the tallest plants at both growth stages and the effective in increasing plant width indicating its effectiveness in promoting plant growth. This highlights the potential for these treatments to enhance overall plant structure, which may contribute to improved yield potential.

4.1.4 Head characteristics

The data summarizes the effects of various treatments on several parameters related to head characteristics. Across the three farmers, IDOA consistently showed the best performance in terms of head height, width, core length, and average head weight, particularly in Farmer 1. The results indicate that IDOA is an effective treatment for enhancing these growth characteristics. Farmer 2 displayed generally lower values, suggesting a need for improved management or conditions, while results of Farmer 3, though lower than Farmer 1, demonstrated that IDOA remains the superior treatment. Overall, these findings highlight the effectiveness of IDOA in promoting robust head characteristics, which may contribute positively to yield potential.

Table 2: Effect of fertilizer management packages on cabbage head characteristics

Farmer	Treatment	Head height (cm) after half cutting	Head width (cm) after half cutting	Core length from head bottom (cm) after half cutting	Average head weight (kg)
1	DOA	12.30	14.80	6.70	1.15
	STB	12.15	14.00	7.40	0.86
	IDOA	13.95	16.65	8.15	1.37

	FP	11.95	15.00	7.00	1.08
2	DOA	11.50	13.00	5.10	0.88
	STB	11.15	13.00	4.55	0.95
	IDOA	11.75	13.85	4.50	0.90
	FP	11.25	13.45	6.10	0.89
3	DOA	10.85	12.45	6.00	0.84
	STB	11.90	14.50	6.25	0.94
	IDOA	13.15	14.60	6.50	1.08
	FP	12.15	13.90	6.00	1.02



Tomato fruit characteristics of different fertilizer management packages

4.1.5 Marketable weight

The data presents the marketable head weight (Figure 3) from various treatments applied by three farmers. The results reflect significant differences in yield performance among treatments and farmers. Across all farmers, the IDOA and FP treatments consistently produced the highest marketable head weights, demonstrating its effectiveness in enhancing yield potential. Farmer 1 achieved the highest overall yields, followed by Farmer 3, while Farmer 2 had the lowest yields across all treatments, indicating that factors such as soil conditions and management practices may be impacting productivity. The results highlight the importance of selecting effective treatments to maximize marketable yields, with IDOA and FP showing the greatest potential across varying conditions.

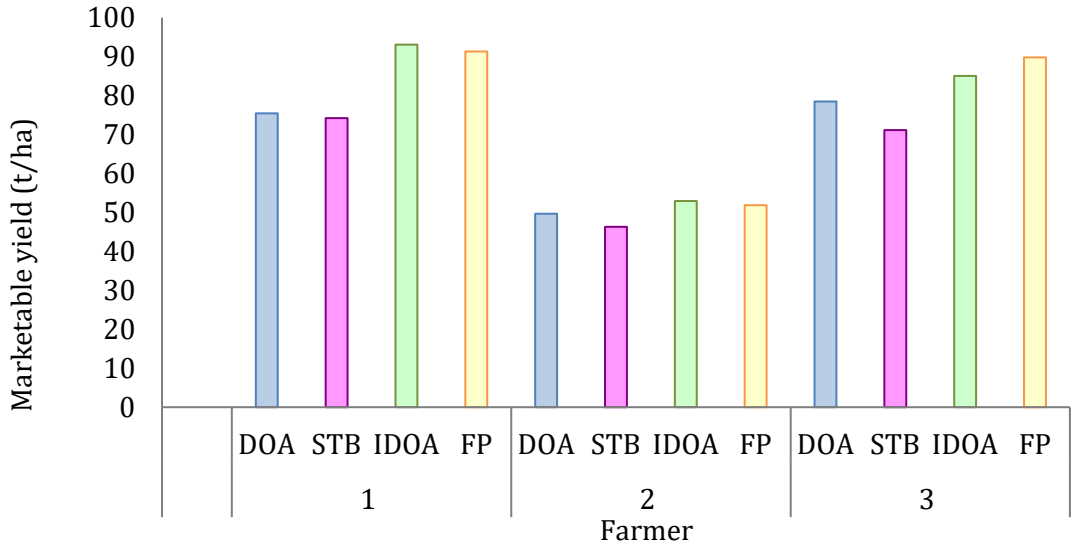


Figure 3: Effect of fertilizer management packages on marketable weight of cabbage

The data presents the effectiveness of different fertilizer management packages, on mean yield of the three farmers (Figure 4). The DOA package yielded 67.867 t/ha. This figure serves as a benchmark for evaluating the effectiveness of other management strategies. The STB package resulted in a lower yield of 63.867 t/ha. This suggests that the package may not be as effective in maximizing yield compared to the DOA recommendations, possibly indicating a need for adjustments based on specific soil nutrient requirements. The IDOA package yielded the highest at 77 t/ha. This indicates that enhanced management practices significantly boost productivity, potentially through optimized nutrient application, timing, or method. The FP, which yielded 77.667 t/ha closely resembles the IDOA package. This suggests that local practices may be effective, potentially due to the farmers' familiarity with their specific conditions and needs.

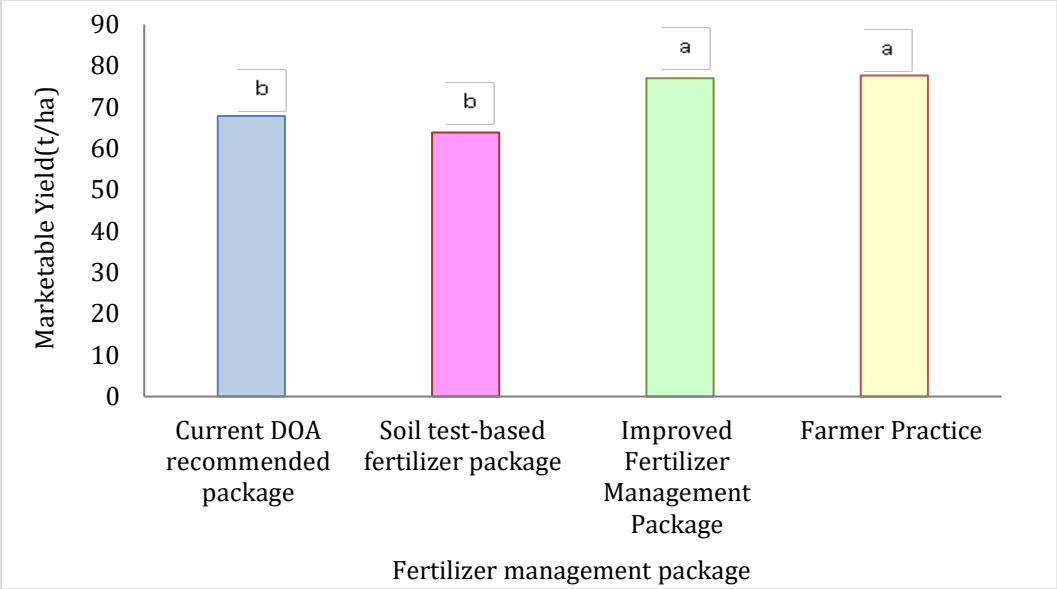


Figure 4: Effect of fertilizer management packages on mean marketable yield of cabbage

4.2 Tomato

4.2.1 Initial Soil conditions

The analysis of the chemical characteristics of soils of three experimental sites is shown in Table 3. The pH values indicate that all sites are slightly acidic, therefore it was decided to add lime to adjust the pH of the sites before start the planting. The levels of available phosphorus varied among the farmers. It was higher than the agronomic critical levels and reduce the amount of P fertilizer application for the T2 treatment, soil test based recommendation.

Table 3: Chemical characteristics in the experimental sites

Soil property	**Content**		
	Farmer 1	**Farmer 2**	**Farmer 3**
pH (1:1) H_2O	5.27	5.24	4.71
EC (dS/m)	0.112	0.035	0.248
Available P (mg kg^{-1})	104.9	82.3	54.6
Exchangeable K (mg kg^{-1})	120	139	185
Organic matter %	1.3	2.1	0.6

4.2.2 Whole plant height

Figure 5 presents whole plant height measurements of tomato plants at two growth stages, 6 weeks after planting (WAP) and 10 WAP. The results are organized by farmer and treatment,

showing variations in plant height based on different management practices. Across all three farmers, the FP treatment consistently resulted in the tallest plants at both growth stages, particularly at 10 WAP. The IDOA treatment also demonstrated strong growth, particularly at 10 WAP.

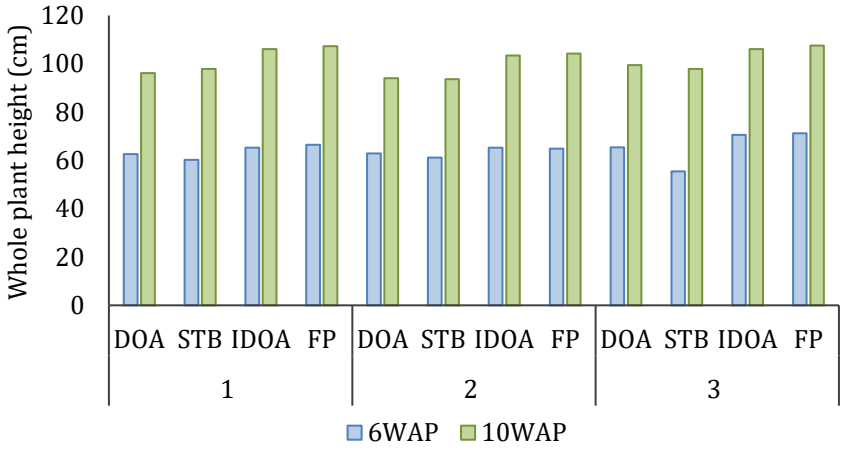


Figure 5: Effect of fertilizer management packages on whole plant height of tomato

4.2.3 Whole plant width

The data in Figure 6 provides measurements of whole plant width for tomato plants at two growth stages. The results are highlighting the variations in plant width based on different fertilizer application practices. The FP treatment consistently produced strong results, particularly at 10 WAP, where it achieved widths ranging from 90.77 mm to 95.13 mm. The IDOA treatment also demonstrated effectiveness, especially in Farmer 3, indicating its potential to enhance plant width. The DOA and STB treatments generally showed lower widths.

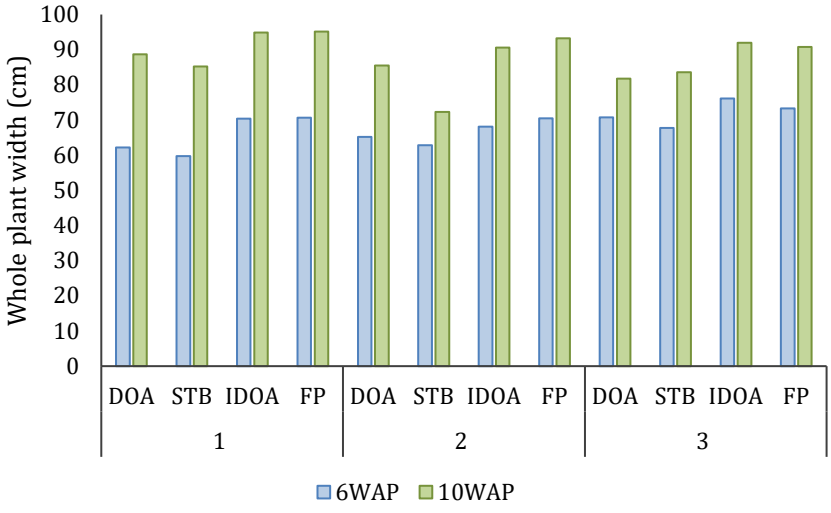


Figure 6: Effect of fertilizer management packages on whole plant width of tomato

Overall, these findings from the data of plant height and width emphasize the importance of selecting effective treatments for improving growth in tomato plants.



4.2.4 Fruit characteristics

Table 4 shows the various fruit characteristics of tomato among the treatments. The results indicate that the IDOA and FP treatment consistently produced heavier fruits, particularly in Farmer 1. The measurements for length and width generally reflected a trend toward larger fruits with IDOA and FP, particularly in Farmer 1.

Overall, IDOA appears to be the most effective treatment for producing larger, heavier fruits, while STB showed potential for higher sugar content, although with generally smaller fruit sizes.

Table 4: Effect of fertilizer management packages on tomato fruit characteristics

Farmer	Treatment	Length of fruit (cm)	Width of fruit (cm)	Thickness of fruit skin (cm)	Brix	Average fruit weight (g)
1	DOA	6.40	5.95	0.65	4.10	98.27
	STB	5.85	5.50	0.78	4.20	86.80
	IDOA	6.40	5.40	0.78	4.00	112.03
	FP	6.05	5.40	0.83	4.30	109.35
2	DOA	5.80	4.80	0.70	4.20	63.47
	STB	5.40	5.50	0.78	4.40	87.49
	IDOA	5.45	5.40	0.75	4.50	82.24
	FP	5.55	5.30	0.78	4.30	89.65
3	DOA	5.05	4.70	0.50	4.20	68.79
	STB	5.25	4.65	0.70	4.60	71.07
	IDOA	5.15	4.50	0.65	4.50	83.48
	FP	4.85	4.65	0.55	4.20	78.89



Tomato fruit characteristics of different fertilizer management packages

4.2.5 Total marketable yield

The Figure 7 shows the marketable yield of tomato plants of three farmers using different treatment packages. Across the three farmers, the IDOA treatment consistently produced the highest marketable yields, particularly in Farmers 1 and 3. FP also demonstrated good performance in Farmer 1 and 3, while STB showed good results in Farmer 2.

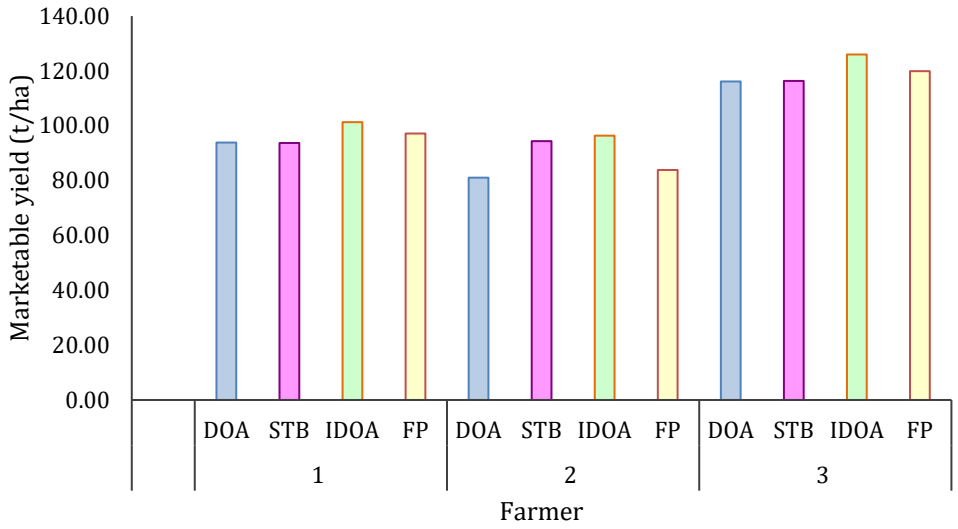


Figure 7: Effect of fertilizer management packages on marketable yield of tomato

The data compares the effectiveness of various fertilizer management packages measured in terms of marketable yield (Figure 8). The DOA package yielded 97.7 t/ha. While this figure serves as a baseline, it is the lowest among the treatments evaluated, indicating room for improvement in yield through alternative practices. The IDOA package achieved the highest yield at 107.9 t/ha. This indicates that improved fertilizer management practices, which likely include optimized nutrient timing and application rates, significantly boost productivity compared to the other packages. The FP package yielded 100.3 t/ha, which is competitive but still below the IDOA package.

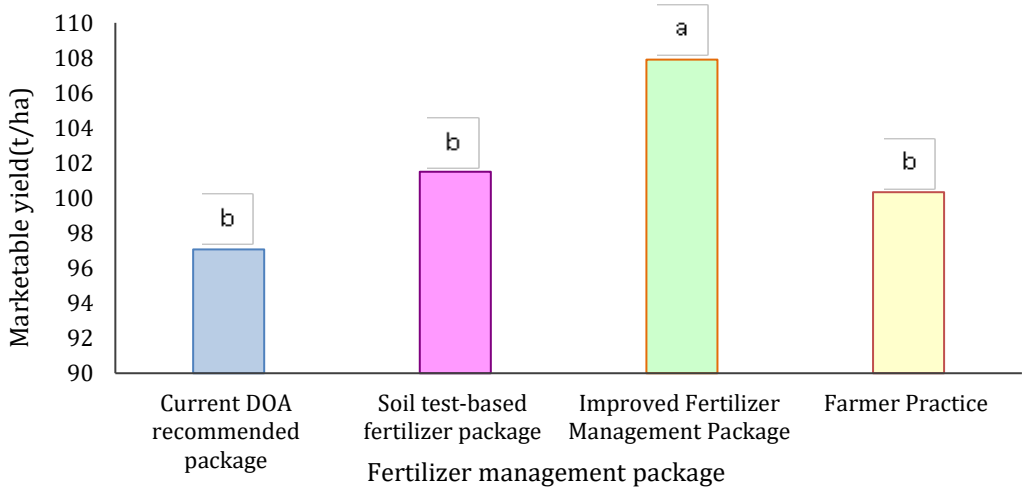


Figure 8: Effect of fertilizer management packages on mean marketable yield of tomato

5. Conclusion

5.1 Cabbage:

- Improved fertilizer management practice significantly boost the productivity, potentially through optimized nutrient application and timing
- The farmer practice, closely resembles the improved fertilizer management package

5.2 Tomato:

- Improved fertilizer management package offers the highest marketable yield, indicating its effectiveness in maximizing production.

6. Suggestions

- The repeating the experiments for further confirmation of results
- The farmer practice, while better than the DOA recommendation, suggests that the importance of updating current recommendation
- The soil test-based package, while informed by soil conditions, performed the least effectively in some conditions suggesting that it may require further refinement to meet the yield potential

Key Activity: Development of area specific nutrient management packages for Cabbage in Kalpitiya

Responsible Officer: Mrs. Renuka Silva, PAS & Mrs. Punya Delpitiya, ADA

Location: Kalpitiya, Puttlam district

Objective: To develop an area specific nutrient management package for Cabbage in Kalpitiya area

Methodology: The study involved testing of five fertilizer packages: DOA recommended (DOA), soil test-based (STB), improved DOA (IDOA), soil test-based improved DOA (IDOA(STB)) and farmer practice (FP) packages for cabbage grown in cabbage growing season in Kalpitiya. Specific differences in type of fertilizer, quantity of fertilizer, time of application and times of application were seen among packages. Packages were employed in plots of 6.3m × 4.5m having 28.35m2 of area for each package, located adjacent to each other as a set/replicate. Two sets were established in 2 farmer fields situated in close by 2 vegetable growing tracts in Kalpitiya. Hybrid varieties Oxylus and Omphalos were separately used for 2 sets. The seedlings were raised in nurseries and one month-old healthy seedlings were transplanted 1 plant/hill and at 45cm × 45cm spacing. Dates of transplanting were November 22nd and December 19th, 2024 respectively. Except for fertilizer application, all the other cultivation practices were done similarly over all the plots by farmers. Yield data were collected. Information on cabbage market price and fertilizer price was gathered. Fertilizer cost, income, profit and income/fertilizer cost ratio in different packages were calculated using the collected information.

Results: IDOA package recorded the highest yield, while STB package showed the lowest yield. In set 2, the DOA package achieved the highest yield, with FP package yielding the least.

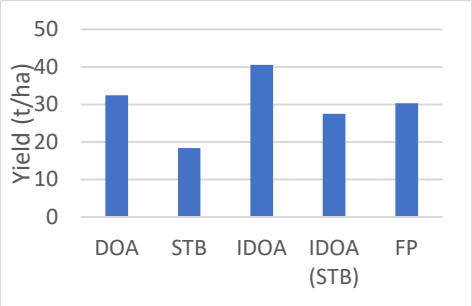


Fig. 1: Yield in set 1

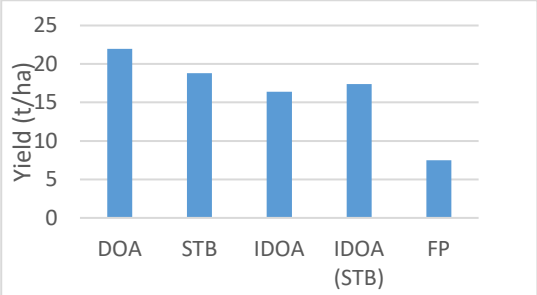


Fig. 2: Yield in set 2

Fertilizer cost was lower for STB package and highest for FP package. Profitability was highest in IDOA package in set1, and in DOA and IDOA packages in set 2

Conclusion: Results indicate that IDOA enhances both yield and cost efficiency in cabbage cultivation, with IDOA and DOA packages recommended for optimized production in the respective locations.

Way forward:

Key Activity: Development of area specific nutrient management packages for Capsicum in Kalpitiya

Responsible Officer: Mrs. Renuka Silva, PAS & Mrs. Punya Delpitiya, ADA

Location: Kalpitiya, Puttlam district

Objective: To develop an area specific nutrient management package for Capsicum in Kalpitiya area

Methodology: The study involved testing of four fertilizer packages: DOA recommended (DOA), soil test-based (STB), improved DOA recommended (IDOA) and farmer practice (FP) packages for cabbage grown in Kalpitiya. Specific differences in type of fertilizer, quantity of fertilizer, time of application and times of application were seen among packages. Packages were employed in 9 m × 3 m plots located adjacent to each other as a set/replicate in one farmer field and in similarly located 6 m x 4.5 m plots in another farmer field. Three sets were situated in close by 3 vegetable growing tracts in Kalpitiya. Hybrid variety 'Prarthana' was used. The seedlings were raised in nurseries and one month-old healthy seedlings were transplanted 3 plants/hill and at 75 cm × 75 cm spacing on 14th June, 2024 respectively. Except for fertilizer application, all the other cultivation practices were done similarly over all the plots by farmers. Plant height and yield data were collected. Information on tomato market price and fertilizer price was gathered. Fertilizer cost, income, profit and income/fertilizer cost ratio in different packages were calculated using the collected information.

Results: Plant growth and yield responses varied across sets and packages. In terms of plant height, IDOA outperformed other packages in set 1. FP was highest in set 2, and STB was superior in set 3. FP consistently produced wider plants across all sets. Yield was highest under FP in set 1 (26.9 t/ha) and 2 (29.2 t/ha), while in set 3, yields were low overall due to sandy soils, with STB (12.9 t/ha) slightly outperforming FP and IDOA.

Fertilizer costs for DOA, STB, and IDOA ranged between Rs. 957–1,034, while FP costs were substantially higher (Rs. 5,356.60–10,273.40). Profitability varied by location: IDOA generated the highest profit in set 1, STB in set 2 and, both STB and IDOA in set 3. Income-to-fertilizer cost ratios followed a similar trend, with IDOA performing best in set 1, while STB was most efficient in sets 2 and 3.

Conclusion: Although highest yields were observed in FP package highest costs for fertilizer also accounted with FP package in all sets. Therefore, profit can be considered as an important criterion in evaluating the fertilizer packages. In 1st set and 3rd set IDOA package showed higher profit and in 2nd set STB showed higher profit thus IDOA can be considered as most suitable fertilizer package as it gives comparable yield also.

Way forward:

REPORT

Key Activity: Development of area specific nutrient management packages for capsicum and cabbage in Kalpitiya

Introduction

Fertilizer or nutrient management is one of the key factors affecting the crop yield and it helps to ensure food security in any country. However, the excessive use of fertilizer has led to several environmental impacts including pollution and groundwater contamination in different parts of the world (Datta, *et al*., 1997; Shamrukh, *et al*., 2001). In the Sri Lankan context, farmers often resort to easily available chemical fertilizers mainly in intensively cultivated vegetable fields; farmers rely on applying high quantities of chemical fertilizers (Vithanage, *et al*., 2014). With the use of hybrid/high yielding varieties and high intensive cropping systems, the use of inorganic fertilizers has increased with the time. According to Kendaragama, 2006 chemical fertilizer application rate has ranged from zero to 830% of the recommended level in different cropping systems in Sri Lanka. Overuse of chemical fertilizers has hardened the soil, decreased fertility, strengthened pesticides, polluted air and water, and released greenhouse gases, thereby bringing hazards to human health and environment.

Fertilizer application recommendations are often based on crop response data averaged over large areas, though farmers' fields show large variability in terms of nutrient supplying capacity and crop response to nutrients. Thus, blanket fertilizer application recommendations may lead farmers to over fertilize in some areas and under fertilize in others, or apply an improper balance of nutrients for their soil or crop. Therefore, Site Specific Nutrient Management (SSNM) aims to optimize the supply of soil nutrients over time for specific areas without affecting the yields and to reduce the over use of fertilizers by farmers.

Kalpitiya is a sandy peninsula situated in the Puttalam District in North-Western Province in Sri Lanka. The main soil type in the Kalpitiya Peninsula is Regosol, and the area is in the DL3 Agro-ecological zone. The Kalpitiya area is in Sri Lanka's low country, dry zone. Being one of the highly productive agricultural areas of the country, Kalpitiya contributes to a high percentage of vegetable and fruit production of the country (Jayasekera *et al*., 2011). The presence of a shallow groundwater table along with highly permeable soil and unsaturated zone and intensive application of agrochemicals have raised doubts regarding the socio-economic and environmental sustainability of intensive agricultural systems in Kalpitiya (Kumarasinghe et al., 2016). Farmers often tend to apply excessive amounts of nitrogen fertilizers, while further increments are applied during the rainy season to compensate for losses due to leaching (Jayasingha et al., 2013). The retention of Nitrogen (N), which is essential for plant growth, is influenced by a variety of factors including soil constituents, irrigation practices and the fertilizer application in terms of type and the quantity (Rinaudo et al., 2005). Retention of N in the sandy soil of Kalpitiya is restricted due to poor contents of organic matter, clay, and silt fractions. Such continuous and rigorous application of agrochemicals and over-extraction of groundwater has led to significant levels of nitrate and other agro-chemical contamination of groundwater, similar to many other countries such as China, Australia and Europe (Jalali, 2005). Therefore, site specific fertilizer recommendation is a necessity to cut-down the application of fertilizer specially for vegetables crops which is the prominent food crops in the Kalpitiya area.

Objective

To develop an area specific nutrient management package to Kalpitiya area for Cabbage

Methodology

A questionnaire survey was done in Nirmalapura and Eththalai areas and information were collected related to fertilizer application practices by cabbage growing farmers. The collected data were analyzed and used to determine the treatments, application intervals and other agronomic practices.

Two cabbage growing farmers were selected from Nirmalapura and Ilanthadiya Grama Niladhari divisions to conduct the experiment.

Soil samples were collected from their fields and analyzed at the HORDI laboratory.

Treatments

This involved testing of 5 nutrient management packages including T1. Current DOA recommendation - DOA, T2. Soil test-based fertilizer recommendation - STB, T3. Improved fertilizer package – IDOA, 4. Soil test-based improved fertilizer package – IDOA(STB) and T5. Farmer practice - FP for cabbage. Description of each treatment is as follows.

T1 - Current DOA recommendation (DOA)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Cattle manure (kg/plot)	30	-	-	-	30
2	TSP (g/plot)	-	765	-	-	765
3	Urea (g/plot)	-	312	312	312	936
4	MOP (g/plot)	-	213	-	213	426

T2 - Soil test-based fertilizer recommendation (STB)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Cattle manure (kg/plot)	30	-	-	-	30
2	TSP (g/plot)	-	382	-	-	382
3	Urea (g/plot)	-	312	312	312	936
4	MOP (g/plot)	-	213	-	213	426

T3 - Improved fertilizer recommendation (IDOA)

	Fertilizer	Time of application								Total
		Before planting	Basal	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	
1	Cattle manure (kg/plot)	30	-	-	-	-	-			30
2	TSP (g/plot)	-	765	-	-	-	-	-	-	765
3	Urea (g/plot)	-	84	142	142	142	142	142	142	936
4	MOP (g/plot)	-	142	-	-	142	-	142	-	426
5	$Ca(NO_3)_2$ (g/plot) as 0.5% spray					10	10	10	10	40

T4 - Soil test-based improved fertilizer package (IDOA-STB)

	Fertilizer	Time of application								Total
		Before planting	Basal	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	
1	Cattle manure (kg/plot) Partially burned paddy husk (kg/plot)	30 17.5	-	-	-	-	-			30 17.5
2	TSP (g/plot)	-	382	-	-	-	-	-	-	382
3	Urea (g/plot)	-	84	142	142	142	142	142	142	936
4	MOP (g/plot)	-	142	-	-	142	-	142	-	426
5	$Ca(NO_3)_2$ (g/plot) as 0.5% spray					10	10	10	10	40

T5 - Farmer Practice (FP)

Time of Application	**Farmer 1**		**Farmer 2**	
	Type	**Amount**	**Type**	**Amount**
Basal	Urea	300 g	Hydro	200 g
	TSP	500 g	30:10:10	200 g
1WAP	Hydro (N)	500 g	31:10:10	200 g
2WAP	Veg mix (N)	500 g	Ammonia	200 g
3WAP	Hydro (K)	500 g	Wuxal super	50 ml
4WAP	Hydro (K)	500 g	Wuxal super	50 ml
5WAP	Hydro (K)	750 g	Ammonia	125 g
			MOP	125 g
6WAP	Hydro (K)	1000 g	Ammonia	125 g
			MOP	125 g

The experiment was established in plots of 6.3m × 4.5m having 28.35m^2 of area for each treatment. Crop spacing was 45cm × 45cm, 1 plant/hill. The seedlings, hybrid variety Oxylus and Omphalos were raised in nurseries and one month-old healthy seedlings were transplanted. Variety and date of transplanting in Nirmalapura (location 1) were Oxylus and November 22nd and in Illanthandiya (location 2) Omphalos and December 19th. Except for fertilizer application, all the other cultivation practices were done similarly over all the plots by farmers.

Yield data were collected. Information on cabbage market price and fertilizer price was gathered. Nutrients usage, fertilizer cost, income, profit and income/fertilizer cost ratio in different treatments were calculated using the collected information.

Results and Discussion

1. Yield

Location 1

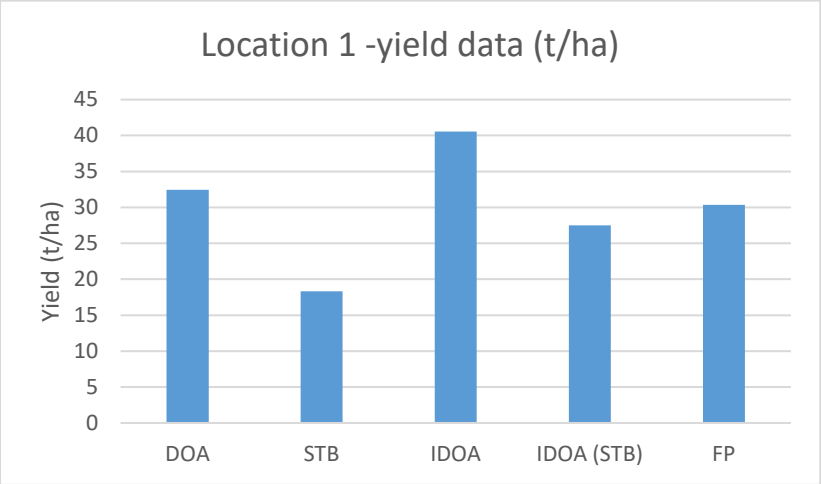


Figure 1: Location 1 yield in treatments

According to the yield values IDOA treatment showed the highest yield of 40.6 t/ha. Department of Agriculture recommendation treatment gave the second highest yield and followed by farmer practice.

Location 2

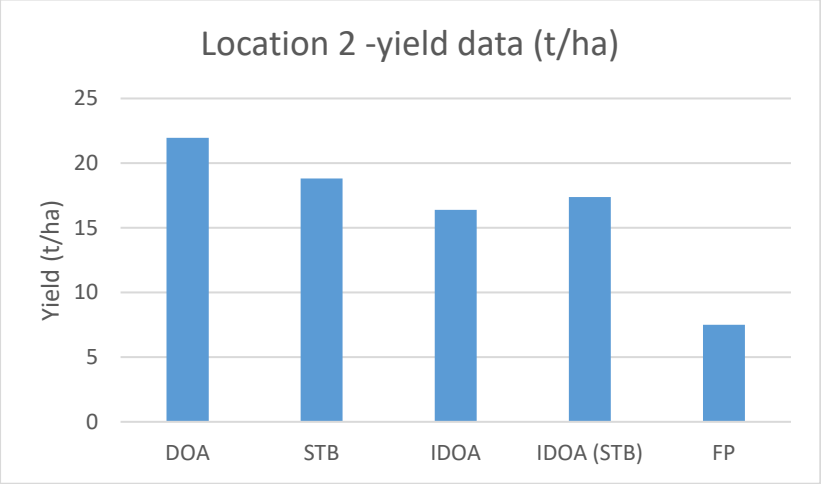


Figure 2: Location 2 yield data in treatments

DOA treatment showed the highest yield of 21.97 t/ha, and followed by STB treatment and IDOA (STB) treatment. Farmer practice showed the lowest yield.

2. Cost calculation for fertilizer used

Location 1

Table 2: Cost for fertilizers applied by farmer 1

DOA			STB			IDOA			IDOA (STB)			FP		
Fertilizer	**Applied amount**	**Cost Rs.**	**Fertilizer**	**Applied amount**	**Cost Rs.**	**Fertilizer**	**Applied amount**	**Cost Rs.**	**Fertilizer**	**Applied amount**	**Cost Rs.**	**Fertilizer**	**Applied amount**	**Cost Rs.**
compost	30 kg	600	compost	30 kg	600	compost	30 kg	600	compost	30 kg	600	compost	30 kg	600
Urea	936 g	168.5	Urea	936 g	168	Urea	936 g	168.5	Urea	936 g	168	Urea	300 g	54
TSP	765 g	183.6	TSP	382 g	91.8	TSP	765 g	183.6	TSP	382 g	91.8	TSP	500 g	120
MOP	426 g	85.2	MOP	426 g	85.2	MOP	426 g	85.2	MOP	426 g	85.2	MOP	0	0
						Ca(NO3)2	40 g	19.2	Ca(NO3)2	40 g	19.2	Hydro	3.25kg	2080
												Veg mix	500 g	145
		1037			**945**			**1056**			**965**			**2999**

Location 2

Table 3: Cost for fertilizers applied by farmer 2

DOA			STB			IDOA			IDOA (STB)			FP		
Fertilizer	**Applied a**	**Cost Rs.**	**Fertilizer**	**Applied an**	**Cost R**	**Fertilizer**	**Applied an**	**Cost Rs.**	**Fertilizer**	**Applied an**	**Cost R**	**Fertilizer**	**Applied an**	**Cost Rs.**
compost	30 kg	600	compost	30 kg	600	compost	30 kg	600	compost	30 kg	600	compost	30 kg	600
Urea	936 g	168.48	Urea	936 g	168	Urea	936 g	168.48	Urea	936 g	168	Hydro	200 g	128
TSP	765 g	183.6	TSP	382 g	91.8	TSP	765 g	183.6	TSP	382 g	91.8	30:10:10	400 g	112
MOP	426 g	85.2	MOP	426 g	85.2	MOP	426 g	85.2	MOP	426 g	85.2	Ammonia	600 g	78
						Ca(NO3)2	40 g	19.2	Ca(NO3)2	40 g	19.2	Wuxal supe	100 l	290
												MOP	400 g	80
		1037.3			**945**			**1056.5**			**965**			**1288**

When considering the cost for the fertilizer in two locations, cost of fertilizers for DOA, STB, IDOA and IDOA (STB) treatments were Rs. 1037, Rs. 945, Rs. 1056 and Rs. 965 respectively. Fertilizer costs in farmer practice treatments were Rs. 2990 and Rs. 1288 for farmer 1 and 2 respectively.

3. Cost, income and profit comparison for farmers

Table 5: Plot yields, cost for fertilizers applied, income and profit taken from the plots

	Treatment	Total yield (k	Income (Rs.)	Cost of fertiliz	Profit (Rs.)	Income/cos
Farmer 1	DOA	92	20240.00	1037.28	19202.72	19.513
	STB	52	11440.00	945.48	10494.52	12.100
	IDOA	115	25300.00	1056.48	24243.52	23.947
	IDOA (STB)	78	17160.00	964.68	16195.32	17.788
	FP	86	18920.00	2999	15921.00	6.309
	Treatment	Total yield (k	Income (Rs.)	Cost of fertiliz	Profit (Rs.)	Income/cos
Farmer 2	DOA	62.28	9342.00	1037.28	8304.72	9.006
	STB	53.34	8001.00	945.48	7055.52	8.462
	IDOA	46.46	6969.00	1056.48	5912.52	6.596
	IDOA (STB)	49.28	7392.00	964.68	6427.32	7.663
	FP	21.26	3189.00	1288	1901.00	2.476

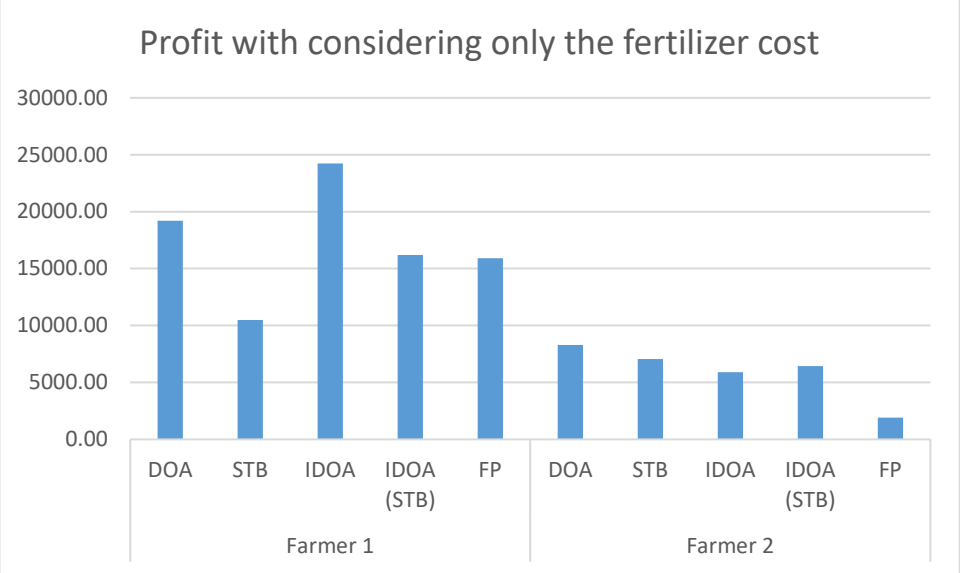


Figure 5: Profit levels in three locations

When considering profit levels accounted only with fertilizer cost, IDOA treatment showed highest profit in location 1. DOA and IDOA (STB) treatments showed highest profit values in location 2. However, profit calculation should include fertilizer application costs such as field application labour cost, transport costs.

4. Income/Cost ratio

Cost/Income ratio was calculated only considering the fertilizer cost.

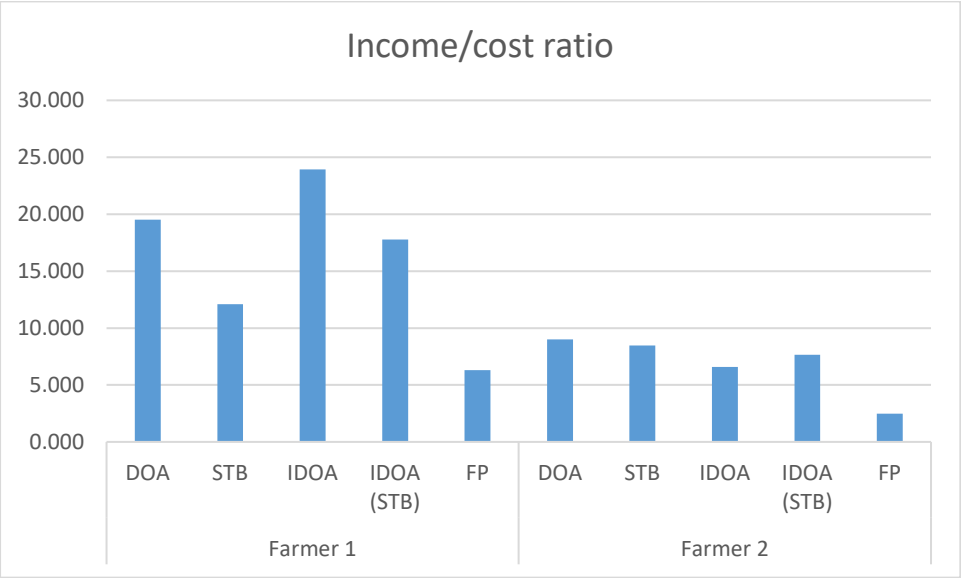


Figure 6: Income/Cost ratio

Conclusions

Highest yields were observed in IDOA treatment in location 1 and DOA treatment in location 2. In 1st location, IDOA treatment showed the higher profit and in 2nd location DOA treatment showed the highest profit.

In cost calculations, application costs, transport costs and other costs for pest and disease control as well as weed management should be considered. Those are related to the nutrient management levels in the crop and soil. Environmental impact assessment should also be considered for better decision making.

REPORT

Key activity: Development of area specific nutrient management packages for capsicum and cabbage in Kalpitiya

Introduction

Fertilizer or nutrient management is one of the key factors affecting the crop yield and it helps to ensure food security in any country. However, the excessive use of fertilizer has led to several environmental impacts including pollution and groundwater contamination in different parts of the world (Datta, et al., 1997; Shamrukh, et al., 2001). In the Sri Lankan context, farmers often resort to easily available chemical fertilizers mainly in intensively cultivated vegetable fields; farmers rely on applying high quantities of chemical fertilizers (Vithanage, et al., 2014). With the use of hybrid/high yielding varieties and high intensive cropping systems, the use of inorganic fertilizers has increased with the time. According to Kendaragama, 2006 chemical fertilizer application rate has ranged from 0 to 830% of the recommended level in different cropping systems in Sri Lanka. Overuse of chemical fertilizers has hardened the soil, decreased fertility, strengthened pesticides, polluted air and water, and released greenhouse gases, thereby bringing hazards to human health and environment.

Fertilizer application recommendations are often based on crop response data averaged over large areas, though farmers' fields show large variability in terms of nutrient supplying capacity and crop response to nutrients. Thus, blanket fertilizer application recommendations may lead farmers to over fertilize in some areas and under fertilize in others, or apply an improper balance of nutrients for their soil or crop. Therefore, Site Specific Nutrient Management (SSNM) aims to optimize the supply of soil nutrients over time for specific areas without affecting the yields and to reduce the over use of fertilizers by farmers.

Kalpitiya is a sandy peninsula situated in the Puttalam District in North-Western Province in Sri Lanka. The main soil type in the Kalpitiya Peninsula is Regosol, and the area is in the DL3 Agro-ecological zone. The Kalpitiya area is in Sri Lanka's low country, dry zone. Being one of the highly productive agricultural areas of the country, Kalpitiya contributes to a high percentage of vegetable and fruit production of the country (Jayasekera et al., 2011). The presence of a shallow groundwater table along with highly permeable soil and unsaturated zone and intensive application of agrochemicals have raised doubts regarding the socio-economic and environmental sustainability of intensive agricultural systems in Kalpitiya (Kumarasinghe et al., 2016). Farmers often tend to apply excessive amounts of nitrogen fertilizers, while further increments are applied during the rainy season to compensate for losses due to leaching (Jayasingha et al., 2013). The retention of Nitrogen (N), which is essential for plant growth, is influenced by a variety of factors including soil constituents, irrigation practices and the fertilizer application in terms of type and the quantity (Rinaudo et al., 2005). Retention of N in the sandy soil of Kalpitiya is restricted due to poor contents of organic matter, clay, and silt fractions. Such continuous and rigorous application of agrochemicals and over-extraction of groundwater has led to significant levels of nitrate and other agro-chemical contamination of groundwater, similar to many other countries such as China, Australia and Europe (Jalali, 2005). Therefore, site specific fertilizer recommendation is a necessity to cut-down the application of fertilizer especially for vegetables crops which are the prominent food crops in the Kalpitiya area.

Objective

To develop an area specific nutrient management package to Kalpitiya area for Capsicum

Methodology

A questionnaire survey was done in Nirmalapura and Eththalai areas and information was collected related to fertilizer application practices by capsicum growing farmers. The collected data were analyzed and used to determine the treatments, application intervals and other agronomic practices.

Three capsicum growing farmers were selected to conduct the experiment from Nirmalapura Grama Niladhari division.

Soil samples were collected from their fields and analyzed at the HORDI laboratory.

Treatments

This involved testing of 4 nutrient management packages including T1. Current DOA recommendation - DOA, T2. Soil test-based fertilizer recommendation - STB, T3. Improved fertilizer package - IDOA and T4. Farmer practice - FP for capsicum. Description of each treatment is as follows.

T1 - Current DOA recommendation (DOA)

	Fertilizer	Time of application				Total
		Before planting	Basal	4WAP	8WAP	
1	Cattle manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	215	-	-	215
3	Urea (kg/ha)	-	100	100	100	300
4	MOP (kg/ha)	-	65	65	65	195

T2 - Soil test-based fertilizer recommendation (STB)

	Fertilizer	Time of application				Total
		Before planting	Basal	3WAP	6WAP	
1	Cattle manure (t/ha)	10	-	-	-	10
2	TSP (kg/ha)	-	107.5	-	-	215
3	Urea (kg/ha)	-	100	100	100	300
4	MOP (kg/ha)	-	65	65	65	195

T3 - Improved fertilizer recommendation (IDOA)

	Fertilizer	Time of application						Total
		Before planting	Basal	1WAP	3WAP	6WAP	8WAP	
1	Cattle manure (t/ha)	10	-	-	-	-	-	10
2	TSP (kg/ha)	-	107.5	-	-	-	-	215
3	Urea (kg/ha)	-	20	60	90	90	90	350
4	MOP (kg/ha)	-	10	20	70	70	70	240
5	$Ca(NO_3)_2$ (kg/ha) as 0.5% spray				3.7	3.7	3.7	11.1
6	K+ application, if necessary							

T4 - Farmer Practice (FP)

Farmer 1	**Farmer 2**	**Farmer 3**

App date	Type	Amt/plot	App date	Type	Amt/plot	App date	Type	Amt/plot
2024.06.14	Compost	30 kg	2024.06.14	Cattle m'r	30 kg	2024.06.14	Cattle m'r	30 kg
	TSP	2 kg	2024.06.14	TSP	1.5 kg	2024.06.28	Veg mix	1.5 kg
	Nemad	250 g	2024.06.25	Hydro	165 g	2024.07.13	Urea	500 g
2024.06.24	Hydro	1 kg	2024.07.08	Hydro	2.1 kg	2024.07.13	MOP	500 g
2024.06.30	Hydro	1 kg	2024.07.14	Urea	500 g	2024.07.13	$Ca(NO_3)_2$	10 g
2024.07.07	Hydro	1 kg	2024.07.14	MOP	500 g	2024.07.20	15:15:20	1.5 kg
2024.07.16	12:10:20	1 kg	2024.07.14	Hydro	300 g	2024.07.28	15:15:20	1.5 kg
2024.07.23	12:10:20	1 kg	2024.07.20	Hydro	2 kg	2024.08.03	15:15:20	630 g
2024.08.01	15:05:15	1 kg	2024.07.28	Hydro	2 kg	2024.08.08	$Ca(NO_3)_2$	10 g
2024.08.06	Mg, Ca	2 kg	2024.08.11	Yaramila	2.5 kg	2024.08.13	15:15:20	1.5 kg
2024.08.16	$Ca(NO_3)_2$	10 g/2l	2024.08.15	CU 3	4.5 kg	2024.08.18	$Ca(NO_3)_2$	10 g
2024.08.24	$Ca(NO_3)_2$	10 g/2l	2024.08.18	$Ca(NO_3)_2$	10 g/2l	2024.08.23	15:15:20	1.5 kg
2024.08.27	Urea	300 g		CU 3	4.5 kg	2024.08.28	15:15:20	1.5 kg
	MOP	195 g	2024.08.25	K+booster	15 ml/2l	2024.08.29	$Ca(NO_3)_2$	10 g
2024.09.02	15:05:25	500 g		30:10:10	3.5 kg			
	Hydro	300 g	2024.08.29	$Ca(NO_3)_2$	10 g/2l			
			2024.09.02	K+booster	15 ml/2l			
			2024.09.03	K+booster	15 ml/2l			
				$Ca(NO_3)_2$	10 g/2l			

The experiment was established in plots of 9m × 3m or 6m x 3m having $27m^2$ of area for each treatment. Crop spacing was 75cm × 75cm, 3 plants/hill. The seedlings, hybrid variety Prarthana were raised in a nursery and five week-old healthy seedlings were transplanted. Except for fertilizer application, all the other cultivation practices were done similarly over all the plots by farmer.

Plant height at two weeks and four weeks after planting and plant width at four weeks after planting were collected in every plot on five plants in each plot. Yield data were collected in every pick. Information on capsicum market price and fertilizer price was gathered. Nutrients usage, fertilizer cost, income, profit and income/fertilizer cost ratio in different treatments were calculated using the collected information.

Results and Discussion

Plant Height

Plant height at two weeks after planting and four weeks after planting are shown Figure 1.

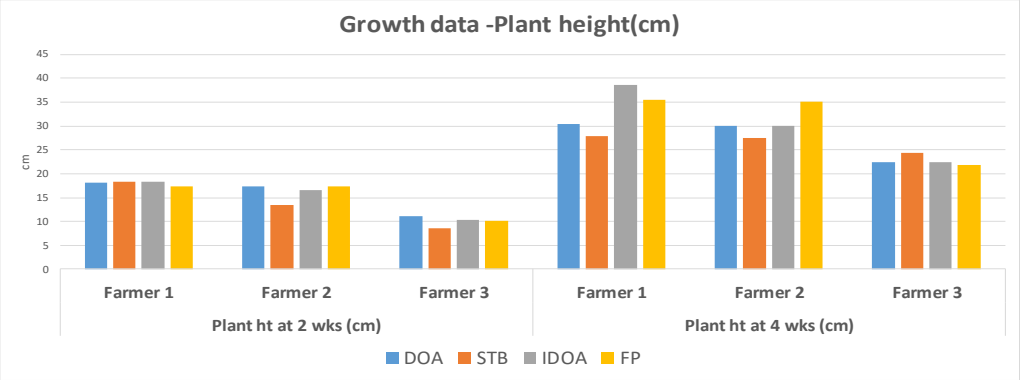


Figure 1: Plant height at 3 locations

In location 1 and 2 plant height data were similar when compared to location 3. This may be due to the sandy nature of the soil in location 3 than the other two locations. At two weeks after planting, there's not much difference among treatments when comparing the height values in location 1. In locations 2 and 3, soil test based recommendation treatment plant height values are somewhat lower than the other treatments. At 4 weeks after planting, in location 1 IDOA treatment showed the highest plant values followed by farmer practice. In location 2, FP treatment showed the highest plant height values. In location 3, STB treatment showed the highest plant height values compared to other treatments.

Plant Width

Plant width at four weeks after planting is shown in Figure 2.

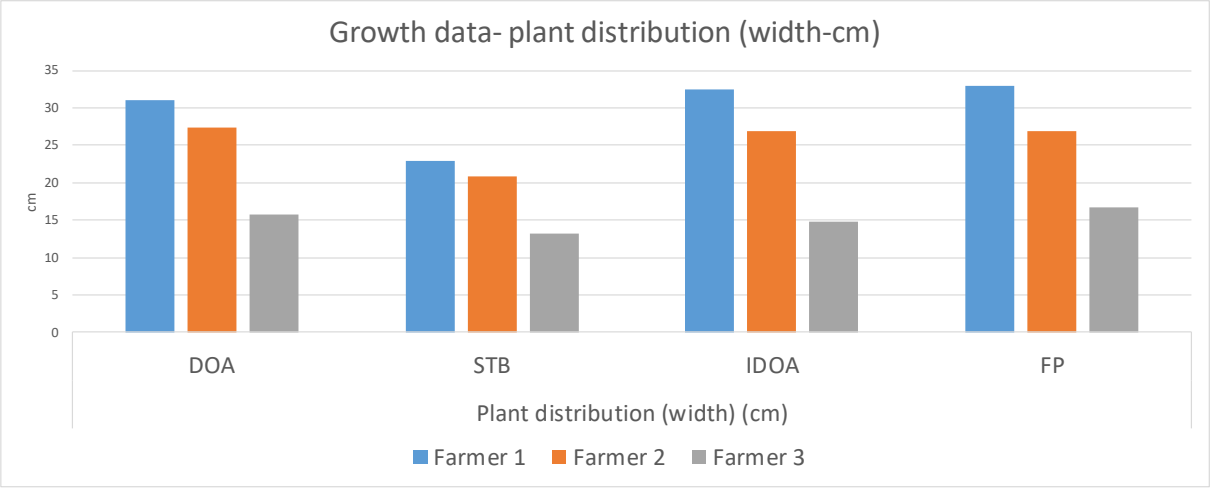


Figure 2: Plant width at 3 locations

When considering all three locations, farmer practice treatment showed higher plant width.

Yield

Location 1

In location 1 farmer has picked capsicum for six times in all the plots and the yields in different treatments are shown in Figure 3.

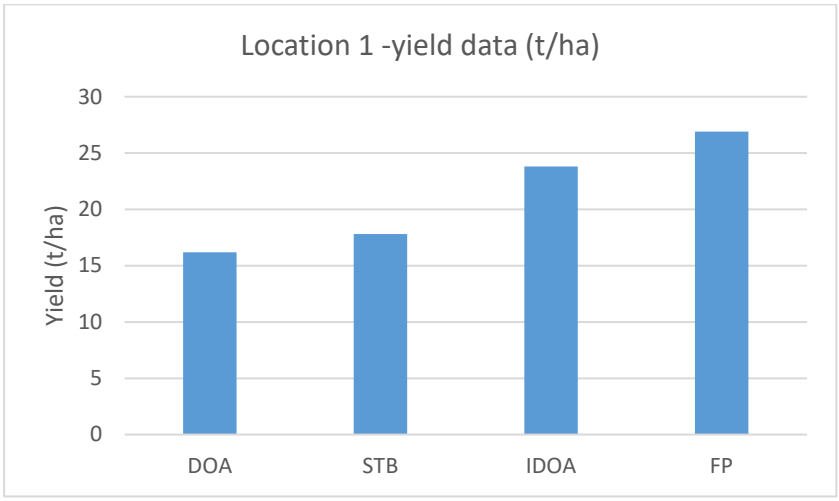


Figure 3: Location 1 yield data in treatments

According to the yield data values, farmer practice treatment showed the highest yield of 26.9 t/ha. Improved fertilizer recommendation treatment gave the second highest yield and followed by soil test based recommendation.

Location 2

In location 2, farmer has picked capsicum for eight times in all the plots and the yields in different treatments are shown in Figure 4.

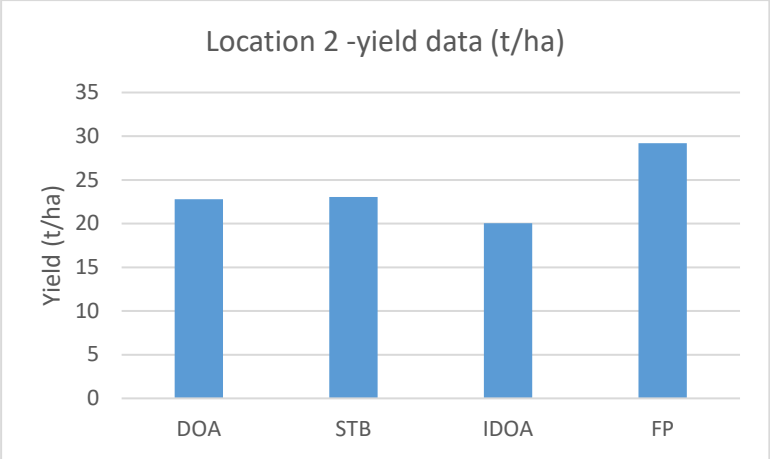


Figure 4: Location 2 yield data in treatments

Farmer practice treatment showed the highest yield of 29.2 t/ha, and followed by STB treatment and DOA treatment. The IDOA treatment showed a yield of 20.0 t/ha.

Location 3

In location 3, farmer has picked capsicum for six times in all the plots and yields in different treatments are shown in Figure 5.

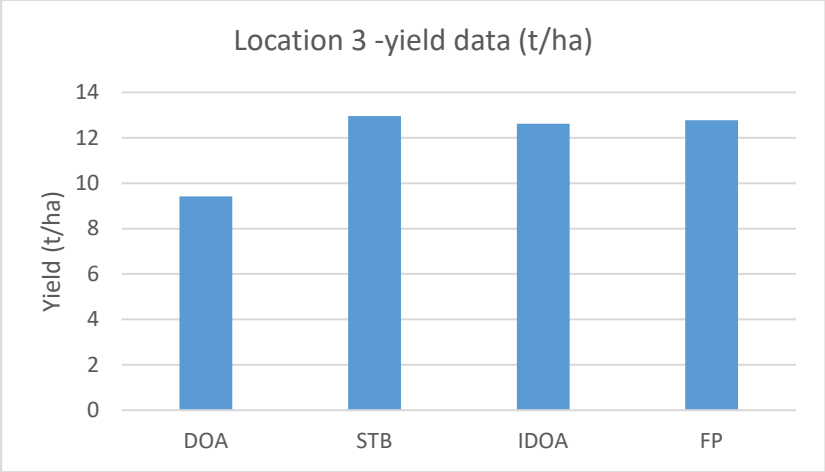


Figure 5: Location 3 yield data in treatments

In location 3, STB, FP and IDOA treatments showed comparatively similar yields (12.9 t/ha, 12.7 t/ha and 12.6 t/ha). In this location, the yields are lower than the other two locations. This may be due to the sandier nature of the soil in location 3.

All locations

Yield averaged over all locations were calculated and it is given in Table 1. It shows that yield in FP is higher than other treatments.

Table 1: Statistical comparison of yield

Treatment	Capsicum yield (t/ha)
DOA	16.125 b
STB	17.940 ab
IDOA	18.819 ab
FP	22.962 a
CV%	15.86

Nutrients usage in different treatments

Amounts of nutrients (N, P and K) added were calculated based on the fertilizer usage in 3 controlled (DOA, STB and IDOA) treatments and it is given in Table 2.

Table 2: Fertilizer and nutrients added to controlled treatment

	Fertilizer use per plot (g)				Nutrients added per plot (g)			
	Urea	TSP	MOP	$Ca(NO_3)_2$	N	P_2O_5	K_2O	N
DOA	900	645	585		405	331.2	356.85	
STB	900	322.5	585		405	269.1	356.85	
IDOA	1050	322.5	720	40	472.5	269.1	439.2	6.2

In IDOA treatment, there's an increase in the amounts of N and K_2O applied when compared to the DOA and STB treatments.

Cost of fertilizer for different treatments

Cost of fertilizers for each treatment was calculated based on the fertilizer usage and it is given in Table 3.

Table 3: Cost for fertilizers applied

DOA			STB			IDOA		
Fertilizer	Amt	Cost (Rs)	Fertilizer	Amt	Cost (Rs)	Fertilizer	Amt	Cost (Rs)
Compost	30 kg	600	compost	30 kg	600	compost	30 kg	600
Urea	900 g	162	Urea	900 g	162	Urea	1000 g	180
TSP	645 g	155	TSP	322.5 g	78	TSP	322.5 g	78
MOP	585 g	117	MOP	585 g	117	MOP	720 g	144
						$Ca(NO_3)_2$	40 g	19.2
		1,034.0			**957.0**			**1,021.2**

Farmer 1			Farmer 2			Farmer 3		
Fertilizer	Amt	Cost (Rs)	Fertilizer	Amt	Cost (Rs)	Fertilizer	Amt	Cost (Rs)
Compost	30 kg	600	Compost	30 kg	600	Compost	30 kg	600
Urea	300 g	54	Urea	500 g	90	Urea	500 g	90
TSP	2 kg	480	TSP	1.5 kg	360	MOP	500 g	100
MOP	195 g	39	MOP	500 g	100	15:15:20	8.13 kg	2300
Hydro	3.3 kg	2244	Hydro	6.565 kg	4202	Veg mix	1.5 kg	435
Nemad	250 g	350	Nemad	250 g	350	Ca	40 g	19.2

12:10:20 /15:05:15	3.5 kg	980	30:10:10	3.5 kg	980	
Mg, Ca	2 kg	600	CU 3	9 kg	1962	
Ca	20 g	9.6	Ca	30 g	14.4	
			K+booster	45 ml	65	
			Yaramila	2.5 kg	1550	
		5,356.6			**10,273.4**	**5,344.2**

Cost for fertilizers in DOA, STB and IDOA treatments are Rs. 1,034, Rs. 957 and Rs. 1,021.20 respectively. In 3 farmer practice treatments, fertilizer costs are Rs. 5,356.60, Rs.10,273.40 and Rs. 3,544.20 which come to more than 5 times that of controlled treatments indicating that farmers bear large costs on fertilizers.

Income and profit

Income as calculated based on yield and profit as calculated subtracting only fertilizer cost from income are given in Table 4 and Figure 6.

Table 4: Income and profit in 3 locations

	Treatment	Total yield (kg)	Income (Rs.)	Cost of fertilizer	Profit (Rs.)
Farmer 1	**DOA**	43.68	27839.00	1034.00	26805.00
	STB	48.10	27640.00	957.00	26683.00
	IDOA	64.26	40133.00	1021.20	39111.80
	FP	72.67	43086.00	5356.60	37729.40
Farmer 2	**DOA**	61.52	23370.70	1034.00	22336.70
	STB	62.22	23810.35	957.00	22853.35
	IDOA	54.12	21324.45	1021.20	20303.25
	FP	78.85	30946.50	10273.40	20673.10
Farmer 3	**DOA**	25.42	8113.80	1034.00	7079.80
	STB	34.995	11427.63	957.00	10470.63
	IDOA	34.055	11042.70	1021.20	10021.50
	FP	34.475	10524.60	3544.20	6980.40

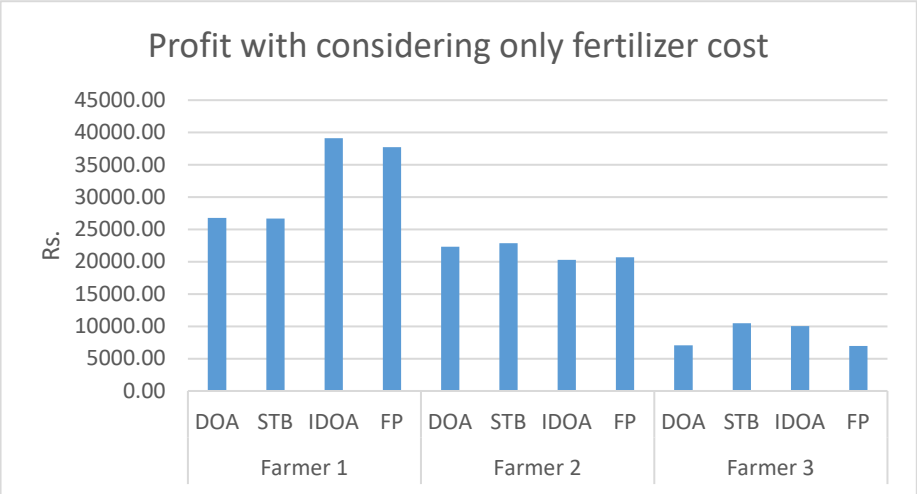


Figure 6: Profit levels in three locations

When considering profit levels accounted only with fertilizer cost of farmers, IDOA treatment showed highest profit with location 1, STB treatment showed highest in location 2, STB and IDOA

treatments showed highest profits in location 3. However, profit calculation should include fertilizer application costs such as field application labour cost, transport costs etc.

Income/fertilizer cost ratio

Income/fertilizer cost ratio was calculated and it is given in Table 5.

Table 5: Income / Fertilizer Cost ratio in three locations

	Treatment	Total yield (kg)	Income (Rs.)	Cost of fertilizer	Income/fertilizer cost ratio
Farmer 1	**DOA**	43.68	27839.00	1034.00	26.924
	STB	48.10	27640.00	957.00	28.882
	IDOA	64.26	40133.00	1021.20	39.300
	FP	72.67	43086.00	5356.60	8.044
Farmer 2	**DOA**	61.52	23370.70	1034.00	22.602
	STB	62.22	23810.35	957.00	24.880
	IDOA	54.12	21324.45	1021.20	20.882
	FP	78.85	30946.50	10273.40	3.012
Farmer 3	**DOA**	25.42	8113.80	1034.00	7.847
	STB	34.995	11427.63	957.00	11.941
	IDOA	34.055	11042.70	1021.20	10.813
	FP	34.475	10524.60	3544.20	2.970

Highest income/fertilizer cost ratio can be observed in IDOA treatment in the first location and in other two locations STB treatment showed the highest values.

Conclusions

Highest yields were observed with farmer practice in all three locations and highest costs for fertilizers also accounted with framer practice in all locations. Therefore, profit can be considered as an important criterion in evaluating the fertilizer packages. In 1st location and 3rd location IDOA treatment showed higher profit and in 2nd location STB showed higher profit thus IDOA can be considered as most suitable fertilizer package as it gives comparable yield also.

Attachment-22

Test report of development of nutrient management packages for protected agriculture crops （WG2-P2）

Key Activity: Development of nutrient management packages for Protected Agriculture crops - Tomato

Responsible Officer: Dr. K.M.S. Kodikara, Deputy Director, RARDC Bandarawela

Location: RARDC, Bandarawela, Badulla District

Objective: To identify effective growth medium and fertilizer packages for tomato in Protected Agriculture

Methodology: The study involved evaluation of combined effect of growing media and fertilizer packages for tomato in protected agriculture. 3 fertilizer packages on coir based media and 3 soil based media with standard fertilizer package were tested in a protected house located at Regional Agriculture Research and Development Center, Bandarawela. Three coir based media fertilizer treatments were Coir peat + Albert fertilizer package, Coir peat + Kodi Mix fertilizer package and Coir peat + Yaramila fertilizer package. The three soil based media consisted of treated topsoil in grow bags with the standard fertilizer package, treated topsoil in cultivation beds with the standard fertilizer package, and untreated topsoil in cultivation beds with the standard fertilizer package. The experiment was conducted using the tomato variety 'Muria'. Plant height, yield parameters and crop yield were recorded.

Results: Highest plant height (117.2 cm) was recorded in coir based Kodi Mix fertilizer package and lowest plant height was observed in untreated topsoil in cultivation beds.

The coir based Albert fertilizer package produced the highest number of fruits (45 fruits per plant) while the coir based Yaramila package recorded the lowest. Both coir based Albert and Kodi Mix packages resulted in significantly higher yields compared to coir based Yaramila package. Treated topsoil in cultivation beds produced the highest yield, followed by treated topsoil in grow bags and untreated topsoil in cultivation beds giving the lowest yield among 3 soil based media packages.

Conclusion: Most suitable growing package for tomato under protected culture is coir based growing media with Kodi Mix fertilizer package in terms of high yield and easy management.

Key Activity: Development of nutrient management packages for Protected Agriculture crops - Capsicum

Responsible Officer: Dr. K.M.S. Kodikara, Deputy Director, RARDC Bandarawela

Location: RARDC, Bandarawela, Badulla District

Objective: To identify effective growth medium and fertilizer packages for capsicum in Protected Agriculture

Methodology: The study involved evaluation of combined effect of growing media and fertilizer packages for capsicum in protected agriculture. 3 fertilizer packages on coir based media and 3 soil based media with standard fertilizer package were tested in a protected house located at Regional Agriculture Research and Development Center, Bandarawela. Three coir based media fertilizer treatments were Coir peat + Albert fertilizer package**,** Coir peat + Kodi Mix fertilizer package and Coir peat + Yaramila fertilizer package. The three soil based media consisted of treated topsoil in grow bags with the standard fertilizer package**,** treated topsoil in cultivation beds with the standard fertilizer package, and untreated topsoil in cultivation beds with the standard fertilizer package. The experiment was conducted using the capsicum variety **'**Sensation'. Plant height, yield parameters and crop yield were recorded.

Results: Plant height at 8 weeks after planting in coir based Kodi Mix and coir based Albert fertilizer package treatments recorded significantly greater heights compared to those under the coir based Yaramila fertilizer package. Plant height showed significant differences among soil based media over the growing period, with the lowest growth recording in untreated topsoil in cultivation beds. Treated topsoil in grow bags produced the tallest plants followed by treated topsoil in cultivation beds.

The number of marketable pods did not differ significantly among coir based fertilizer packages, though total marketable yield varied notably. The coir based Kodi Mix produced the highest yield (4.04 kg per plant), while the coir based Yaramila resulted in the lowest. Both the number of marketable pods and yield per plant differed significantly among three soil based media. Treated topsoil in grow bags recorded the highest number of pods and marketable yield per plant, followed by treated topsoil in cultivation beds, whereas the untreated topsoil in cultivation beds showed the poorest performance.

Conclusion: Most suitable growing package for capsicum under protected culture is coir based growing media with Kodi Mix fertilizer in terms of high yield and easy management.

Title: Development of Nutrient Management Packages for protected Agriculture (PA) Crops

Objective: To identify effective growth medium and fertilizer packages for PA crops

Methodology:

Location –Regional Agriculture Research and Development Centre, Bandarawela

Crops Tested – Capsicum Var. Muria
Tomato Var. Santation

Treatments – Coir Peat bag cultivation with Albert
Coir Peat bag cultivation with KodiMix
Coir Peat bag cultivation with Yaramila
Treated Top Soil bag cultivation with standard fertilizer
Treated Top Soil media bed cultivation with standard fertilizer
Top Soil media bed cultivation with standard fertilizer

Replicates – 5 replicates each comprising of 4 plants (total of 120 plants / crop)

i. Capsicum - 120 bags / plants (3 fertilizer packages x 5 replicates with 4 plants per experimental unit in coir peat media, and 3 soil media x 5 replicates with 4 plants per experimental unit in soil based media)
ii. Tomato - 120 bags / plants (3 fertilizer packages x 5 replicates with 4 plants per experimental unit in coir peat media, and 3 soil media x 5 replicates with 4 plants per experimental unit in soil based media)

Media preparation -

Coir Peat - Mixture of coir dust and coir chips in 3:2 ratio

Treated Top Soil - Incubated (by keeping in a heap covered by black polythene for 21 days) mixture of top soil, lime 2 kg, half burn paddy husk 6.8 kg, poultry manure 100 g/plant, gliricidia leaves and wild sunflower leaves 20% V/V

Top Soil – Mixture of top soil lime 2 kg, half burn paddy husk 6.8 kg, poultry manure 100 g/plant

- Polythene bags (25 cm wide 25 cm tall) were filled with relevant media to prepare pots for bag cultivation
- Planting beds (0.5 m wide and 2 m length with 0.25 m high) were prepared using relevant soil for bed cultivation

Fertilizer application on coir peat based cultivation -

Weeks	Six days/week g/plant/day				
	Kodi mix	Albert based package	Yaramila based package		
		Albert + K + Ca	Yara starter + Ca	Yara grower + Ca	Yara target + Ca
1	0.25	0.25 + 0.15 + 0.1	0.25 + 0.2		
2	0.5	0.50 + 0.15 + 0.1	0.50 + 0.2		
3-4	0.75	0.75 + 0.15 + 0.1	0.75 + 0.2		

5-6	1.0	1.0 + 0.2 + 0.15		1.0 + 0.2	
7-8	1.25	1.25 + 0.2 + 0.15		1.25 + 0.2	
Onwards	1.5	1.5 + 0.2 + 0.15			1.5 + 0.3

Fertilizer application on soil based cultivation -

Basal g/plant	Top dressing (g/plant at once a week)						
	1st-4th week		5th-8th week		9th week onwards		3rd week onwards
	Urea	MOP	Urea	MOP	Urea	MOP	Albert
TSP – 5.0g Utha – 3.0g	1.0g	0.75g	1.5g	1.0g	1.5g	1.5g	1.5g

Date of nursery establishment – 2024.04.30
Date of planting - 2024.05.22

Results and discussion:

1. Plant height in capsicum

1.1. Capsicum plant height in coir-based media (cm)

Plant height was not significantly varied among treatment up to 6 WAP of the crop. However it showed significant differences at late part of the crop. Kodi mix and Albert based package showed significantly superior plant height over the Yara based package at 8 WAP.

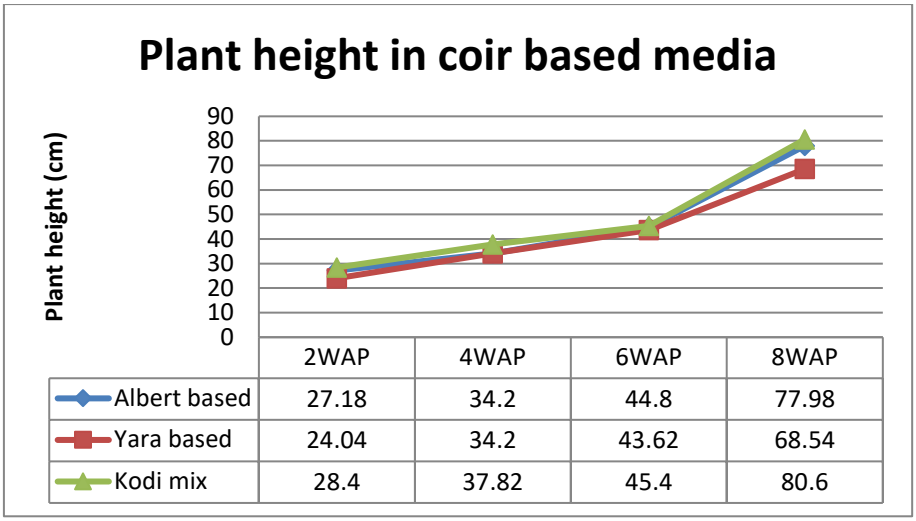


Figure 1. Changes of capsicum plant height in different fertilizer packages grown in coir media

1.2 Capsicum plant height in soil-based media (cm)

Plant height was significantly varied in different growth medium over the growth stages. Direct soil was reported poor plant height compare to treated soil. Grow bags filled with treated soil showed significantly higher plant height over the beds fill with treated soil.

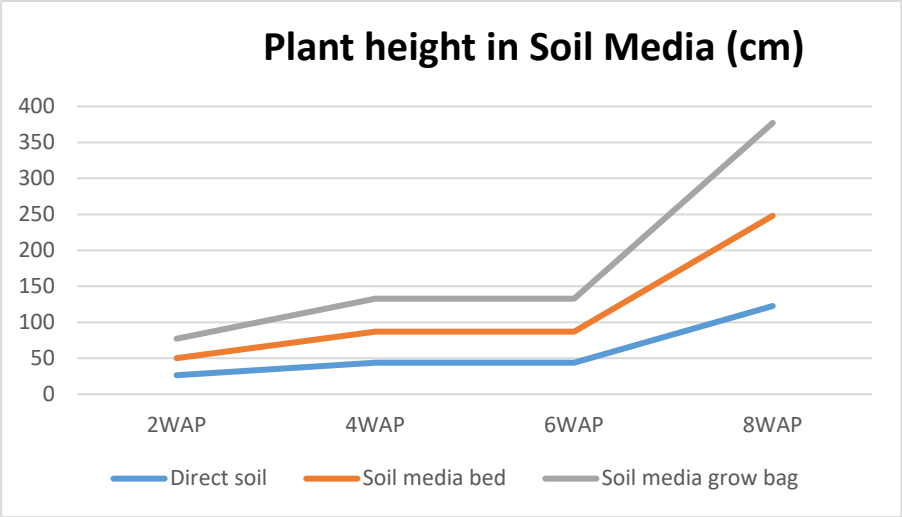
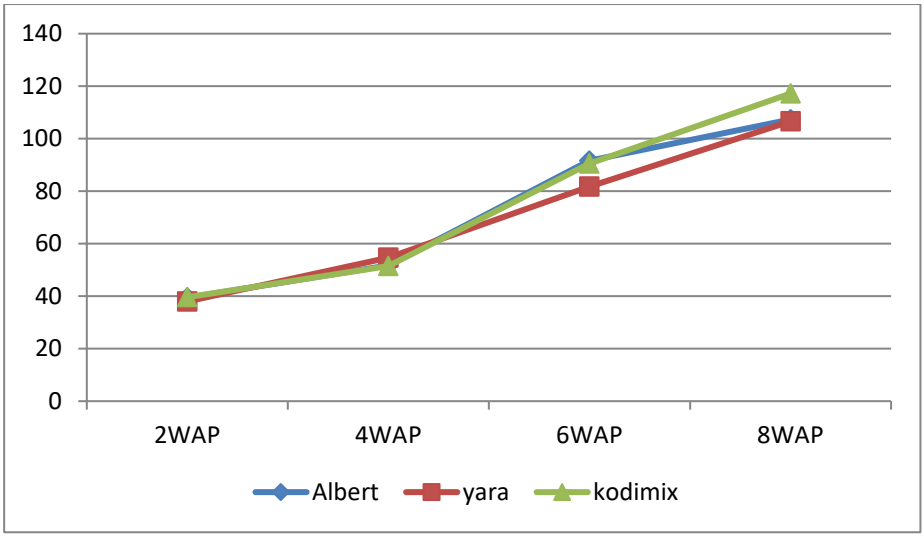


Figure 2: Changes of capsicum plant height in different soil media

2. Plant height in tomato

2.1. Tomato plant height in coir- based media (cm)

Tomato plant height was not showed significant differences among treatments. The highest value (117.20 cm) was reported in Kodi mix over the other two fertilizer packages.



2.2 Tomato plant height in soil-based media (cm)

Height of the plants was not significantly differing at 2WAP among treatments. At 4 and 6 WAP it was differed significantly and the lowest value was reported in direct soil compare to traded soil. However, at 8 WAP all treatments performed similarly.

	2WAP	4WAP	6WAP	8WAP

Direct soil	37.40[a]	52.20[b]	79.08[b]	122.60[a]
Soil media bed	40.60[a]	61.04[a]	92.78[a]	125.42[a]
Soil media grow bag	40.58[a]	61.02[a]	93.14[a]	129.02[a]
CV	*11.64*	*2.44*	*2.30*	*10.57*

3. Yield of capsicum

3.1. Capsicum yield in coir-based media

Marketable pod number of harvests was not significantly varied among three fertilizer packages. Total marketable harvest was significantly varying in treatments while reporting highest value (4.04 kg) in Kodi mix. Yara based fertilizer package reported significantly lower yield compare to other two fertilizer packages.

Treatment	Marketable pod number/plant	Marketable pod yield (kg/plant)
Albert	96.20[a]	3.98[a]
yara	91.00[a]	2.52[b]
Kodimix	94.40[a]	4.04[a]
CV	*12.65*	*17.17*

3.2. Capsicum yield in soil-based media

Marketable pod number was significantly varied in treatments. The highest number of pods was reported in Soil media grow bags and the lowest reported in direct soil. Soil media beds reported in between Marketable pod number/plant. Marketable pod yield/plant was varied significantly among treatments while reporting the highest and lowest in Soil media bag and direct soil respectively.

Treatment	Marketable pod number/plant	Marketable pod yield (kg/plant)
Direct soil	76.20[c]	2.84[b]
Soil media bed	82.00[b]	3.87[a]
Soil media bag	91.60 [a]	3.88[a]
CV	*18.39*	*20.04*

4. Yield of tomato

4.1. Tomato yield in coir-based media

Marketable fruits and yield were varied significantly in treatments. The higher number of fruits (45) was reported in Albert based package and the lowest reported in Yara based package. Kodimix performed similar to the Albert in case of number of fruits. Kodimix and Albert based packages reported significantly higher yield over the Yara based fertilizer package.

Treatment	Marketable fruits/plant	Marketable fruit yield (kg/plant)
Albert	45.0[a]	4.18[a]
Yara	22.6[b]	1.16[b]
Kodimix	40.8[a]	4.51[a]
CV	*19.57*	*30.15*

4.2. Tomato yield in soil-based media

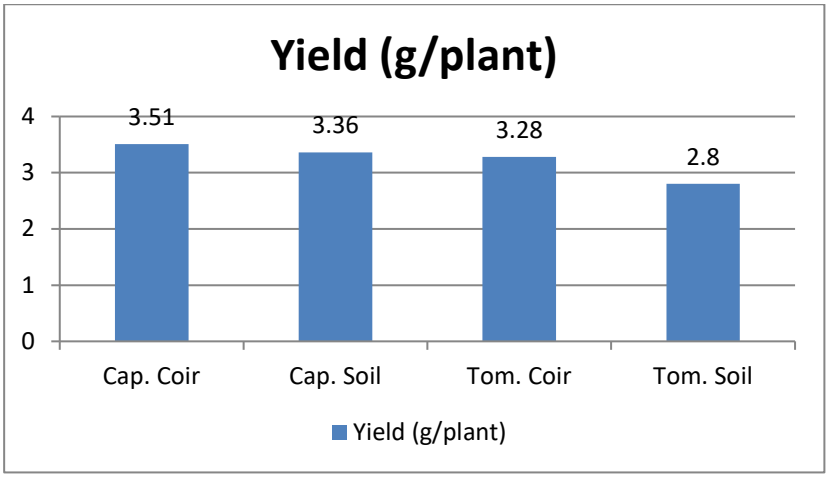
Marketable fruit yield of tomato varied significantly in treatments and highest value was reported in beds with treated soil. The lowest value was reported in direct soil treatment. Marketable yield per plant was varied considerably and treated soil in beds and bags showed similar performances and direct soil reported significantly lower yield.

Treatment	Marketable fruits/plant	Marketable yield (kg/plant)
Direct soil	24.40^{b}	1.63^{b}
Soil media bed	38.00^{a}	3.73^{a}
Soil media grow bag	33.80^{ab}	3.25^{a}
CV	*25.16*	*24.67*

Discussion:

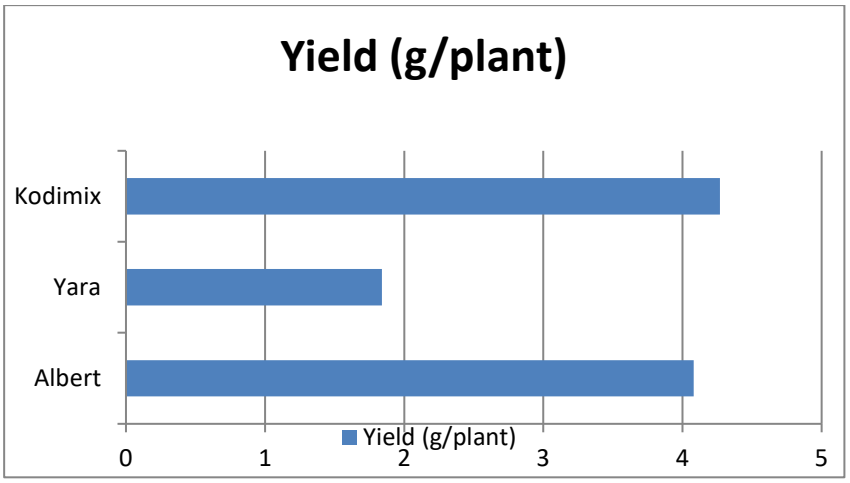
Yield in different media

Both crops performed well in coir media over the soil media. Yield gap in capsicum between two media is not remarkable. But in tomato variation is considerable. However, based on the management and other practices coir media can be recommended for the poly tunnel cultivation.



Yield response to fertilizer packages

Related to fertilizer packages Kodimix performed well over the other treatments while Albert also showed similar yield to Kodimix. But Yara package reported considerable lower yield.



Finally can be proposed most suitable growing package for capsicum and tomato under protected culture is coir based growing media with Kodimix fertilizers in terms of high yield and easy management.

Attachment-23

Test report of Development of fertilizer recommendation based on leaf N status for N management （WG2-P3）

Key Activity: Development of a method for N management based on leaf N status

Responsible Officer: Renuka Silva, PAS, HORDI, Gannoruwa

Location: Horticultural Crop Research and Development Institute (HORDI), Gannoruwa

Objective: Promotion of rapid guiding for demand based fertilizer management in tomato and capsicum

Methodology: The study involved evaluation of effectiveness of the N – Analyser (Leaf N-Meter) by determining the accuracy and establishing the relationship among the leaf N meter reading with the fruit yield and other growth parameters of tomato. Greenhouse and field experiments were conducted using seven N fertilizer levels in a Completely Randomized Design using tomato and capsicum as test crops respectively. Green house experiment was conducted using pots with 7 kg of soil and 0, 45, 90, 112.5, 135, 180 and 205 kg/ha N levels. Field experiment was conducted using field plots and 0, 35, 70, 135, 160, 180 and 200 kg/ha N levels. K and P fertilizers were applied at the rate recommended by the Department of Agriculture. Parameters measured included leaf N content (by N-Meter and laboratory), chlorophyll content, plant height, yield, and biomass. Meter readings were taken on the uppermost/youngest fully expanded leaf from five different spots of the leaf (repeated five times) and average values were calculated from five repetitions. At the 50% flowering stage, after measuring N and chlorophyll contents using the N meter, the same leaves were cut out and prepared for laboratory analysis of leaf N content.

Results: Leaf N meter reading correlates with lab method reading (Fig. 1).

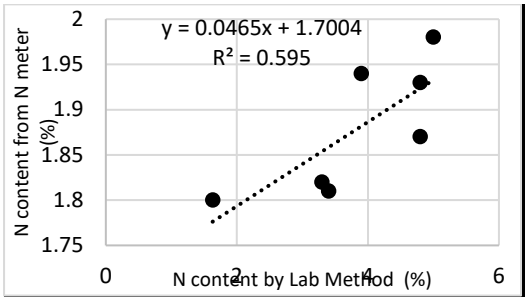


Fig. 1: Relationship of N contents in leaf measured by two methods

Leaf N meter readings correlate with tomato yield (Fig. 2) and capsicum yield (Fig. 3).

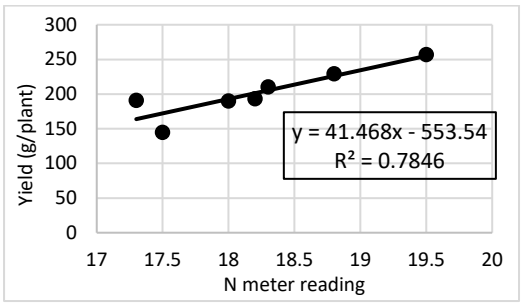


Fig. 2: Relationship of tomato yield and N meter reading

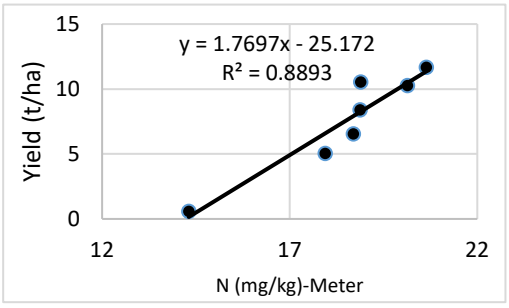


Fig. 3: Relationship of capsicum yield and N meter

Conclusion: Leaf N-Meter can effectively estimate leaf N concentration and predict yield performance, providing a practical alternative to chemical leaf analysis for N management in tomato and capsicum crops thus it can be recommended as a field level tool for rapid guiding of demand based fertilizer application.

REPORT

Key Activity: Development of a method for N management based on leaf N status

Introduction

In developing countries, nitrogen (N) fertilizer management often relies on blanket recommendations, which provide uniform N rates across large areas. While these recommendations aim to optimize yields, they can lead to the over-application of fertilizers, negatively impacting the environment and consumer health (Bijay-Singh et al., 2020). This approach often results in a poor match between applied N and crop demand. Farmers frequently apply excessive amounts of N fertilizer at planting, which can promote excessive vegetative growth, ultimately leading to reduced yields and increased susceptibility to diseases. In Sri Lanka, N fertilizer rates in the blanket recommendations are often not based on soil N supply and crop N demand, as estimated by the crop yield response to applied N; instead, they are primarily yield-based. Crop N demand varies across landscapes in a given cropping season and from year to year at a single location (Basso et al, 2019). Its prediction at the time of deciding on fertilizer N application, and also considering possible future weather scenarios, is not easy.

The effects of soil, climate, and management conditions on N supply and demand are reflected by leaf N status, which can be used for guiding fertilizer N input to achieve N synchrony. Leaf greenness or chlorophyll content and crop biomass reflect soil N- -supply as well as N requirement for optimum crop growth. A low chlorophyll content or lesser green color of leaves along with reduced biomass production are associated with an insufficient supply of N (Zhao et al, 200). Generally, different approaches involve comparing the leaf N status and biomass of crops to be fertilized with that of crops grown under no N limiting conditions (Shanahan et al, 2008). Determination of leaf N contents by chemical analysis of plant tissues is a widespread tool to identify the N requirement of the crop. However, this analysis is time-consuming, destructive, and costly. Therefore, there is a need to identify and introduce a fast and simple complimentary tool for determining the plant N status in the crops. Plant N analyzer or Leaf N-Meter (Model Infitek BPNA – 4) provided by INFITEK BioSciences Co. Ltd., measures the leaf N content as well as chlorophyll contents in the plant. The principle of measurement of two measurements is the same, but output values are presented in different scales. Due to the close association between leaf greenness and leaf chlorophyll content (Mdeira et al., 2000), the N status and greenness of the topmost fully expanded leaf of the growing crop plants at any time reflect the N demand and biomass production (Peng et al., 1996).

Leaf chlorophyll contents are measured by a chlorophyll meter or SPAD meter. The chlorophyll content of a plant is a good qualitative indicator for leaf N concentrations (N) (Olfs et al., 2005), and for several crops, it has been demonstrated that leaf N and chlorophyll concentrations are strongly correlated. The use of chlorophyll measurements to derive information on the N status of plants instead of laboratory N analysis has been reported (wood et al, 1992). Although there are few studies relating to the use of LCC, SPAD meter results mainly on European crops especially for cereals, and not for vegetable crops, and also limited research conducted relating to the use of N analyzer. Furthermore, considering the different agroecological conditions, there is a need to calibrate and validate the N analyzer for different crops.

Therefore, the objectives of this study were to determine the relationship between N fertilization and leaf N content measured by Leaf N- Meter, to determine the accuracy of the N – Analyser (Leaf N-Meter) for predicting the tissue N contents in tomato plants and to determine the relationship among the leaf N meter reading with the fruit yield and other growth parameters.

Materials and Methods – Green House Experiment with Tomato

The greenhouse experiment was conducted at the Horticultural Crops Research and Development Institute in a controlled environment.

Treatments

A Complete Randomized Design (CRD) was conducted with seven treatments having different N fertilizer rates (0, 45, 90, 112.5, 135, 180 and 205 kg/ha) and five replicates using pots with 7kg of soil. K and P fertilizers were applied at the rate recommended by the Department of Agriculture (DOA). NPK fertilizer was applied as urea, TSP, and MOP respectively.

Sampling and data collection

Plant height, N contents in leaves, chlorophyll contents, number of fruits, and yield data were collected throughout the study. Plant height was measured biweekly. Leaf N contents and chlorophyll contents in the leaves were also measured at two-week intervals using the leaf N meter. Meter readings were taken on the uppermost/youngest fully expanded leaf from five different spots of the leaf (repeated five times) and average values were calculated from five repetitions. At the 50% flowering stage, after measuring N and chlorophyll contents using the N meter, the same leaves were cut out and prepared for laboratory analysis of leaf N content.

Statistical Analysis

Correlation analysis was done using the SAS Studio and compared the correlation coefficients of the Leaf N contents measured by the N meter with the other parameters measured such as plant height, number of fruits, fruit yield, chlorophyll contents measured by the same meter, shoot weight, root weight and root length, etc.

Results and Discussion

Initial soil analysis

pH	- 6.5
Electrical Conductivity (dS/m)	- 0.052
Available P (ppm)	- 4.3
Exchangeable P (ppm)	- 82.7
Organic Matter (%)	- 5.2

Table 1: Leaf N contents at flowering stage measured by both laboratory and N Meter

Amount of N (kg /ha)	N% - Lab	N% - N Meter
0	3.3	1.82
45	3.4	1.84
90	3.9	1.96
112.5	4.8	1.87
135	5.4	1.98
180	4.8	1.92
225	1.63	1.84

Table: 2. Pearson correlation coefficients (R2) of N% - N Meter and other parameters

Parameter	Correlation coefficients between N% - N Meter and measured parameters	P value
N – Lab	0.771	0.04
Root length	0.310	0.499
Root fresh weight	-0.438	0.325
No. of Fruits	0.343	0.5067
Yield	0.711	0.018

Chlorophyll	0.310	0.499
Shoot dry weight	0.769	0.041
Shoot fresh weight	0.704	0.118

Table: 2. Pearson correlation coefficients of N% - Lab and other parameters

Parameter	Correlation coefficients between N% - Lab and measured parameters	P value
Root length	0.594	0.021
Root fresh weight	0.042	0.937
No. of Fruits	0.343	0.507
Yield	0.711	0.022
Chlorophyll	0.310	0.499
Shoot dry weight	0.769	0.044
Shoot fresh weight	0.704	0.012

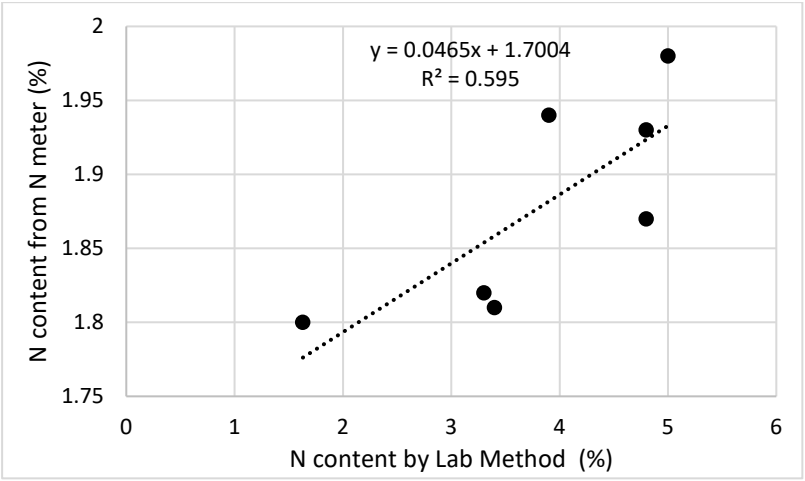


Figure 1: Relationship of N contents in leaf measured by two methods

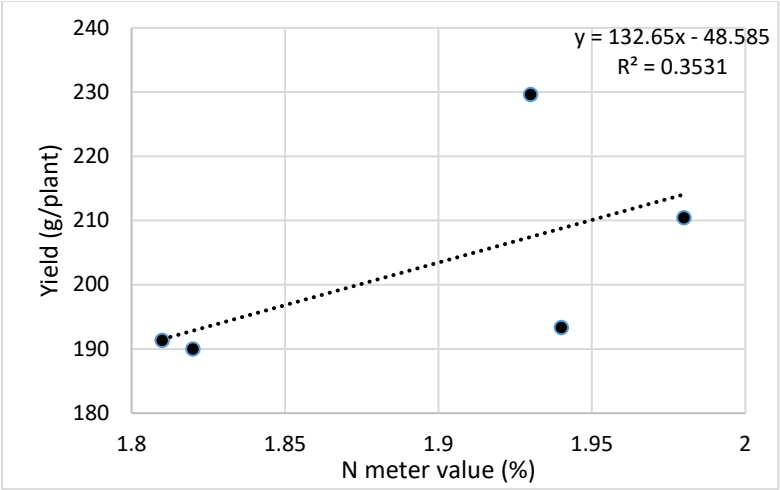


Figure 2: Relationship between N meter reading and Fruit Yield

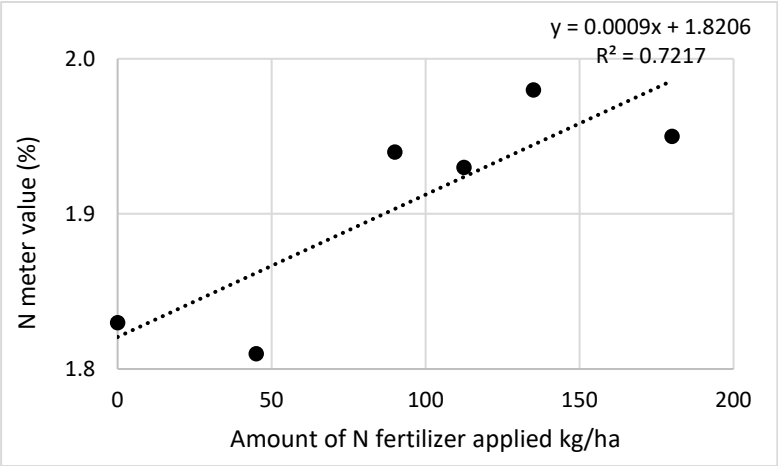


Figure 3: Relationship between rate of N fertilizer applied and N content in leaf measured by N meter

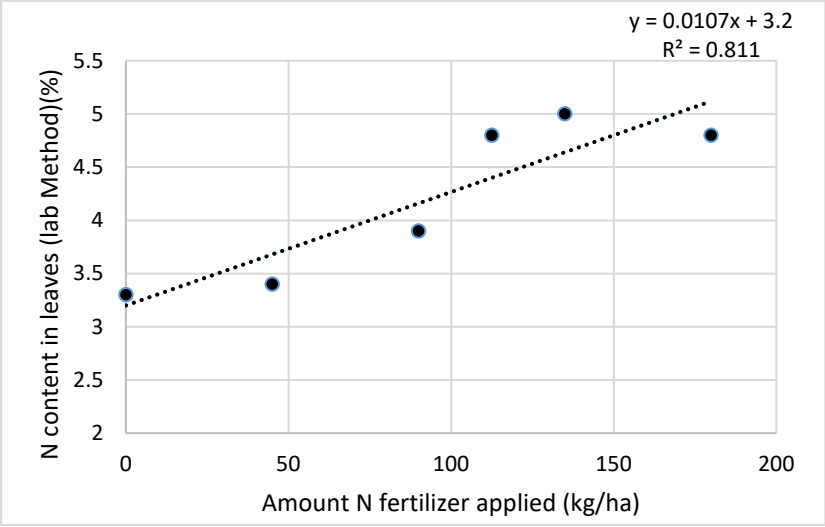


Figure 4: Relationship between rate of N fertilizer applied and N content in leaf measured by Laboratory method

Table: 4. Yield, No. of fruits and other growth parameters of the plants

Amount of N (kg /ha)	Plant Height at 50% flowering stage (cm)	Yield (g/pot)	No of fruits	Shoot fresh weight (g)	Shoot dry weight (g)	Root Fresh weight (g)	Root Length (cm)
0	111.4	190	8.2	166.1	45.9	25.4	11.52
45	118.2	191.3	8.8	191.2	67.4	19.8	14.3
90	125.0	193.3	9	191.3	82.9	20.1	12.9
112.5	120.8	145	7.8	177.8	54.1	23.8	14.8
135	118.8	210.4	9.75	203.8	96.2	13.2	13.5
180	118.8	229.6	9	190.4	62.6	35.1	14.87
205	122.6	257	13.8	212.7	93.8	38.2	12.4

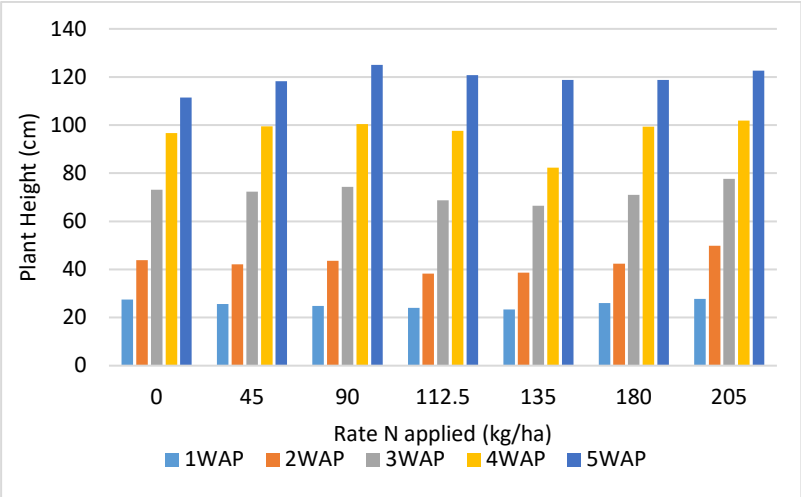


Figure 5: Variation of plant height with the growing period and treatments

Table 5: Relationship between the measured parameters and rate of applied N fertilizer

	Correlation coefficients with the rate of N fertilizer applied	P value
Leaf N - N Meter	0.374	0.408
Leaf N - Lab	0.901	0.014
Root length	0.313	0.494
Root fresh weight	0.537	0.021
No. of Fruits	0.781	0.046
Yield	0.895	0.016
Chlorophyll	0.130	0.780
Shoot dry weight	0.580	0.017

Tables 1and 4 showed that leaf N contents at the flowering stage measured by both laboratory and N meters and the amount of yield, number of fruits, and other growth parameters such as root and shoot weight, plant height, root length, etc. respectively. Both Leaf N contents measured by N-meter and measured by laboratory method were increased significantly ($p<0.05$) with the increase of N fertilizer application and they were significantly correlated with the amount of N fertilizer applied Figure 2). The objective of this study was to determine the accuracy of the Leaf N- N-Meter for predicting the leaf N contents for vegetable crops. The close linear relationship between the N meter reading and the leaf N contents measured by the laboratory method and N meter reading and total fruit yield per plant (Table 2 and Figures 1 and 4).

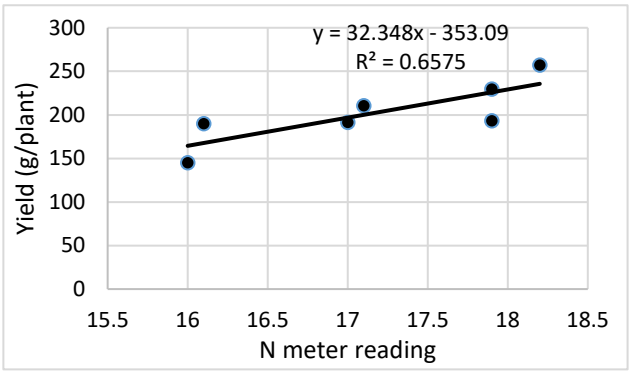
Similarly, Leaf N contents measured by both methods showed correlations with the tomato fruit yield and shoot fresh and dry weight (Tables 2 and 3) while, there were no observed correlations of leaf N contents measured by the two methods and root weight and length, number of fruits, and chlorophyll contents.

Generally, at the initial flowering stage leaf N contents are ranged from 4-5%, and full blooming stage it is 3.5% to 4.5% (https://ipm.ucanr.edu/agriculture/tomato/fertilization). Parvizi et. al. (2004) reported that leaf N contents in normal plants vary from as low as 2-3% up to 4-5% depending primarily on plant species. Leaf N content of 3-4% represented by N meter readings of between 18.3 to 18.9 mg/g or 1.83 -1.89%. Therefore, knowledge of the leaf N contents for the different growth stages could be used to estimate the corresponding Leaf N-Meter readings, thus, the need for N fertilizer application. It is necessary to repeat this experiment several times for each crop to calibrate this N meter reading with actual N contents in leaves.

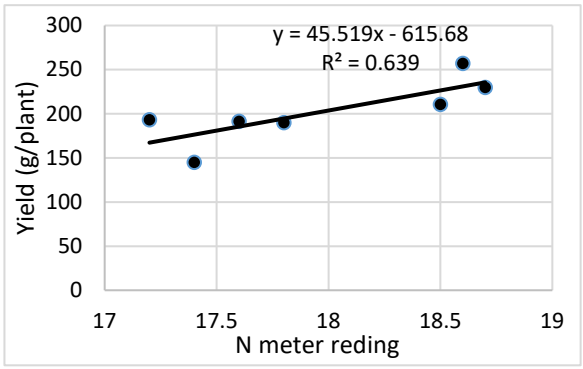
Furthermore, we measured the leaf N contents by conventional laboratory method only at the flowering stage and compared the N meter reading with only the flowering stage. However, it is necessary to measure the leaf N contents by both methods in different growth stages of the crops including blooming, fruiting, and harvesting stages to calibrate the N meter with the actual N contents in leaves at different growth stages. This N meter reading can be influenced by water stress, drought stress, and other nutrient imbalances, etc. (Neukirchen & Lammel, 2002) Therefore, before using this apparatus for applying N fertilizer recommendation, it is important to ensure crops are grown under optimum conditions.

Additionally, correlation analysis was done between the N contents measured from N- Meter and yield at different growth stages such as 1, 2, 3, 4, and 6 weeks after planting. There were good correlations were observed between the N contents in different growth stages and yield. The actual N content in leaves in different growth stages can be calculated from the equation observed in the correlation graphs.

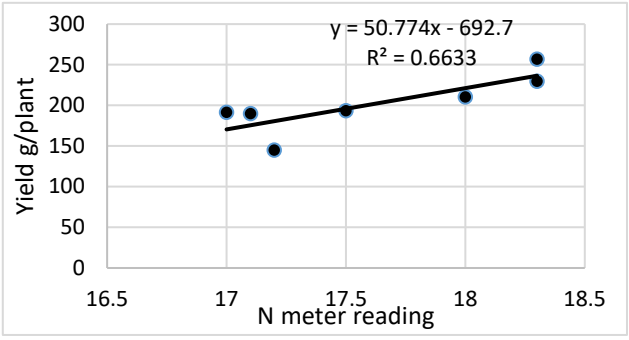
Correlation analysis between N meter reading and Yield at different growth stages



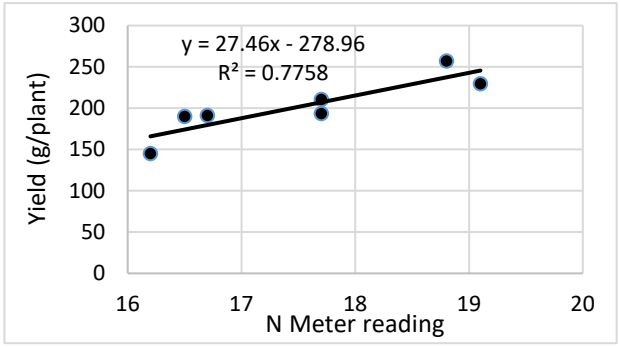
After 1st week



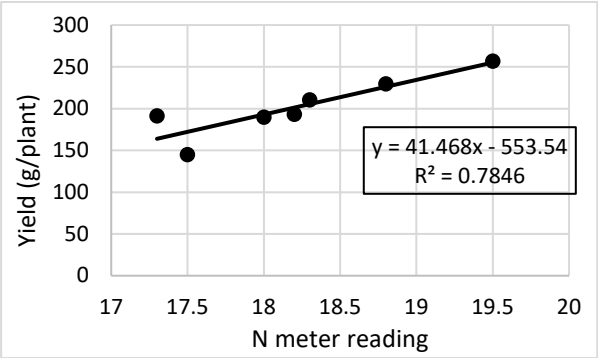
After 2nd week



After 3rd week



After 4th week



After 6th week

Conclusion

According to the results, the Leaf N meter reading correlates with several parameters measured, and therefore this meter can be an effective substitute as an indicator for tomato plant N%, and also could potentially replace the chemical leaf analysis for N, but this needs further confirmation from field experiments, and also need to proceed to farmer field evaluation and calibration of other vegetable crops as well. And also need to fine-tune the proper method for measuring the reading and identification of suitable leaves, leaf age positions along the leaf, etc. for measurements. Furthermore, this meter does not indicate the amount of N fertilizer applied, it only indicates the need for additional N, and this meter should be calibrated for different environments as well.

Materials and Methods – Field Experiment with Capsicum

The field experiment was conducted in the research field at the Horticultural Crops Research and Development Institute.

Treatments

A Complete Randomized Design (CRD) was conducted with seven treatments having different N fertilizer rates (0, 35, 70, 135, 160, 180 and 200 kg/ha) and three replicates. K and P fertilizers were applied at the rate recommended by the Department of Agriculture (DOA). NPK fertilizer was applied as urea, TSP, and MOP respectively.

Sampling and data collection

Plant height, N contents in leaves and chlorophyll contents from the n meter, number of fruits, and yield data were collected throughout the study. Plant height was measured biweekly. Leaf N contents and chlorophyll contents were also measured at two-week intervals using the leaf N meter. Both N and chlorophyll contents in the leaves were measured by leaf N- meter and meter readings were taken along the uppermost/youngest fully expanded leaf from five different spots of the leaf (repeated five times) and average values were calculated from five repetitions. At the 50% flowering stage, N and chlorophyll contents were measured again using the N meter, and the same leaves were then cut out and prepared for laboratory analysis and leaf N contents were determined.

Statistical Analysis

Correlation graphs were constructed for the Leaf N contents measured by the N meter with the other parameters measured, such as plant height, fruit yield, and chlorophyll contents measured by the same meter and N contents measured by the laboratory method.

Results and Discussion

Table: 6. Leaf N contents at flowering stage measured by both laboratory and N tester

Amount of N (kg /ha)	N% - Lab Method	N (mg/kg) - N Meter
0	1.41 b	14.31 b
35	2.47 a	17.95 a
70	2.35 ab	18.70 a
135	2.69 a	18.89 a
160	2.69 a	18.88 a
180	2.27 ab	20.14 a
200	2.40 a	20.64 a

Table: 7. Yield, No. of fruits and other growth parameters of the plants

Amount of N (kg/ha)	Plant Height at 50% Flowering stage (cm)	Chlorophyll Contents	Root length (cm)	Yield (t/ha)
0	62.29 b	32.29a	12.42b	0.584 e
35	90.67 a	47.57a	18.1 a	5.03 d
70	92.29	50.13a	16.67 a	6.54 cd
135	103.07	51.15a	17.27 a	10.54 ab
160	93.56	51.25a	17.27 a	9.64 ab
180	99.94	55.01a	16.91 a	10.2 ab
200	101.43	58.55a	18.43 a	11.65 a
CV %	6.4	11.2	9.7	18.6

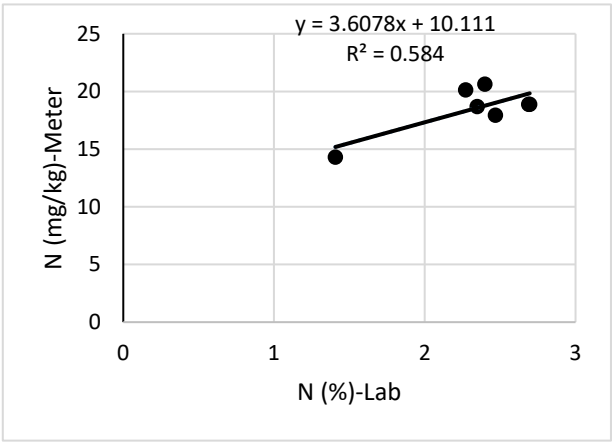


Fig. A: Correlation of leaf N-Lab and Meter

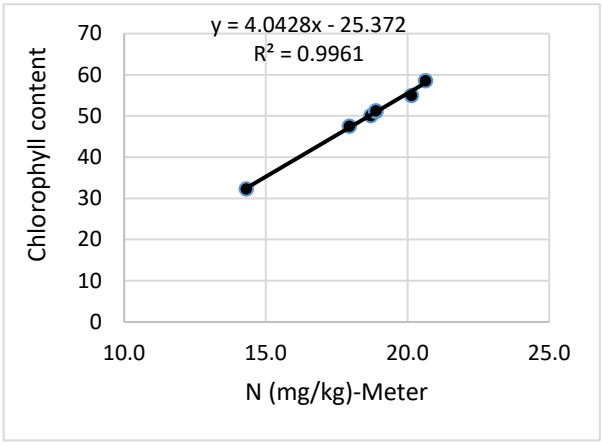


Fig. B: Correlation of Leaf N-Meter and Chlorophyll content-Meter

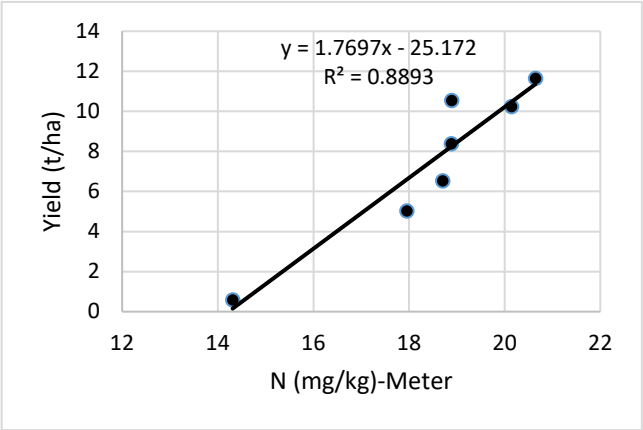


Fig. C: Correlation of Leaf N-Meter and yield

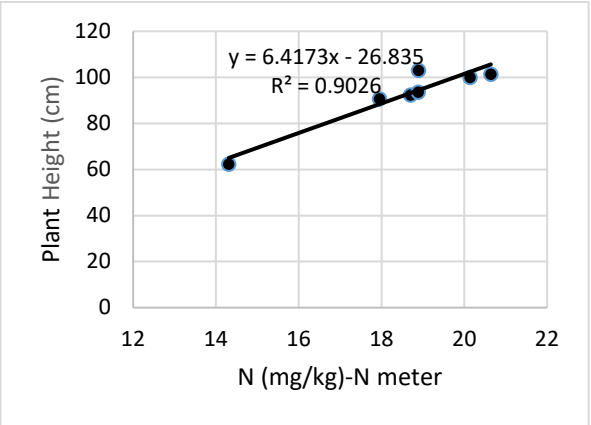


Fig. D: Correlation of Leaf N-Meter and plant height

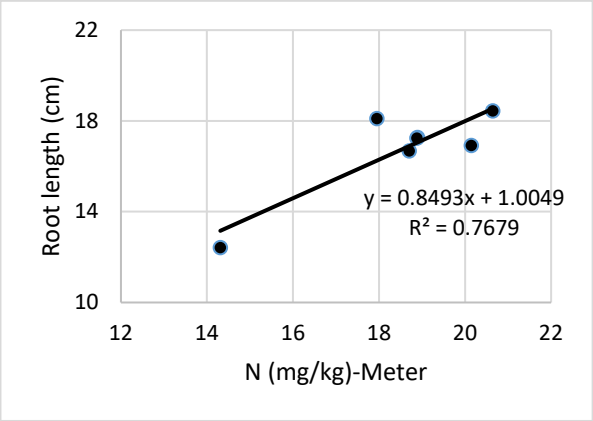


Fig. E: Correlation of Leaf N-Meter and root length

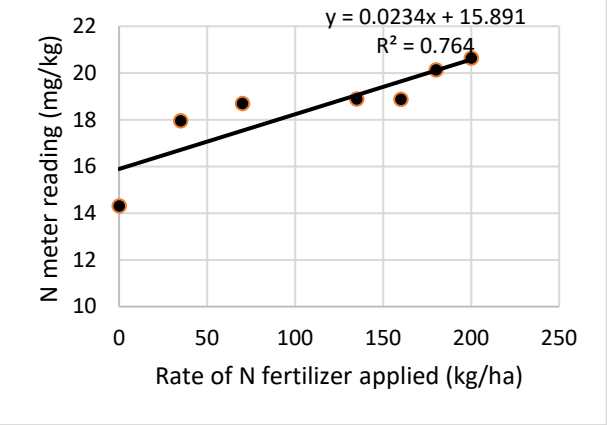


Fig. F: Correlation between the rate of N fertilizer applied and Leaf N-Meter

Conclusion

According to the results of the field experiment for capsicum the Leaf N meter reading positively correlated with several parameters measured such as chlorophyll contents, plant height, fruit yield and root length, and therefore this meter can be an effective substitute as an indicator for capsicum plant N%. Leaf N meter reading also correlated with n contents measured by laboratory method, therefore, and also could potentially replace the chemical leaf analysis for N (Fig. A). N fertilizer amount can be calculated using equations from Fig A and F.

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Attachment-24

Test report of evaluation of pruning as a field sanitation technology for vegetables and evaluation of disposal method for infected plant parts （WG3-P2）

Key Activity: Evaluation of the effect of field hygiene practice in pest and disease management in brinjal

Responsible Officer: Dr. Pradeepa Ranaweera

Location: Walawela AI Range, Matale District, Central Province

Objectives:

- To assess the impact of crop hygiene practices on the incidence of major pests in brinjal, particularly focusing on the brinjal shoot and fruit borer (*Leucinodes orbonalis*) and mites
- To evaluate the effect of crop hygiene on disease prevalence in brinjal, with a specific focus on reducing phomopsis blight
- To develop practical recommendations for farmers on implementing effective crop hygiene practices as a component of Integrated Pest Management (IPM) for brinjal.

Methodology:

The study was conducted to evaluate the effect of crop hygiene practices on fruit yield and pest damage in brinjal cultivation. Two treatments; (1) crop hygiene practice (removal of infested plant parts, dried leaves, lower leaves (25-30 cm from the base), and yellowed leaves, as well as weeding) and (2) farmer practice (removal damaged shoots due to shoot and fruit borer only,) were compared. Each treatment was replicated 4 times in plots with 25 plants each. The total number of fruits, percentage of damaged fruits, and number of damaged shoots were recorded over the cropping period. Data were analyzed using t-tests and chi-square tests in SPSS (version 25).

Results:

Results showed that the mean total number of fruits was significantly higher under farmer practice (290) than crop hygiene practice (224). However, the percentage of damaged fruits due to shoot and fruit borer was significantly lower in the crop hygiene treatment (57%) compared to farmer practice (68%). Damage reduction was particularly significant in border plants ($p=0.01$). Additionally, fewer damaged shoots were recorded under crop hygiene practice (283) than farmer practice (333), showing a significant difference ($\chi^2=4.058$, $p=0.04$).

Conclusion:

Crop hygiene practices effectively reduced fruit and shoot damage compared to standard farmer practices, particularly in border plants, although total fruit yield was slightly higher under farmer practice. Fewer damaged shoots were observed with crop hygiene, indicating improved plant health. The field hygiene practice is therefore recommended for inclusion in Integrated Pest Management (IPM) programs to enhance sustainable pest management.

Way Forward: Not any

Evaluation of crop hygiene, sanitary pruning, and proper disposal techniques on pest and disease development of Brinjal (*Solanum melongena*)

Background

Brinjal (*Solanum melongena*), is an important vegetable crop widely cultivated in tropical and subtropical regions due to its high nutritional value and economic importance (Daunay, 2008). However, brinjal production is often constrained by various pests and diseases, which significantly impact yield and crop quality. Among the most damaging pests of brinjal are the brinjal shoot and fruit borer (*Leucinodes orbonalis*) and sucking pests both of which cause substantial losses by damaging the plant directly and spreading plant pathogens (Srinivasan, 2009). Fungal diseases and bacterial wilt (*Ralstonia solanacearum*) further complicate production, reducing crop health and productivity (Sundin et al., 2020). To manage these pest and disease challenges, farmers often rely on chemical pesticides, which can lead to environmental contamination, health risks, and the development of pesticide-resistant pest populations (Pimentel & Edwards, 1982). As a result, there is an increasing interest in sustainable, non-chemical methods, such as crop hygiene, that minimize pest and disease incidence while reducing reliance on pesticides. Crop hygiene encompasses practices like the removal of infected plant debris, sanitary pruning, and proper disposal of diseased material, all of which can disrupt pest and pathogen life cycles, lower inoculum levels, and reduce the likelihood of infestation (Sharma et al., 2015). The efficacy of crop hygiene in tomato cultivation, that removing infected leaves and pruning has been shown to reduce fungal infections and improve fruit quality (Oerke, 2006). However, there is limited research specifically focused on the effectiveness of crop hygiene practices for managing pest and disease pressures in brinjal. Therefore, the need for sustainable production methods, evaluating crop hygiene as a pest and disease management strategy is essential. The impact of crop hygiene on pest and disease development in brinjal, will be provided valuable insights into sustainable practices that can benefit farmers and the environment.

Objectives

1.To assess the impact of crop hygiene practices on the incidence of major pests in brinjal, particularly focusing on the brinjal shoot and fruit borer (*Leucinodes orbonalis*) and mites

2. To evaluate the effect of crop hygiene on disease prevalence in brinjal, with a specific focus on reducing phomopsis blight

3.To develop practical recommendations for farmers on implementing effective crop hygiene practices as a component of Integrated Pest Management (IPM) for brinjal.

Study Area

The study was conducted in the Walawela and Yatawattha area of the Matale District, situated in Sri Lanka's Central Province (Figure 1). Matale is renowned for its diverse agricultural activities, particularly the cultivation of vegetables like brinjal that one of the main crops in the region. The research was conducted in two farmer fields located in the Walawela and Yatawattha.



Figure SEQ Figure * ARABIC 1: location 1- Walewela farmer practice plots (one month after planting, hybrid variety Bayoona)

Experimental Design

In this study, two treatments were compared as replicated study with approximately 25 plants per plot. Treatments were replicated four times.

Treatments

1. Crop hygienic practice (removal of infested leaves (plant parts), dried leaves, lower leaves, yellowed leaves and weeding)

2. Farmer practice

Methodology

Seedlings were transplanted on May 2, 2024, in Location 1 (Walewela) and on May 1, 2024, in Location 2 (Yatawatta). However, Location 2 was later discontinued due to a severe bacterial wilt infestation. The following data were recorded during the trial, where Treatment 1 involved the removal of infested plant parts, dried leaves, lower leaves (25-30 cm from the base), and yellowed leaves, as well as weeding, while Treatment 2 followed standard farmer practices (no removal of infested plant parts except damaged shoots due to shoot and fruit borer only, no removal of dried leaves, lower leaves (25-30 cm from the base), and yellowed leaves). Following data were recorded.

Assessments

1. Number of damaged shoots
2. Shoot and pod borer damaged/ undamaged fruit number and weight

3. Number of damaged fruit due to phomopsis blight (fungus)
4. Number of mites/thrips damaged fruits

* When removal of infested plant parts, the farmer used clorox mixture (Active Ingredients: Sodium Hypochlorite (7.5%), Other Ingredients (92.5%). (Total 100.0% yields 7.1% available chlorine) to disinfect the secateurs.

Proper disposal of plant parts

To maintain field hygiene, removed crop debris was transported to a designated area near the field (about 500 m) for burning. The farmer maintains this specific location to safely destroy infested plant material.

Application of pesticides

The farmer applied the same insecticides and miticides to control pest incidences, sometimes at different time intervals, but with the same number of applications.

Data Analyzing

The total number of fruits, damaged fruit percentage due to shoot and fruit borer, damaged fruit percentage due to shoot and fruit borer in middle plants and boarder plants in treatment 1 and 2 from 10 th September to 4 th October (4 harvests) were statistically analyzed using a T- test and number of damaged shoot removal from 8 th June to 27 th August 2024 in treatment 1 and 2 were analyzed using chi- square test. These analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 25.

Total number of fruits in different treatments

In the crop hygiene practice treatment, the mean total number of fruits harvested was 224, while under the farmer practice treatment, it was 290 (Table 1). Statistical analysis shows a significant difference between these two treatments, with a t-value of 0.4 and a p-value of 0.026, indicating that farmer practices resulted in a higher fruit yield compared to crop hygiene practices.

Table 1 : Mean total number of fruits harvested during 10 th September to 4 th October (4 harvests)

Treatments	Mean total number of fruits
1. Crop hygiene practice	224
2. Farmer practice	290
Significance	t(6) = 0.4, **p = 0.026**

Percentage (%) of total damaged fruits in different treatments

The table shows (Table 2) the percentage of total damaged fruit under two different treatments due to shoot and fruit borer. In the crop hygiene practice treatment, 57% of the fruits were damaged, whereas in the farmer practice treatment, 68% of the fruits were damaged. Statistical analysis indicates a significant difference between these treatments, with a t-value of 0.33 and a p-value of 0.003. This suggests that crop hygiene practices were more effective in reducing fruit damage compared to farmer practices.

Table 2: Percentage (%) of damaged fruits in different treatments

Treatments	Damaged fruit percentage (%)
1. Crop hygiene practice	57
2. Farmer practice	68
Significance	t(6) = 0.33, **p = 0.003**

Percentage (%) of damaged fruits in middle plants and border plants in different treatments

The table compares the percentage of damaged fruits in middle and border plants under two treatments: crop hygiene practice and farmer practice. For middle plants, the crop hygiene practice resulted in 57% damaged fruit, while farmer practice led to a slightly higher damage rate of 63% (Table 3). Statistical analysis for middle plants yielded a t-value of 0.203 and a p-value of 0.381, indicating no significant difference between the two treatments in this section. For border plants, the crop hygiene practice had 58% fruit damage, compared to 71% with farmer practice. Here, statistical analysis produced a t-value of 0.218 and a p-value of 0.01, suggesting a significant reduction in fruit damage with crop hygiene practices in border plants compared to farmer practices.

Table 3: Percentage (%) of damaged fruits in middle plants and border plants in different treatments

Treatments	Damaged fruit percentage (%) middle plants	Damaged fruit percentage (%) border plants
1. Crop hygiene practice	57	58
2. Farmer practice	63	71
Significance	t(6) = 0.203, **p = 0.381**	t(6)=0.218, **p = 0.01**

Number of damaged shoot removed in different treatments

The table presents the total number of damaged shoots removed between June 8 and August 27, 2024, under two different treatments. Under the crop hygiene practice treatment, 283 damaged shoots were removed, while under farmer practice, a higher total of 333 damaged shoots were removed. A chi-square test indicates a statistically significant difference between the treatments, with a chi-square value (χ^2) of 4.058, degrees of freedom (df) of 1, and a p-value of 0.04. This suggests that the farmer practice treatment required the removal of significantly more damaged shoots, indicating potentially higher shoot damage compared to the crop hygiene practice.

Table 4: Number of damaged shoot removed in different treatments

Treatments	Number of damaged shoot removed from 8 th June to 27 th August 2024
1. Crop hygiene practice	283
2. Farmer practice	333
Significance	χ^2 =4.058, df=1**, p = 0.04**

Conclusion

The findings indicate that crop hygiene practices generally resulted in lower rates of fruit and shoot damage compared to farmer practices. Specifically, regarding fruit yield, while farmer practices produced a higher total yield, crop hygiene practices significantly reduced the percentage of damaged fruits, especially in border plants. In terms of fruit damage, crop hygiene practices were associated with a lower overall percentage of damaged fruits, demonstrating a statistically significant reduction in damage to border plants. Additionally, fewer damaged shoots were removed under crop hygiene practices, suggesting these methods effectively reduce shoot damage compared to farmer practices. Overall, the results suggest that crop hygiene practices are beneficial in minimizing both fruit and shoot damage, potentially leading to improved crop health and quality. Therefore, crop hygiene practices are recommended for inclusion in an Integrated Pest Management (IPM) program to promote sustainable pest management.

This study aimed to observe the effects of crop hygiene practices on pest mites and Phomopsis blight; however, these pests were not observed in either treatment, so no conclusions could be drawn regarding their impact. Additionally, the hybrid variety Raveena performed poorly, with low flower production observed throughout the season, leading to reduced yields in both treatments. The plants were subjected to extreme weather conditions during the 2024 Yala season, including a strong dry period at planting, heavy rainfall post-planting, and another dry spell during harvesting.

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Key Activity: Evaluation of the effect of field hygiene practices in pest and disease management in guava

Responsible Officer: Dr. Chandrani Abhayagunasekara

Location: Pemaduwa AI range, Anuradhapuara District, North-Central Province

Objective:

- To evaluate and demonstrate the effect of field hygiene practices in pest/disease management

Methodology:

A field experiment was conducted to evaluate the impact of improved hygiene practices on guava production. The field was divided into two sections: control plot and treatment plot, each with 54 plants, separated by two guava rows serving as buffer zones and a shade net. The treatment plot received an integrated package of improved practices, including soil test-based fertilizer application, drip irrigation, standardized fruit bagging, regular weeding, and other recommended cultural practices, along with a live fence of sun hemp (*Crotalaria juncea*). Control plot was managed using conventional farmer practices and basin irrigation. Total yield, marketable yield, damage yield and fruit quality parameters were measured.

Results:

Treatment plot consistently outperformed control plot in all measured parameters. The total yield in treatment plots was 96.6 kg compared to 66.0 kg in control plots. Marketable yield was 84.0 kg in treatment versus 48.0 kg in control. The proportion of Grade I fruits was significantly higher in treatment plot (72.0 kg) compared to control (5.0 kg), while Grade II fruits were lower (12.0 kg vs. 43.0 kg). Damaged yield was also reduced in treatment plot (12.6 kg vs. 18.0 kg). Consequently, income from treatment plot was substantially higher (Rs. 37,800) than control plot (Rs. 15,275). Fruit quality parameters such as fruit length and diameter were improved in the treatment plot.

Conclusion :

The study demonstrates that field sanitation practice techniques with locally adapted management practices can substantially boost both productivity and profitability in guava orchards. Therefore, widespread adoption of these improved practices is recommended for sustainable and high-quality and profitability guava production.

Way Forward: Not any

WG3

Field hygiene practices for pest and disease management of Guava (*Psidium guajava* L.)



A.V.C. Abhayagunasekara (DD-R- FCRDS, Gannoruwa)

Nilantha Upul (SMO)

R.J.M.C. Rajakaruna (T/A)

U.A.B.G. Chamara Prabath Karunarathna (farmer)

Justification

Importance

Guava (*Psidium guajava* L.) is one of the most important fruit crops in tropical and subtropical regions of the world. It is a highly perishable fruit and is, therefore, more susceptible to postharvest diseases. Once the skin of guava becomes edible, the presence of pathogenic injuries, even a small spot, can compromise fruit quality and make the product unfit for marketing.

Field sanitation

The health status of present guava orchards is alarming and poor health leads to early termination of the plant's productive life leading to the spread of pests and disease incidents rapidly and widely. Therefore the use of pesticide application has been increased creating a serious adverse effect for consumers. Field sanitation is important in terms of reducing the amount of pesticide application. Faulty nurseries, defective management, poor cultural practices, and other biotic and abiotic problems are the major factors that collapse field hygiene. Biotic factors include insects and diseases caused by pathogens like fungi, bacteria, root-knot nematodes, and viruses, particularly in guava. *Phytophthora*, *Fusarium* sp, etc. Maintaining the field with optimum sanitation levels, practicing appropriate pruning, and safe waste disposal methods are effective cultural practices that improve field hygiene thereby managing/preventing pests and diseases. Therefore, sustainable field hygiene practices minimize the incidence of the growth of pest and disease outbreaks leading to the minimum requirement of pesticide applications.

Some key factors to be considered for the sustainable existence of guava cultivation,

Nursery sanitation in Guava

Proper growth and maintenance of the cultivation, the main prerequisite factor is healthy and sanitized plant materials. Because, guava is facing serious decline issues related to soil-borne problems like *Phytophthora, Fusarium,* and in some cases nematodes.

Plant vigor

Maintaining the crop with high vigor will help to avoid being susceptible to pests and diseases by preparing plants for higher yield and quality harvest, thereby, it will increase the farmer's profit. Therefore it is important to supply balanced fertilizer to increase plant vigor, hence, guava utilizes a higher amount of nutrients especially NPK from the soil. It is a general observation that limited/over-nutrient supply is one of the major impediments to efficient plant growth and development. The knowledge of nutrient composition, structure, and texture of media components could be useful for formulating a better standard plant growth media.

Fertilizing

The concept of integrated nutrient supply involving organic, inorganic, and biofertilizers has developed to meet the growing need for nutrients under intensive cultivation. The basic goal of an integrated plant nutrient management system is maintaining or improving soil fertility to an optimum level for sustaining the desired crop productivity. Guava is very hardy to soil and agro-

climatic conditions but provides a good response for manuring organics and chemical fertilizers in terms of increasing the yield, but also improving the fruit quality in guava.
Further, the indiscriminate use of chemical fertilizers aimed at yield maximization has given rise to several problems associated with soil health, crop management, and the environment. Therefore, it needs to supply essential nutrients only after a soil test. It will facilitate an eco-friendly, sustaining method for increasing crop productivity.

Irrigation

On timely and efficient irrigation water use and reducing leaching of nutrients from the root zone. These two are the important objectives of irrigated agriculture, which face pressure to reduce environmental impacts and increase water use efficiency.
Drip irrigation is used more often for orchard crops than for field crops. and is a means of increasing the efficiency of irrigation; primarily because the spacing between drippers and laterals is larger consequently system cost per hectare is less. Soil texture is of primary importance in designing drip irrigation and directly affects the number and placement of drippers.

Pruning

Guava fruit harvest peaks can deviate from prevailing weather conditions and cultural practices because flowers produce new growth. Defoliation, pruning, and other cultural practices such as Irrigation and fertilization can stimulate new growth and influence fruiting in guava. Further, it increases yield, fruit size, and qualitative attributes of guava as a result of pruning, This improvement is attributed to better light penetration into fruit-bearing portions of the tree canopy. Determination of the pruning effects on light penetration within guava trees may enable canopy designing for improved fruit yield and quality.

Bagging and grading

Fruit fly infestations adversely affect the guava crop, resulting in significant economic losses. Bagging techniques can protect fruits from pests and eliminate pesticide use, thus improving fruit quality. Harvested fruits are graded according to their size and appearance, as well as being free of damage from mechanical, pest, and disease.

Materials and Methods

The field is divided into 2 sections, ‘control’ and ‘treatment plots’ with 54 plants from each. Two guava rows separated each plot as ‘buffer zones’, separated with a shade net (Figure 4). An improved package of cultural practices was introduced to treatment plots and farmers used management practices applied to control plots. Further, a live fence with sun hemp (*Crotalaria juncea*) was established around the treatment plot.

Fertilizer application: After the result of an initial soil test, fertilizer application was done accordingly.

Irrigation: The basin irrigation method used in control while a drip irrigation system established for treatment.

Weeding and other cultural practices were done according to the developed package.

Bagging: Introduced standardized fruit bags/covers for guava for use in the treatment plot.

Data recorded

Yield data: The number of fruit plucking and the following physiological data were recorded in treatment and control plots. The number of fruits, fruit weight (g), girth (cm), and length (cm) of fruit in each plucking (Annexed 1)
As quality data, the brix value of the fruit was recorded.

Results and Discussion

i. Fertilizer application:

Initial soil nutrient level was checked before establish the trial.

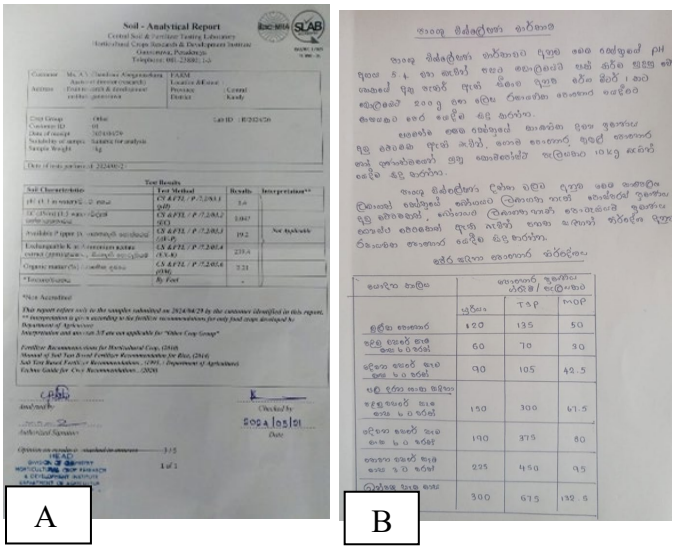


Figure 01. A- Result of soil test: B: Recommendation from experts

According to the result of an initial soil test, they recommended adding dolomite (200 g/ m^2) to reduce the acidic nature of the soil pH level (5.4) and recommended adding organic manure (10 Kg/plant) due to the low level of organic matter content. Further, the available phosphorous level was low while the medium level of potassium content. A new recommendation was provided adjusting to balance deficiencies of that field. Therefore, it can avoid the overuse of fertilizers while enriching the organic matter content of the soil.

ii. Field sanitation



Figure 2. Field view at the initial stage

All diseased, damaged, and infected plant parts remained in the tree as well as the surroundings of the field.



Figure 3. Field layout. Control and treatment plots separated with a shade net.
A. Treatment block. B. Control block

iii. Establish a 'buffer zone'



Figure 4. Field layout. Control and treatment plots separated with a 'buffer zone'

iv. Protect from surroundings



Figure 5. Protect from surrounding cultivations

The treatment block is covered with a net to avoid entering pests and pathogens from nearby, old cultivations,

Treatment

v. Establish a live fence



Figure 6. A live fence with sun hemp (*Crotalaria juncea*) around the treatment plot.

vi. Keep personal hygiene



Figure 7. Instruments used for maintaining personal hygiene

Used a bag to carry instruments, disinfection solutions, and a bucket to collect derbies of individual plants when every field visit the farmer.

vii. Use sanitized instruments to do maintenance practices at the field



Figure 8. The method of sanitizing instruments before every use

viii. Weeding



Figure 9: Weeding

Keep the field weed-free to prevent pest and disease spread and to destroy the host plant of pests.

ix. Instrument used for pruning



Figure 10. Instrument used for pruning

A. Pruning saw B. Pruning Looper C. Secateurs

The tools used in pruning differ with the size of the stem, and branches to prune. A pruning saw is suitable for pruning a large guava plant to a manageable height. Loppers are used for cutting medium-sized branches and secateurs are suitable for cutting off smaller branches.

It is important to remember to disinfect the tools after every use in the field to avoid the spreading of diseases and pests from plant to plant.

x. Pruning

Pruning increases the ventilation and sunlight penetration into the plant canopy. Therefore, it will destroy the environment for the growth and spread of pathogens. Hence, pests and diseases are controlled automatically.

Out of available tree pruning methods, open-center head pruning is best suited for guava. The Figure 11

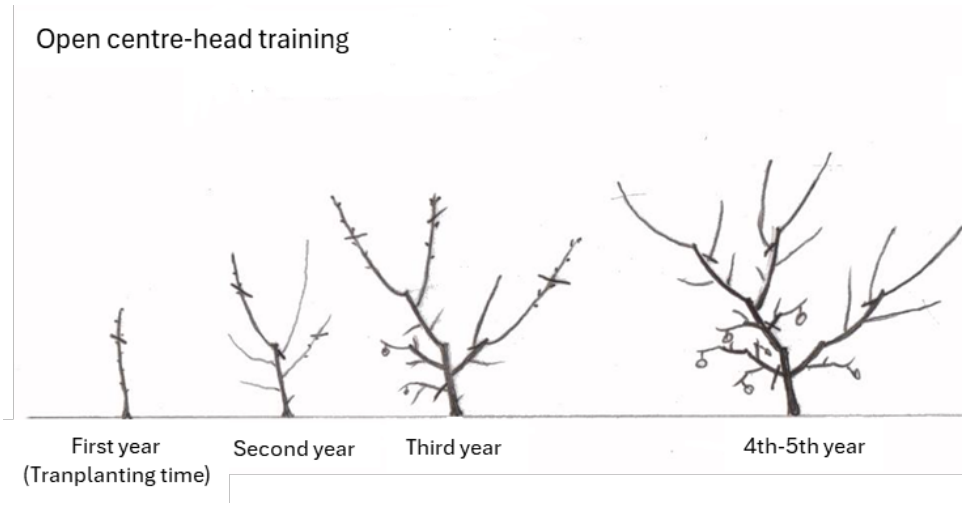


Figure 11. The steps of open center head pruning method



Figure 12. A- Before pruning, B- three weeks after pruning, C-final view after pruning

About three weeks after the first pruning, a light pruning cycle should be done; hence, there are many newly emerged branches. It helps to make the canopy structure well.

xi. Post-pruning care



Figure 13: Wound sealer applied to pruned surfaces of the tree

The wound that created by pruning makes an extra stress to the plant due to high vaporization of water from the plant, and then it makes an open path to enter pest and diseases. Therefore, it is important to heal that wound/ cut surface by applying a solution with fungicide or available thick liquid on all cut surfaces.

xii. Training



Figure 14. Training of guava tree.

Training the branches of the tree helps to improve sunlight penetration and increase the ventilation of the canopy using a peg and rope can train the branches easily.

xiii. Fertilizer application



Figure 15. Fertilizing of inorganic and organic fertilizer

Just after pruning, the plant gets stressed and needs to recover. It is important to ere-energize plants by supplying fertilizer. Before applying fertilizer, an initial soil test is done to avoid misuse of fertilizer. The required amount of fertilizers supplied, according to the soil test, with minimizing wasting fertilizer. In the case of organic fertilizer, approximately ten kilos of organic fertilizer applied to one hectare of the field.

When applying fertilizer, a small (shallow depth) channel is prepared to parallel the canopy margin and mix well with the soil. Applying fertilizer just adjacent to the stem is useless, hence absorbable root hairs are present only along the canopy margin. Further, it should be careful when handling tools such as hoes, it is important to pay attention not to damage roots as guava is highly susceptible to root-knot nematodes.

xiv. Irrigation



Figure 16. Irrigation -Drip irrigation

A drip irrigation system supplies the required amount of water to the root zone to maintain the soil in field capacity.

xv. Frequent observation of the field



Figure 17. Frequent field observation and prompt action on problem-solving

xvi. Proper waste disposal from the field



Figure 18. Practiced waste disposal methods. A- Pit for collecting and burning derbies
B- Burning derbies

xvii. Fruit thinning

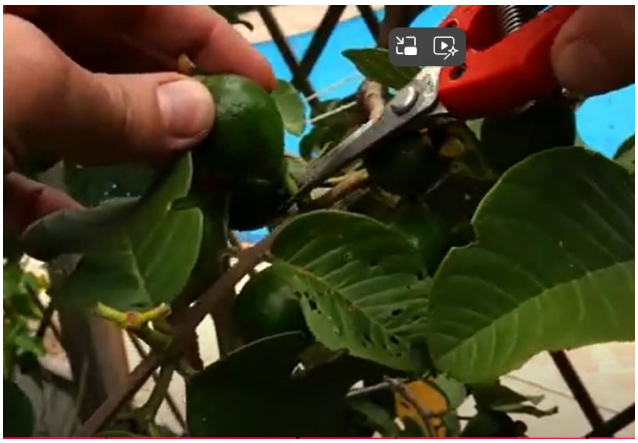


Figure 19. Fruit thinning

Sometimes, guava fruit buds arise as clusters with 2-3 pods. In that case, it is impossible to put two or more bags for each fruit in a cluster. As well, it is not possible to put the two fruits together in one bag. Therefore, it is better to remove additional fruits from the cluster and to get a high-quality yield.

xviii. Bagging



Figure 20. Fruit bagging

A data recording system is to be keep by farmers as their own way, along with fruit bagging. It helps to harvest fruit nearly 3 months after applying the fruit covers. In commercial fruit bags,

there are letters at the bottom of the cover and can mark them to identify the date of bagging, so no need to open the bag until the date of harvesting.

xix. Selective harvesting



Figure 21. Selective harvesting according to the maturity days





Figure 22. Before (upper -control) and after (down - treatment plot) view of the field that applied the hygiene practices at the harvesting stage

Total weight

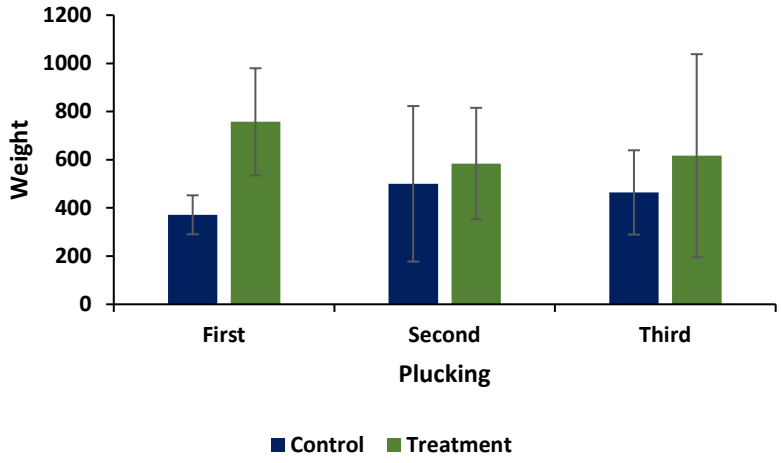


Figure 23. The variation of fruit weight between the treatment and control on consecutive fruit plucking.

Fruit weight was higher than control at each pod plucking time.

Fruit quality

The quality of pods was higher in treatment than control in every lucking time due to their higher size (higher fruit length and diameter).

Grading



Figure 24. Fruits grade according to their size, appearance and free of damages

Net income

The total marketable yield from the treatment plot (84.0 Kg) was higher than the control (40.0 Kg) at the second plucking. Out of the total yield of the treatment plot (96.6 K), which included grade 1 – 72.0 Kg and 12.0 Kg from grade II. The amount of unmarketable harvest was 12.6 Kg. At that time, the total yield of the control plot was 66.0 kg consisting of grade I - 5 Kg, grade II - 43 Kg, and 18 Kg of damaged fruits.

The price of one Kg of grade I guava was Rs. 450 -500.00 and grade II was Rs. 300.00.

Achievements



A TV program on field sanitation of guava telecasted in “Govibimata Arunalu” program on Jathika Rupavahiniya on 2024.11.03. Further, a tik-tok video clip was prepared for using farmers' training.

Conclusion

Applying field hygiene practices can increase the yield and number of harvesting times. The appearance and quality of fruit increased with decreasing incidents of pests and diseases. Net profit increased due to reducing the costs for controlling pests and diseases while receiving a higher price for the harvest than control.

After pruning, continuous flushing occurs and can get year-round bearing with new flushes and flowering.

Annexed 01.

DATA SHEET
Farmer Name and Address:
Date:

Data records on		**Amount (wgt or Number)**	**Frequency of removal (daily, twice a day etc.)**
Above ground	1. Removal of infected fruits, plant parts and dried plant parts 2. Fruit thinning 3. Bagging or covering fruits at an early stage of fruit 4. Establishment of pheromone traps/ protein traps		
On the ground	1. collecting and burring of infected fruits and plant parts, leaves on the ground 2. Removal of weed and fallow plants at surroundings 3. Pruning of infected plants for improving plant structure, lightning and ventilation inside the canopy		
Other data	1. Severity of pest and disease incidences 2. Treatments for control (time and interval, type of chemical applied, and the cost)		
Improvement of plant vigor	1. Frequency of applying fertilizer and watering		

EvaluationEvaluation Method

Cliteria		**Pre application of the technology**	**Post application of the technology**
1. Yield	1. Number of infested fruits 2. Amount of gross harvest		
2. Management	1. Interval and frequency of weeding		
3. Lateral distribution of knowledge	1. Number of adapted farmers		

	2. Identification of problems and application treatment at the correct time, dosage and interval
Expenditure	1. Expenditure on chemicals and fertilizers 2. Severity and frequency of problem arisen

Attachment-25

Test report of promoting of non-chemical pest and disease control methods (Yellow lighting bulb) （WG3-P3）

Key Activity: Promoting non-chemical pest and disease control methods - special yellow light application to repel moths in brinjal

Responsible Officer: Dr. K.M.D.W. Prabath Nishantha

Location: Nawakkaduwa AI Range, Puttalam District, North Western Province

Objectives:

- To reduce the pesticides usage on pest controlling on vegetable production.
- Reduce the pesticide residues on marketed products

Methodology:
The study was conducted to evaluate the effectiveness of yellow light as a biological control method against adult moths responsible for damaging brinjal, mainly brinjal shoot and pod borer. Two large plots (1000 m^2 each) were established, one as the treatment (yellow bulb) plot and the other as a control using variety 'Raveena' in a farmer field. Each plot was divided into six subplots for replication. Special yellow light system was installed at planting in the treatment plot with five bulbs which was later increased to nine bulbs 2 months later to ensure sufficient coverage and effective pest suppression. Number of pest damaged plants and crop yield were collected from 20 plants per subplot.

Results:
In the treated plots, brinjal production was substantially higher, with a total yield of 1,176 kg and a marketable yield of 1,116 kg, representing only 5.1% damage, whereas the control plots produced 175 kg total yield and 144 kg marketable yield, with 17% damage. The trials demonstrated a substantial reduction in pest-related damage, with average crop losses decreasing from 50% to 10% in fields treated with yellow bulbs. Furthermore, the frequency of chemical pesticide applications declined by more than 60%, resulting in notable cost savings and environmental benefits.

Economically, the yellow bulb treatment proved highly beneficial: treated plots generated a total income of Rs. 162,920 and a net profit of Rs. 25,920, while control plots, despite a lower total income of Rs. 137,000, incurred higher costs and resulted in a loss of Rs. –193,760. Additionally, the yellow bulb application reduced crop losses from 50% to 10% and decreased pesticide usage by more than 60%, highlighting both economic and environmental advantages over the untreated control.

Conclusion
The use of yellow bulbs is an eco-friendly, low-cost, and effective pest management strategy that reduces moth activity, suppresses pest populations, enhances beneficial parasitoid activity, and significantly improves crop yield and profitability. Incorporating yellow bulbs into Integrated Pest Management (IPM) programs can substantially reduce dependence on chemical pesticides and promote sustainable brinjal production.

Way Forward: Not any

Yellow Bulb Installation – Kalpitiya Brinjal Field

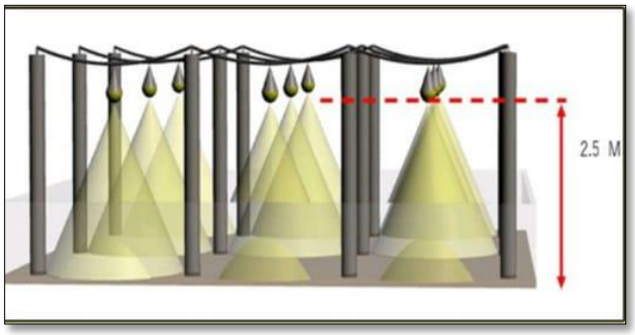
- **Introduction**

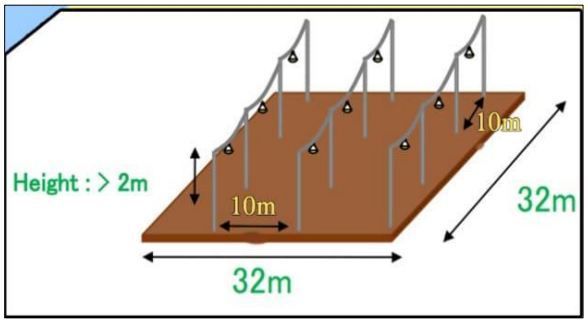
Brinjal cultivation in Sri Lanka faces significant challenges from infestations of the Brinjal Shoot and Fruit Borer (*Leucinodes orbonalis*), which cause severe crop damage. Traditional control methods, including chemical insecticides and pheromone traps, have had limited success in managing these pests. Since 2018, the Horticultural Crops Research and Development Institute (HORDI) in Gannoruwa, in collaboration with private sector partners, has been exploring innovative solutions. Among these, yellow LED moth repellent bulbs have shown great promise in repelling night moths and reducing pest activity. Field demonstrations across the country have validated this eco-friendly technology as an effective and sustainable approach to pest management in brinjal farming. The use of yellow LED moth repellent bulbs represents a significant advancement in the integrated pest management of brinjal cultivation. This technology effectively deters night moths, by inhibiting their behavior when the bulbs are activated at night. The method is particularly advantageous for small-scale fields, providing a sustainable alternative to chemical-based pest control.





- **Method of installation**
    - Apply yellow bulbs at the distance of 7-10 m
    - Apply 2.5 m above the crop
    - If required bulbs can be installed around the field











- **Field Installation**
  - Location – Kalpitiya Nawakkadu Brinjal Field
  - Date of plant establishment – 2024/06/06

Installing yellow bulb –

at first 5 yellow bulbs were applied in the field - 2024/06/06

then 9 bulbs were applied in the field – 2024/08/06

  - Number of replicates – 6





- **Data collection**
    - Brinjal weight at harvesting
    - No of pest related damaged plants
    - Market price

- **Results**

1. **Brinjal yield (Kg)**

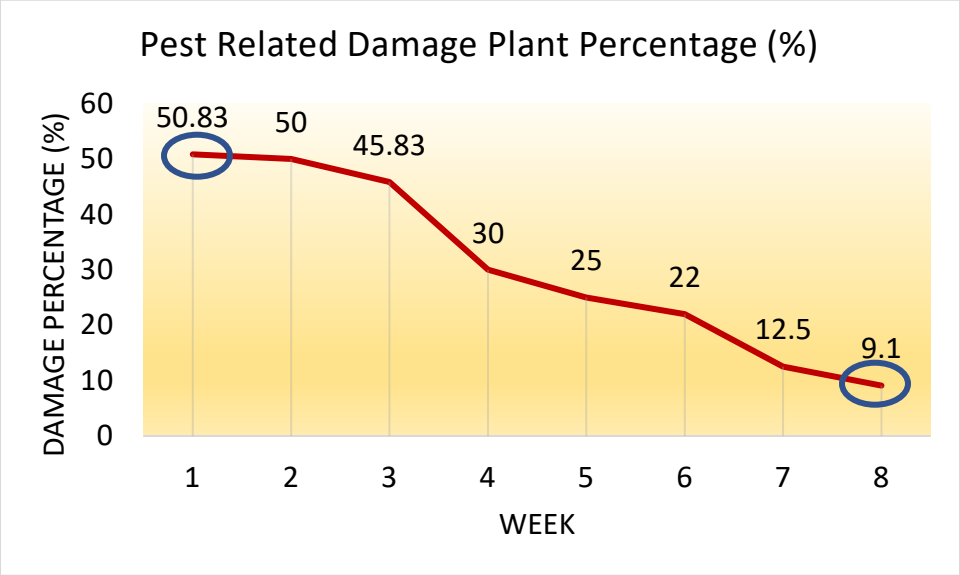
	Yield (Kg)			Damage yield %
	Total Yield	Damage Yield	Marketable Yield	
Yellow bulb applied plot	**1,176**	**60**	**1,116**	**5.10%**
Control Plot	**175**	**31**	**144**	**17%**



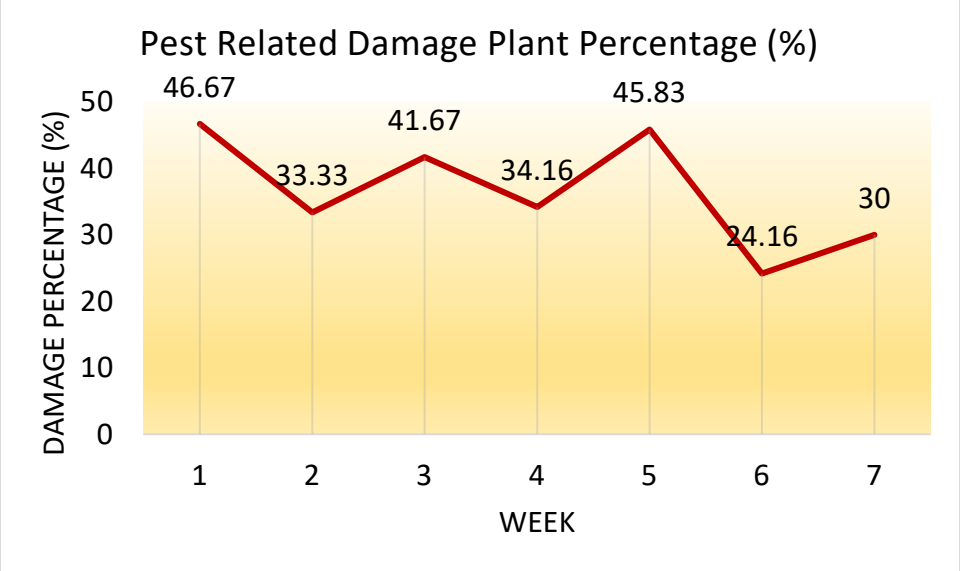


2. **Pest Related Damage Plant Percentage (%)**

In yellow bulb applied field



In control plot



No pf replicates – 6

No of plants in a replicate – 20

Pest damages on the newly developed leaves were examined from each plant weekly. Then the damage percentage were calculated using following equation.

Pest related damaged plant percentage = $\frac{No.of\ damaged\ plants}{No\ of\ total\ plants} \times 100$

The trials showed significant reductions in pest-related damage, with crop losses decreasing from 50% to 10% on average in yellow bulb applied field. Additionally, the frequency of chemical pesticide applications was reduced by over 60%, contributing to cost savings and environmental benefits.

3. Total yield (Kg) and total income (Rs.)

Yellow bulb applied field

Day	Brinjal Yield (Kg)	Price per Kg (Rs.)	Total Income (Rs.)
First Day (grade 1)	64	200	12,800
(grade 2)	80	20	1,600
Second Day (grade 1)	180	130	23,400
Third Day (grade 1)	172	170	29,240
(grade 2)	32	20	640
Fourth Day (grade 1)	470	170	79,900
(grade 2)	118	130	15,340
	1,116		**162,920**

Controlled field

Day	Brinjal Yield (Kg)	Price per Kg (Rs.)	Total Income (Rs.)
First Day	12	150	1,800
Second Day	17	170	2,890
Third Day	43	170	7,310
Fourth Day	72	170	12,240
	144		**24,240**

4. Cost-Benefit Analysis

The initial setup cost of this technology is approximately 1.37 Lakh Rs. per 1,000 m², with a lifespan of 5 years (Table 2).

Table 01: Cost encored for the brinjal cultivation with pesticides application during the period of July to September, 2024

Description	**Total Cost (Rs) /Season**
Land preparation	15,000.00
Cow dung	15,000.00
Chemical fertilizer	15,000.00
Seeds	8,000.00
Fungicide	30,000.00
Pesticide	100,000.00
Labor	30,000.00
Miscellaneous	20,000.00
Total cost	**218,000.00**

Table 02: Cost encored for the brinjal cultivation with yellow bulb application during the period of July to September, 2024

Descripsion	**Cost /season**
Land preparation	15,000.00
Cow dung	15,000.00
Chemical fertilizer	15,000.00
Seeds	8,000.00
Fungicide	30,000.00
* Yellow bulb set	9,000.00
Labor	30,000.00
miscellaneous	30,000.00
Total cost	**137,000.00**

* Warranty has given for five years. Therefore, total cost for nine bulbs divided by ten considering two seasons per year.

This long-term investment is offset by substantial savings due to decreased pesticide usage, improved crop yields, and enhanced marketable produce.

Farmers reported a return on investment within two cultivation cycles.

Key Activity: Promoting non-chemical pest and disease control methods - special yellow light application to repel moths in cabbage

Responsible Officer : Dr. K.M.D.W. Prabath Nishantha

Location: Boralanda AI Range, Badulla District, Uwa Province

Objective:

- To reduce the pesticides usage on pest controlling on vegetable production
- Reduce the pesticide residues on marketed products

Methodology:

The study was conducted to evaluate the effectiveness of yellow bulbs as a biological control method against adult moths responsible for damaging cabbage, particularly cabbage leaf-eating caterpillars and the diamondback moth (*Plutella xylostella*). Two large plots (>1000 m² each) were established; one as the treatment plot and the other as the control plot. Each plot was divided into four subplots for replication. Special yellow light system was installed with 9 bulbs was installed in the treatment plot. Insect count, yield, yield loss due to pest attack and cost analysis were determined.

Result:

The population of diamondback moths (DBM) increased in control plots but declined in yellow bulb–treated plots, where the activity of the natural enemy *Cotesia plutellae* was notably higher. The average plant weight after removing mature leaves was similar across treatments (1.19 kg in treated vs. 1.17 kg in control), but leaf damage was considerably lower in yellow bulb plots, confirming effective pest suppression. In the treated plots, total cabbage production was substantially higher, with a total yield of 2,071 kg compared to 1,176 kg in the control plots.

Economic analysis showed that treated plots recorded higher returns and lower costs than control plots. In brinjal, the yellow bulb treatment generated a net profit of Rs. 263,110, while control plots incurred a loss of Rs. –30,615. Similarly, in cabbage, the treated plots achieved higher income (Rs. 333,235) with lower cultivation cost (Rs. 70,125) compared to control plots (Rs. 60,510 incomes; Rs. 91,125 cost).

Conclusion:

The use of yellow bulbs is an eco-friendly, low-cost, and effective pest management strategy that reduces moth activity, suppresses pest populations, enhances beneficial parasitoid activity, and significantly improves crop yield and profitability. Incorporating yellow bulbs into Integrated Pest Management (IPM) programs can substantially reduce dependence on chemical pesticides and promote sustainable cabbage production.

Way Forward: Not any

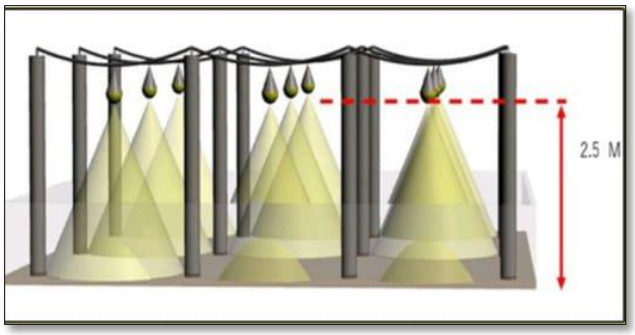
Yellow Bulb Installation – Boralanda Cabbage Field

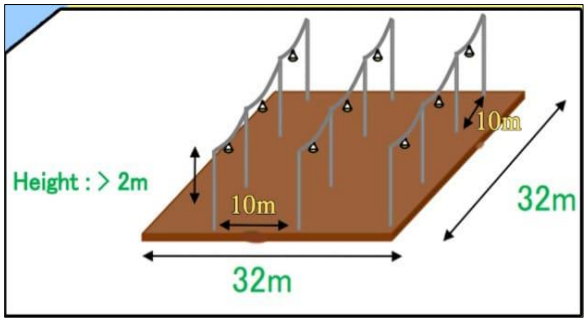
- **Introduction**
  Yellow bulbs serve as an effective biological control method against adult moths that damage horticultural crops. This method works by reducing the nocturnal activity of adult moths, preventing their ability to fly, and consequently controlling their mating and egg-laying behavior. Targeted pests are cabbage leaf eating caterpillars, pod borer in brinjal and okra. It attracts beneficial biocontrol agents of DBM, *Cotesia plutellae*. Recommended amount for the application is 9 yellow bulbs per ¼ acre. This method is particularly useful in integrated pest management (IPM) strategies, reducing the dependence on chemical pesticides and promoting sustainable agricultural practices.






- **Metod of installation**
  - Apply yellow bulbs at the distance of 7-10 m
  - Apply 2.5 m above the crop
  - If required bulbs can be installed around the field









- **Field Installation**
  - Location – Boralanda Cabbage Field
  - Date of plant establishment – 2024/05/16

    installing yellow bulb - 2024/05/16

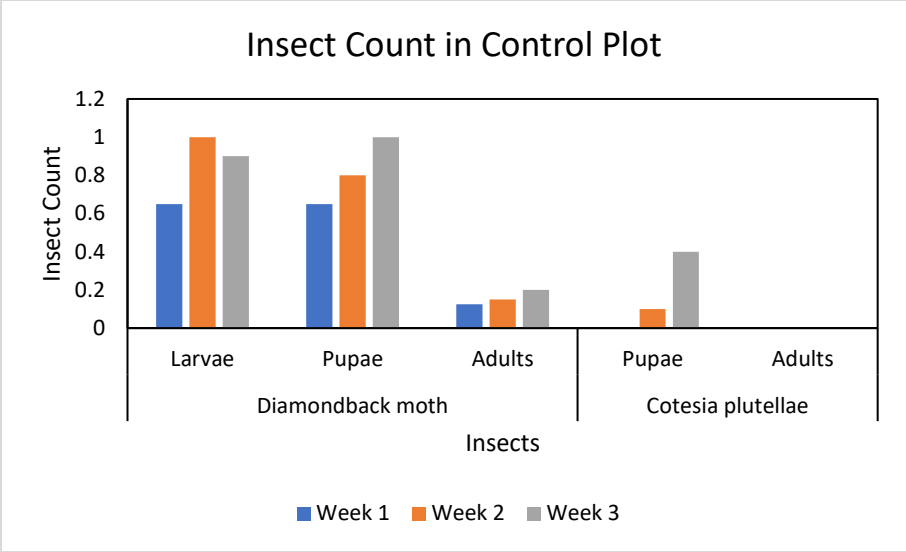
  - Number of replicates – 4




- **Data collection**
  - Insect count up to 3 weeks in yellow bulb installed plots and in the control plot
  - Cabbage weight at harvesting
  - Cabbage weight after removing damaged leaves (Market weight)
  - Insect related damage %
  - Yield loss
  - Market price

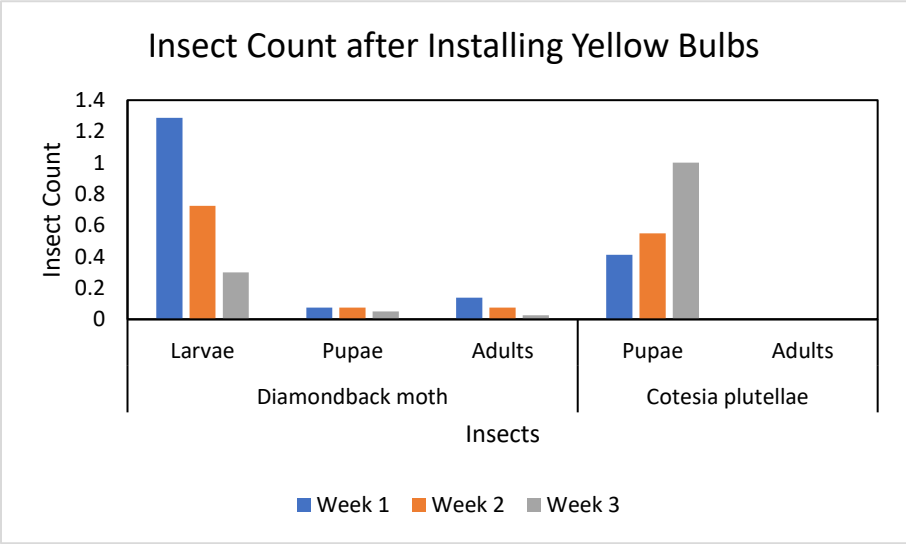
- **Results**

1. **Insect count of first three weeks in control plot**



In control plot the amount of diamond backed moth (DBM) gradually increase with time. Number of Larvae, pupae and adults increase in the field. It's naturally occurring biological control agent *Cotesia plutellae* is lower in the plot.

2. **Insect count of first three weeks after installing yellow bulbs**



In yellow bulb installed plot the amount of diamond backed moth (DBM) gradually decrease with time. Number of Larvae, pupae and adults decrease in the field. It's naturally occurring biological control agent *Cotesia plutellae* is higher in the plot. It shows that yellow bulbs successfully repelled DBM and attract *Cotesia plutellae.*

3. Average Weight of Cabbage Plant (Kg)

	Average weight of cabbage plant (Kg)		
	Plant weight with mature leaves	**Weight of mature leaves**	**Weight after removing mature leaves**
Yellow bulb applied plot	**1.55**	**0.36**	**1.19**
Control Plot	**1.65**	**0.48**	**1.17**

No pf replicates – 4

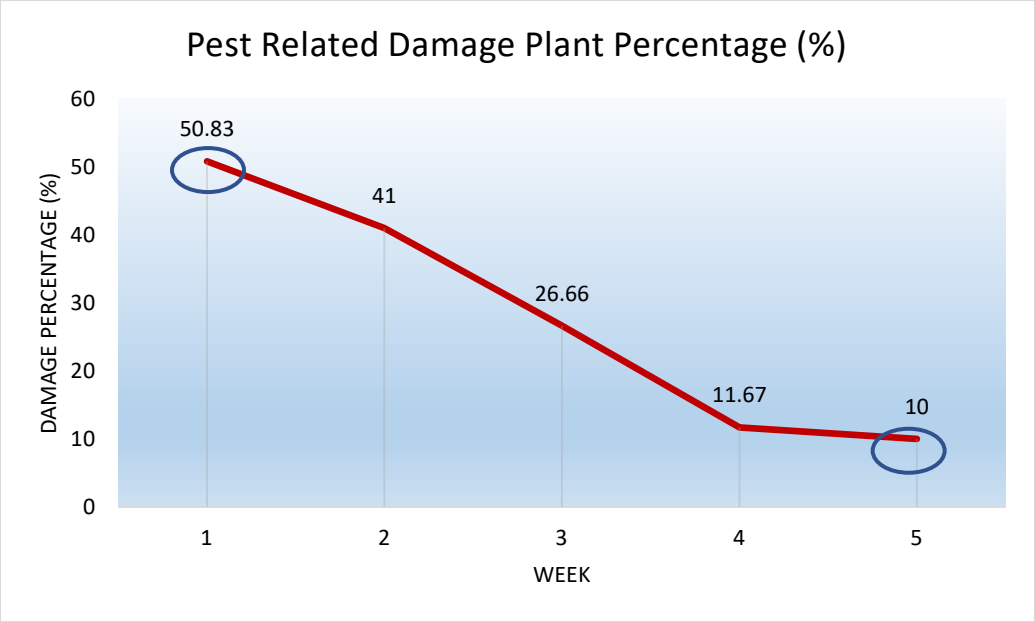
No of plants in a replicate – 10

First the average weight of cabbage plants was measured with mature leaves. Then the average weight was measured after removing mature leaves.

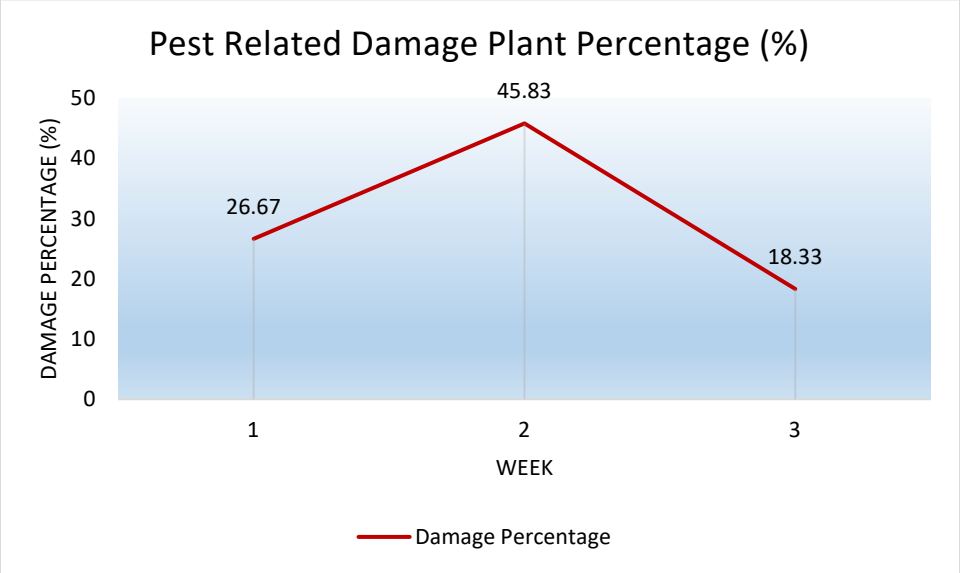


4. **Pest Related Damage Plant Percentage (%)**

In yellow bulb applied field



In control plot



No pf replicates – 4

No of plants in a replicate – 30

Pest damages on the newly developed leaves were examined from each plant weekly. Then the damage percentage were calculated using following equation.

Pest related damaged plant percentage = $\frac{No.of\ damaged\ plants}{No\ of\ total\ plants} \times 100$

The trials showed significant reductions in pest-related damage, with crop losses decreasing from 50% to 10% on average in yellow bulb applied field. Additionally, the frequency of chemical pesticide applications was reduced by over 60%, contributing to cost savings and environmental benefits.

5. **Total yield (Kg) and total income (Rs.)**

Yellow bulb applied field

Day	Cabbage Yield (Kg)	Price per Kg (Rs.)	Total Income (Rs.)
First Day	1,339	145	194,155
Second Day	682	190	129,580
	50	190	9,500
	2,071		**333,235**

Controlled field

Day	Cabbage Yield (Kg)	Price per Kg (Rs.)	Total Income (Rs.)
First Day	288	80	23,040
Second Day - 1	40	52	2,080
Second Day - 2	401	47	18,847
Third Day	244	47	11,468
Fourth Day	203	25	5,075
	1,176		**60,510**



7. Cost-Benefit Analysis

The initial setup cost of this technology is approximately 1 Lakh Rs. per 1,000 m², with a lifespan of 5 years.

This long-term investment is offset by substantial savings due to decreased pesticide usage, improved crop yields, and enhanced marketable produce.

Farmers reported a return on investment within two cultivation cycles.

Table 01: Cost encored for the cabbage cultivation with pesticides application during the period of July to September, 2024

Description	Cost (Rs)	Total (Rs)
Land preparation	7,000.00	7,000.00
Planting materials - Cabbage seeds	12,000.00	12,000.00
Fertilizer - Urea - Foliar Spray-Sara Pohora - Fertilizer-Mix - Foliar Spray-Green AV	7,590.00 4,460.00 8,120.00 980.00	21,150.00
Fuel - Fuel for Spray Machine - Fuel for Water Motor	1,600.00 700.00	2,300.00
Labor Cost	13,400.00	13,400.00
Pesticide - Evisect - Radiant - Avant - Corejen	12,500.00 7,500.00 8000.00 2000.00	30,000.00
Fungicide - Daconil + Mancozeb	1,375.00	1,375.00
Harvesting	3,900.00	3,900.00
		91,125.00

Table 02: Cost encored for the cabbage cultivation with yellow bulb application during the period of July to September, 2024

Description	Cost (Rs)	Total (Rs)
Land preparation	7,000.00	7,000.00
Planting materials - Cabbage seeds	12,000.00	12,000.00

Fertilizer		
- Urea	7,590.00	
- Foliar Spray-Sara Pohora	4,460.00	21,150.00
- Fertilizer-Mix	8,120.00	
- Foliar Spray-Green AV	980.00	
Fuel		
- Fuel for Spray Machine	1,600.00	
- Fuel for Water Motor	700.00	2,300.00
Labor Cost	13,400.00	13,400.00
Yellow bulb set	9,000.00	9,000.00
Fungicide		
- Daconil + Mancozeb	1,375.00	1,375.00
Harvesting	3,900.00	3,900.00
		70,125.00

Attachment-26

Training report in a third country training (Thai training)

Thai Training Report

1.1 Training Program

Thai training program is shown in the Attachemnt-1 and its summary is shown in the table below.

Table 1 The summary of Thai training program

Objective	To obtain insights from the experience of Thailand on safe and appropriate use of pesticides and fertilizers for Sri Lanka with its focus on the following 3 focus areas. - IPNS : Implementation of Integrated Plant Nutrition Systems - IPM : Implementation of Integrated Pest Management - GAP : Promotion of good agricultural practices
Institution	National Agricultural Extension and Training Center (NAETC) in Kamphaeng Saen Campus, Kasetsart University
Duration	6th to 16th May, 2024
Methodology	Lectures, Site visits, Discussions, and Reporting
Participants	16 officers from Department of Agriculture (DOA) and 5 officers from Provincial DOAs

Source: JICA project team



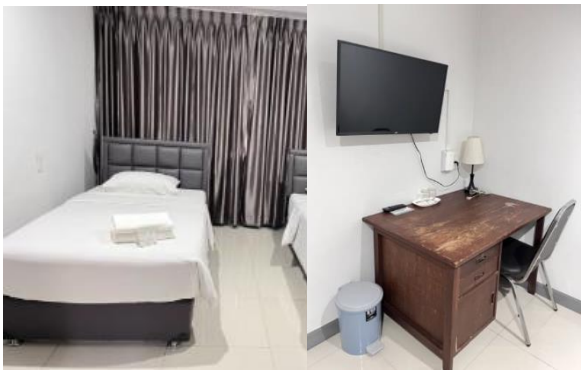
National Agricultural Extension and Training Center



Group photo of participants



Lunch at canteen



Accommodation at NAETC

1.2 Training Subjects

Training subjects and its summary are shown in the table below.

Table 2 Thai training schedule and subjects

Date	Time	Area	Modalities	Subject	Summary
May 6th (MON)	AM	-	-	・Travel from Colombo to Bangkok ・Visit to Tor Gor market and Big C supermarker.	-
	PM	-	-	・Move to NAETC in Kasetsart university	-
May 7th (TUE)	AM	IPNS	Lectures and discsussion	・Overall experiences of issues, solutions of IPNS in Thailand	・Various aspects of IPNS and overview of Sri Lanka's main crops and soil challenges ・Significance of collaborative partnerships
				・Introduction to nutrient management for crop production (field crop, vegetable and fruit tree)	・Importance of changing fertilizer ratio based on growth stages of crops ・4R concepts for nutrient management as in Right source, Right rate, Right time, and Right place
	PM	IPM	Lectures and discsussion	・Overall experiences of issues, solutions of IPM approaches in Thailand as an introduction	・Principles of IPM (Grow a healthy crop, Understand and conserve defenders, Visit fields regularly, and Farmers becoming experts in crop management) ・Agroecosystem Analysis (AESA) to make decisions for maintaining pest population below ETL(Economic threshold level)
				・Introduction of user-friendly guide for farmers of pest identification and control packages / tools in Thailand	・Integrated Pest Management Principles and Field Practice ・Methods to popularize IPM techniques among farmers (Farmers Field School and use communication media)
May 8th (WED)	AM	IPNS	Lectures and discsussion	・Case study for nutrient management package for maximize profit for crop (rice) base on chemical fertilizer	・Different types of fertilizers such as microbial, organic, and inorganic ・Calculating site-specific fertilizer requirements based on soil analysis results
				・Integrate nutrient management or site-specific nutrient management (microbial - organic - chemical fertilizer)	・Webpage of theLand Development Dept. to obtain site-specific fertilizer rates based on soil analysis results
	PM	IPM	Lectures and discsussion	・Introduction of rapid test kits for plant disease identification which are popular in Thailand	・Pests and natural enemies identification and monitoring
				・Introduction of pesticide information management system on digitalizing registration of	・Explanation on types of pesticides and the registration process

Date	Time	Area	Modalities	Subject	Summary
				companies and products, issuance of import licenses, licensing dealers and service companies, etc.	
May 9th (THU)	AM PM	-	-	・Cultural Visit 1 to Bangkok - Temple of Emerald Buddha (Wat Phra Kaew) - Grand Palace	-
May 10th (FRI)	AM PM	IPM	Site visit and discussion	・Observation of pesticide residues analytical facilities	・Central laboratory to test most of the food safety criteria such as pesticide residue analysis, heavy metal analysis, microbial contamination detection, determining of nutrient requirements of crops, water quality analysis, detection of GMO crops etc
May 11th (SAT)	AM PM	IPNS	Site visit and discussion	・Field Observatio for Community Rice Center, Supanburi Province ・Field Observation for Farmer field in Supanburi province	・Using a very user-friendly fertilizer calculation chart to calculate and mix their required amounts of straight fertilizers based on the soil test analysis results
May 12th (SUN)	-	-	-	・Cultural Visit 2 to Bangkok - Chatuchak Weekend Market	-
May 13th (MON)	AM	GAP	Lectures and discsussion	・Promote of the GAP system for business sector	・Importance of promoting GAP with market opportunities ・Introduction of Q-GAP and THAI-GAP systems
	PM	GAP	Lectures and discsussion	・Farm Data required by the GAP system	・Four types of documents required in the GAP system as in policy, procedures, work instructions, and records ・Audit inspector observing by evidence and practice on the farm and interviewing farmer in process of certifying
May 14th (TUE)	AM	GAP	Lectures and discsussion	・Content of the personal safety required by the GAP system	・Personal protective equipment and the safety requirements of the GAP system
	PM	GAP	Lectures and discsussion	・Harvesting management and the concerned of the sanitary process in farm	・The criteria during the harvesting and processing of produce on a farm ・Introducing available pesticide residue test kits
May 15th (WED)	AM PM	GAP	Site visit and discussion	・Vegetable farm with experience working with export company, Pesticide-free vegetable farmers' group	・Visit to Melon farm with certified Q Gap and Thai Gap
May 16th (THU)	-	-	-	・Travel from Bangkok to Colombo	-

Source: JICA project team



Lecture on IPNS



Demonstration of mango bagging by farmer



Trying on Personal Protective Equipment





Melon farm with GAP certification and sticky trap

1.3 Training Outcome

During the training period, wrap-up session was conducted to review learnings of the training and to discuss recommended actions to promote safe and appropriate use of pesticides and fertilizers for Sri Lanka. The session was conducted in each Working Group (WG1 for pesticide, WG2 for fertilizer, and WG3 for GAP) and each WG prepared the list of learnings and recommended actions as follows.

Table 3 Learnings of Thai training and recommended actions

Working Group-1 (Pesticide)

Learnings of Thai training	Recommended actions for Sri Lanka
・ Importance of establishing Economic Threshold Levels (ELT) ・ Decision-making on pest control to be done only after scouting/ monitoring ・ Practical use of natural enemies for selected pest control in Thailand ・ Use of different mass media strategies for IPM promotion ・ How to train a farmer to become an IPM expert ・ Familiarized with the differentiation of insect pests and natural enemies by morphological diagnosis ・ Pest control strategy of motivating farmers for incentive-based insect collection ・ New knowledge on Argo Ecosystem Analysis (AESA) as decision-making tool ・ One-stop analytical facility for pesticide residues, fertilizers, GMOs etc. ・ Use of test kits for pesticide residue analysis ・ Practical aspects of establishing re-entry periods after pesticide application ・ Community based approach for preparation of pest control material by farmers (ex. Developing Trichoderma cultures for pest control) ・ Government approach for allowing mixing certain combinations of pesticide ・ Use of crop calendar to forecast pests and the need of pest management	・ Convince record keeping in farming through the project for pest management ・ Training needs for extension officers and farmers on pest and natural enemy differentiation ・ Preparation of novel promotional materials (eg. Video clips) for IPM promotion, biological control and pest/ natural enemy diagnosis ・ Use of Farmer Field Schools (FFS) concept to develop IPM ・ Train farmers to monitor pests followed by control measure ・ Introduction of AESA concept to train farmers on pest management ・ Introduction of incentive-based pest collection strategies ・ Farmer motivation for developing certain recommended pest control practices (ex. Preparation of Trichoderma solutions, Use of drones for pesticide application) through farmer organization approach ・ Use of pesticide residue kits by the Research/ extension Sectors for quick/ random analysis and forecasting based on such analyses. ・ Pesticide Registrar to seek the possibilities for studies on mixing identified pesticides

Source: JICA project team

Working Group-2 (Fertilizer)

Learnings of Thai training	Recommended actions for Sri Lanka
・ Application of soil conservation methods (ex. Soil conservation by Vetiver grass) ・ Application of fertilizer by calculated fertilizer ratio for fruit crops based on the growth stages (ex. vegetative, flowering, fruiting or reproductive stage) and yield ・ Calculation of soil test based N fertilizer recommendation based on the soil organic matter contents ・ Farmer-friendly soil test kit for NPK analysis in soil ・ User or farmer-friendly fertilizer calculator based on soil test results ・ GAP Certified Melon Farm-Nutrient and other crop management practices, nursery management, pest and disease management in crops cultivated under protected house and value addition of the crop	・ Introduction of soil conservation methods (ex. Vetiver grass) ・ Research to determine suitable fertilizer ratios for different fruit crops based on their growth stages ・ Development of N fertilizer recommendations based on soil available N ・ Development and introduction of fertilizer calculation chart based on soil test results ・ Introduction of a user-friendly soil test kit that the farmers can use ・ Introduction of technologies for maintaining of crops (vines), fertigation, and other crop management practices in protected houses according to requirements ・ Preparation of books, leaflets, and social media posts for disseminating the technologies to DOA officers and farmer communities

Source: JICA project team

Working Group-3 (GAP)

Learnings of Thai training	Recommended actions for Sri Lanka
・ Characteristics of Thai market, where hyper markets and export market need to adhere to GAP and GMP ・ Key components of a fresh supply chain ・ The enterprises and SMEs, Community enterprises and the importance of grouping/ cluster farming ・ Q GAP as the public standard of Thailand and the Thai GAP as the private standard ・ The requirements of GAP for export industry ・ The major requirement in GAP system with example from ASEAN GAP ・ The evidence to fulfill the criteria in a GAP system ・ Evidence from observation, documentation and farmer interview ・ Traceability and how it can help food safety ・ The identification of farm risks associated with food safety ・ The GAP in Thailand, by law it is needed to have GMP certified pack houses to market the products to hyper market and exports ・ Global GAP needs evidence on harvesting prior to issue Global GAP certificate ・ Need for personal hygene in a GAP program ・ Storage and transporting the produce, the points needed to understand for a GAP program ・ Refreshed the knowledge on personal safety requirements by GAP system ・ Thai experience and different types of PPE (Personal Protected Equipment) used by farmers which is more or less similar to Sri Lanka. ・ Rapid testing kits for Organo chlorides and carbamate pesticide residue ・ Possibility of mixing pesticides, fungicides and fertilizer ・ Importance of motivating farmers for market oriented farming and use of IPM ・ Importance of preventive measures as following IPM principals ・ Convincing farmers to follow GAP practices by informing its benefits	・ Introduction of appropriate record keeping methods with simplified formats ・ GAP focusing with market avenues ・ Strengthening of GAP farmers by introducing them to export and supper market ventures ・ Preparation of farmer friendly training manuals with pictures ・ Introduction of suitable PPE for Sri Lanka ・ Increase the awareness program on GAP ・ Encouraging of group certification as farmer group and link to the market ・ Inquire the possible avenues to link the GAP and GMP by low ・ Study the feasibilities of marking GAP compulsory in Hypermarket and Export market ・ Promote GAP certification as levels (ex. Level 1,2 and 3) to make it more attractive

Source: JICA project team



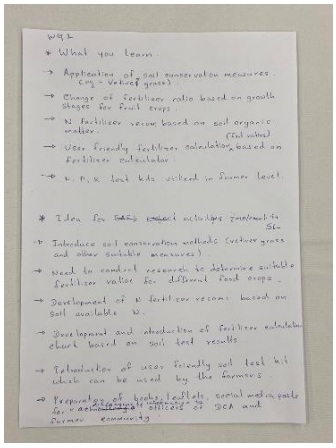
Discussion in each WG



Presentation by each WG



Question and comments on presentation



List of learnings and recommended actions

1.4 Overall Impression

In the report prepared by Kasetsart University (refer to the Attachment-2), there is summary of evaluation made by participants regarding Thai training. Considering the result, participants were basically satisfied with lectures and site visits, but more satisfied with site visits. It shows that participants were more interested in practical contents by site visits rather than conceptual content by lectures.

In Thai training, participants learned 3 technical areas, which are IPNS, IPM, and GAP. One of the training achievements is to obtain specific technology that can be referred to WG activities in SAFE project from each technical area. For example, WG2 is fertilizer group and one of the activities under WG2 is related to site-specific nutrient management package. One of principles of site-specific nutrient management is to apply fertilizer based on soil nutrient amount. In Sri Lanka, it is recommended by government that farmers mix straight fertilizer based on soil test result and apply the mixture to soil so that farmers can only apply minimum amount



Fertilizer calculation chart in Thailand

of fertilizer to fill in the gap between required nutrient and current nutrient in soil. However, it is difficult for farmers to calculate necessary amount of straight fertilizer and there is no support tool in Sri Lanka. In the farm visit regarding IPNS during Thai training, the lecturer and Thai farmers introduced fertilizer calculation chart (refer to the above picture). After soil testing, Thai farmers can easily calculate necessary amount of straight fertilizer for mixing with using the chart. It is farmer-friendly tool that is required in Sri Lanka and can be incorporated into WG2 activity. It is recommended that such kind of specific technologies that become good examples can be referred to each WG activity.

In SAFE project, there are 3 working groups (WG1 for pesticide, WG2 for fertilizer, and WG3 for GAP) and project activities are ongoing under each WG. So far, there is less opportunity to communicate inter-WG members. In this Thai training, participants were mainly selected from each WG, and they all were together in lectures, site visits, and discussion. It promoted inter-WG communication, and it is considered as big advantage for further smooth project activity implementation. In addition, participants learned not only their WG technical areas (ex. IPNS for WG1), but also learned all 3 technical areas (IPNS, IPM, and GAP). It deepened their understanding beyond WG technical areas and promoted to grasp ideal image of safe and appropriate use of pesticides and fertilizers.

Lastly, the problems and improvements of this Thai training is summarized in the table below and it is expected that those improvements are referred to other trainings to be conducted in SAFE project.

Table 4 Problems and improvements of Thai training

Problems	Improvements
・ In some lectures, there was disrepancy in terms of what to learn between lecturers and paritipants. ・ SAFE project team had online meeting with Kasetsart University to discuss training contents, but there were miscommunication.	・ To have face-to-face meeting in Thai to match the needs of participants and training contents by lecturers.
・ Lectures contained conceputual contents, but less practical contens, which participants are more intersted in. ・ In this Thai training, lectures were made by academic staff / professorsin Kasetsart University who are more familiar with conceputual contents.	・ To include officers from department of agriculture and agriculture instructors who work with farmers as lecturers and to have discussion with them.

Source: JICA project team

Study Visit Program in Thailand

Project for Promoting of Safe and Appropriate Use of Pesticides and Fertilizers in Sri Lanka (SAFE)

1. Objectives

The aim of the study program is to obtain insights from the experience of Thailand on safe and appropriate use of pesticides and fertilizers for Sri Lanka with its focus on the following 3 focus areas.

A. Implementation of Integrated Plant Nutrition Systems (IPNS)

B. Implementation of Integrated Pest Management (IPM)

C. Promotion of good agricultural practices (GAP)

2. Study methodologies

The program is conducted through lectures, site observations and discussions. Details of topics taken up by this training under 3 focus areas are as follows.

A. Implementation of Integrated Plant Nutrition Systems (IPNS)

A-1 Overall experiences of issues and solutions of IPNS in Thailand

- An overview of agriculture in Thailand: its strengths and challenges.
- Regional variations in cultivated crops and soil characteristics.
- Key stakeholders involved in Integrated Plant Nutrition Systems.

A-2 Introduction to nutrient management for crop production (field crop, vegetable and fruit crops)

- Principles of nutrient management for crop production
    - Vegetable: cabbage, tomato
    - Fruit crops: orange mango

A-3 Case study for nutrient management package for maximizing profit for crop base on chemical fertilizer.

- Thai soil database: Geographic Information System (GIS) Agri Map, LDD on farm
- Standard soil analysis laboratory: Thai Soil Laboratory Network (TSLAN) GLOSOLAN
- Fertilizer recommendation by Rice Department and Department of Agriculture

A-4 Integrated nutrient management or Site-specific nutrient management. (Microbial - organic - chemical fertilizer).

- Introduction KU soil test kits
- Farmer implementation: Farmer's group supported by Department of Agriculture Extension (the community fertilizer soil management center (CFSM)) and Soil doctor program.
- Tailor made fertilizer technology (simplification of site-specific nutrient management)
- Empowerment of farmer's groups supported by government and private sector

B. Implementation of Integrated Pest Management (IPM)

B-1 Overall experiences of issues and solutions of IPM approaches in Thailand as an introduction.

B-2 Introduction of user-friendly guide for farmers of pest identification and control packages/tools in Thailand

B-3 Introduction of rapid test kits for plant disease identification which are popular in Thailand

B-4 Introduction of pesticide information management system on digitalizing registration of companies and products, issuance of import licenses, licensing dealers and service companies, etc.

B-5 Observation of pesticide residues analytical facilities (Visits and discussion)

C. Promotion of good agricultural practices (GAP)

C-1 Promotion of the GAP system for business sector in Thailand
C-2 Farm data required by the GAP system in Thailand.
C-3 Content of the personal safety required by the GAP system in Thailand
C-4 Harvesting management and the concerns of the sanitary process in farms in Thailand

3. Program outline

- Date: From May 6 to 16th 2024
  - Departure : 06 May 01:10 at Colombo (BANDARANAIKE INTL) by UL402
  - Arrival : 16 May 09:35 at Colombo (BANDARANAIKE INTL) by UL403
- Program duration: 11 days
- Training duration: 7 working days
- Venue: Mainly at National Agricultural Extension and Training Center (NAETC), Kasetsart University, Kamphhaengsaen Campus, Nakorn Pathom, Thailand
  - Telephone : (66)-2942-8460
  - Email : sommyred@gmail.com
  - Adress : 1 Moo 6 Tambon Kamphaeng Saen, Amphur Kamphaeng Saen, Nakhon Pathom 73140, Thailand

- Training programs and schedules

Day and Date	TIME	Focus areas	Code	Subject	Modalities	Lecturer
May 6th Monday	Morning	Travel from Colombo to Bangkok (UL402 CMB01:10 BKK06:15)				
	Afternoon	Travel from Bangkok to NAETC Kamphaengsaen Campus				
May 7th Tuesday	09.00-10.30 AM	A	A-1	Overall experiences of issues, solutions of IPNS in Thailand	Lectures and discussion	Assist. Prof. Audthasit Wongmaneeroj Dept. of Soil Science
	10.30-12.00 AM	A	A-2	Introduction to nutrient management for crop production (field crop, vegetable and fruit tree).	Lectures and discussion	Assist. Prof. Audthasit Wongmaneeroj Dept. of Soil Science
	01.00-02.30 PM	B	B-1	Overall experiences of issues, solutions of IPM approaches in Thailand as an introduction	Lectures and discussion	Assoc. Prof. Dr. Sopon Uraicheun Dept. of Entomology
	02.30-04.00 PM	B	B-2	Introduction of user-friendly guide for farmers of pest identification and control packages / tools in Thailand	Lectures and discussion	Assoc. Prof. Dr. Sopon Uraicheun Dept. of Entomology
May 8th Wednesday	09.00-10.30 AM	A	A-3	Case study for nutrient management package for maximize profit for crop (rice) base on chemical fertilizer.	Lectures and discussion	Assist. Prof. Audthasit Wongmaneeroj Dept. of Soil Science
	10.30-12.00 AM	A	A-4	Integrate nutrient management or site-specific nutrient management (microbial - organic - chemical fertilizer).	Lectures and discussion	Assist. Prof. Audthasit Wongmaneeroj Dept. of Soil Science
	01.00-02.30 PM	B	B-**3**	Introduction of rapid test kits for plant disease identification which are popular in Thailand	Lectures and discussion	Assoc. Prof. Dr. Sopon Uraicheun Dept. of Entomology
	02.30-04.00 PM	B	B-4	Introduction of pesticide information management system on digitalizing registration of companies and products, issuance of import licenses, licensing dealers and service companies, etc.	Lectures and discussion	Assoc. Prof. Dr. Sopon Uraicheun Dept. of Entomology
May 9th Thursday	Morning	OFF		Cultural Visit 1: Temple of Emerald Buddha (Wat Phra Kaew) and Grand Palace, Bangkok		
	Afternoon	OFF				
May 10th Friday	Morning 10.00-12.00	B	B-5	Leave from KU Kamphaengsaen Campus Observation of pesticide residues analytical facilities	Visits and discussion	Mr. Pichit Kiatsomporn (Chairman of CRC) and Assist. Prof. Audthasit
	Afternoon			Back to NAETC		

Day and Date	TIME	Focus areas	Code	Subject	Modalities	Lecturer
						Wongmaneeroj, Dept. of Soil Science
May 11th Saturday	AM	A	Field Observation - Community Rice Center, Supanburi Province			
		A	Field Observation - Farmer field in Supanburi province		Visits and discussion	Central Laboratory (Thailand) Company Limited, BKK
	Afternoon					
May 12th Sunday		OFF	Cultural Visit 2: Chatuchak Weekend Market, Bangkok			
		OFF				
May 13th Monday	Morning	C	C-1	Promote of the GAP system for business sector	Lectures and discussion	Assoc. Prof. Dr. Chainarong Rattanakreetakul or Dr. Roongnapa Korpraditskul, Dept. of Plant Pathology
	Afternoon	C	C-2	Farm Data required by the GAP system	Lectures and discussion	Assoc. Prof. Dr. Chainarong Rattanakreetakul Dept. of Plant Pathology
May 14th Tuesday	Morning	C	C-3	Content of the personal safety required by the GAP system.	Lectures and discussion	Dr. Pisut Keawmanee Dept. of Plant Pathology
	Afternoon	C	C-4	Harvesting management and the concerned of the sanitary process in farm	Lectures and discussion	Assoc. Prof. Dr. Chainarong Rattanakreetakul, Dept. of Plant Pathology
May 15th Wednesday	Morning	C	Vegetable farm with experience working with export company, Pesticide-free vegetable farmers' group		Visits and discussion	Assoc. Prof. Dr. Chainarong Rattanakreetakul and Dr. Pisut Keawmanee, Dept. of Plant Pathology
	Afternoon	C	Vegetable farm under contract area, Pesticide-free vegetable farmers' group or farm in Kamphaengsaen or other province.		Visits and discussion	Assoc. Prof. Dr. Chainarong Rattanakreetakul and Dr. Pisut Keawmanee, Dept. of Plant Pathology
May 16th Thursday	Morning	Travel from NAETC Kamphaengsaen Campus to Bangkok Travel from Bangkok to Colombo (UL403 BKK 07:45 CMB09:35)				

4. List of participants

Group	No	Name	Designation	Place of work	Role	Mobile contacts	Email
Group 1: Pesticides	1	Dr. (Mrs.) J.P. Marasinghe	Principal Agriculture Scientist (PAS) (Toxicology)	Office of the Registrar of Pesticides (ROP), Peradeniya	Leader	+94718480675	jeevanimarasinghe@gmail.com
	2	Ms. C. Magamage	Principal Agriculture Scientist (PAS) (Ana. Che.)	Horticultural Crops Research and Development Institute (HORDI), Peradeniya	Member	+94718040364	champamgmg@gmail.com
	3	Mrs. T.K.A.I. Hadji	Assistant Director of Agriculture/Research (ADA/R)	Regional Agriculture Research Development Center (RARDC), Bandarawela	Member	+94754465965	hadjiakila38@gmail.com
	4	Mrs. H.A.S.N. Hettiarachchi	Assistant Director of Agriculture/Research (ADA/R)	Agriculture Research Station (ARS), Seethaeliya	Member	+94759751146	shyamanadeeka@gmail.com
	5	Ms. K. Pushpanjie	Assistant Director of Agriculture/Research (ADA/R)	Agriculture Research Station (ARS), Seethaeliya	Member	+94716431992	pushpanjie@yahoo.com
Group 2: Fertilizer	6	Mrs. Renuka Silva	Principal Agriculture Scientist (PAS) (Soil Sci.)	Horticultural Crops Research and Development	Leader	+94714484172	renukasilva@yahoo.com

				Institute (HORDI), Peradeniya			
	7	Dr. M. Kodikara	Deputy Director / Research (DD/R)	Regional Agriculture Research Development Center (RARDC), Bandarawela	Member	+94718245646	manojkodikara@gmail.com
	8	Ms. A. Mayakaduwa	Assistant Director of Agriculture (ADA)	Agriculture Research Station (ARS), Seethaeliya	Member	+94759751157	amodapriyangi@gmail.com
	9	Mrs. G.S.P. Thennakoon	Additional Director (AddlD)	National Agriculture Information and Communication Centre (NAICC), Peradeniya	Member	+94710421263	admgtenne@gmail.com
Group 3: GAP	10	Mr. S. Liyanagama	Deputy Director (DD)	Division of Agri Business (AgBiz), Peradeniya	Leader	+94712247502	samanthathusitha@gmail.com
	11	Mrs. H.R.U.T. Erabadupitiya	Deputy Director (DD)	Seed Certification Service (SCS), Peradeniya	Member	+94711955744	udani.doa@gmail.com
	12	Mr. K.W.P. Nishantha	Additional Director (AddlD)	Plant Protection Service (PPS), Peradeniya	Member	+94718667990	wpnishantha@yahoo.com

	13	Mrs. P. Ranaweera	Assistant Director of Agriculture/Research (ADA/R)	Horticultural Crops Research and Development Institute (HORDI), Peradeniya	Member	+94714395481	ranaweerapra@yahoo.com
	14	Mr. A.S.M. Roshan	Assistant Director of Agriculture (ADA)	Division of Agri Business (AgBiz), Peradeniya	Member	+94714856647	roshanemail@gmail.com
	15	Dr. (Mrs.) A.V.C.A. Abhayagunasekara	Deputy Director /Research (DD/R)	Fruit Crop Research and Development Station (FCRDS), Peradeniya	Member	+94714485165	chandranihordi@yahoo.com
Field Implementation	16	Mr. D.G.M.N.U. Kumara	Subject Matter Officer (SMO)	Deputy Provincial Deputy Director (Extension) Office, Anuradhapura	Field Officer – Anuradhapura	+94716903277	nilantha.upul.doa@gmail.com
	17	Mr. G.A.A. Gurusinghe	Assistant Director of Agriculture (ADA)	ADA Office, Rattwatta Road, Badulla	Field Officer - Badulla	+94702562256	guruwelimada@gmail.com
	18	Mrs. M.M.N. Weerasooriya	Subject Matter Officer (SMO)	DDA Office, M C Road, Matale	Field Officer – Matale	+94715328298	nayomaniw@gmail.com

	19	Mrs. U.K.S.T. Kumari	Head Quarter Agriculture Instructor (AI)	ADA Office, Pundaluoya	Field Officer – Nuwaraeliya	+94759747172	stkumari1972@gmail.com
	20	Mrs. W.A.B. Priyangika	Subject Matter Officer (SMO)	ADA Office, Puttalama	Field Officer – Puttalama	+94768048333	priyangikabanduni@gmail.com
IT	21	Mr. K.A.U.N.N. Bandara	Development Officer	National Agriculture Information & Communication Center,Gannoruwa	Gannoruwa	+94716820756	unbandara@gmail.com

5. Eligibilities of training participants

Current duties:

- Designated Working Group members of the SAFE Project to develop technical and extension packages of safe use of agrochemicals.
- Designated officers for implementing field activities of the SAFE Project in Nuwara Eliya, Matale, Badulla, Anuradhapura and Puttalam districts.
- Program level: Fit into program level (This study program designed for practitioners on safe use of agrochemical food safety but not designed for high-ranking officers).
- Language: Competent in spoken and written English
- Health: In good health both physically and mentally to participate in the program in Thailand.

6. Expected outputs of the program by the participants

- Submission of inception report by each participant and presentation at the orientation meeting. The report should include both the report and ppt presentation. The report may comprise of maximum 5 pages each includes topics of overviews, trends, progress and challenges of safe use of agrochemicals with which your institutions cover.
- Developing completion reports by group by 2 weeks after completion of the training program including following topics.
- Describe summary of note takings from lectures, field visits and results of discussion including photos and training materials.
- Conduct comparative analysis between Thailand and Sri Lanka of the respective themes assigned to each group indicated Chapter 4 above.
- Provide group findings, possible strategic opinions and recommendations.
- Group presentations to the Director General of Agriculture summarizing the group reports prepared by the team by 4 weeks after completing the training program.

7. Key steps of preparation and implementation of study visit

1. The SAFE Project develops the training program in collaboration with KU-NAETC.
2. The SAFE Project identify list of working group members as training candidates, and sends them to JICA Sri Lanka Office together with the training program.
3. JICA Sri Lanka office requests Department of External Resources /ERD to facilitate government approval of candidates to participate in the training.
4. ERD provides approval to JICA regarding proposed candidates to participate in the training.
5. Each candidates to prepare application form of the training and sent it to JICA via SAFE project.

6. JICA Sri Lanka Office to assess eligibility of applicants according to the criteria mentioned in Chaper5 above.
7. JICA Sri Lanka Office to issue acceptance letter for selected participants.
8. Selected participants to obtain necessary clearance such as government release from the MoA or PDOA.
9. JICA Thailand Office via JICA Sri Lanka Office sends invitations to participants
10. Participants to prepare visa to travel Thailand
11. The SAFE Project to conduct orientation and preparatory meeting with participants
12. Implementation of the training program
13. Participants to submit reports/outputs
14. Participants to make presentation at DOA

8. Sharing of responsibilities between JICA (The Project) and Ministries/Department

Responsibilities of JICA

- Provision of acceptance and invitation letter
- Booking and cost of roundtrip flight ticket to Bangkok (economy class)
- Actual cost of the VISA fee to Thailand, if any
- Travel insurance for participants
- Cost and arrangements of the training program in Thailand (lectures & field visit)
- Cost for food and accommodations in Thailand
- Transportation from/to Bangkok Suvarnabhumi Airport

Responsibilities of the participants

- Obtaining visa to Thailand on time via travel agents arranged by SAFE Project.
- Obtaining official release for the full training period, as per Government Circulars
- Participation in the preparatory meetings in Sri Lanka (pre-departure) before the program as requested by JICA /DOA
- Submission of inception report, group report and presentations of findings to DOA
- Cost of Passport Issuance or any other costs related to VISA (other than VISA fee)
- Any costs that may arise beyond the coverage of JICA`s travel insurance
- Domestic (in Sri Lanka) transportation costs relating to the Program if any, including transportation costs to/from Colombo Bandaranaike Airport
- Any other costs incurred during the program not included in the program

9. Follow up activities expected by the participants after the visits

- Engaging in Working Group activities on pesticides, fertilizers and GAP groups of the SAFE Project.
- Developing technology and extension packages for safe and appropriate use of agro chemicals for the SAFE project.
- Conducting Training of Trainer (TOT) for master trainers or extensionists on safe and appropriate use of agro chemicals as resource persons for the SAFE project.

End of memo

End of the Program Report

The Third Country Training in Thailand for the Project "Promotion of Safe and Appropriate Use of Pesticides and Fertilizers"

6 – 16 May 2024

Conducted by:

The National Agricultural Extension and Training Center,
Kasetsart University Kampaengsen Campus
In collaboration with JICA Sri Lanka

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I. Objectives of the Program

II. Participants

III. Course Facilitators

IV. Program Structure

V. Program Schedule

VI. Highlights of the Activities

VII. Conclusion

VIII. Attachments

- Attachment 1 – Challenges and Expectations from the Training
- Attachment 2 – Comments on Lectures and Activities
- Attachment 3 – Summary of Evaluation
- Attachment 4 - Documentation

I. Objectives

The aim of the study program is to obtain insights from the experience of Thailand on safe and appropriate use of pesticides and fertilizers for Sri Lanka with its focus on the following 3 focus areas:

A. Implementation of Integrated Plant Nutrition System (IPNS)

B. Implementation of Integrated Pest Management (IPM)

C. Promotion of Good Agricultural Practices (GAP)

II. Participants

List of Participants

Group	No	Name	Designation	Place of work	Role
Group 1: Pesticides	1	Dr. (Mrs.) J.P. Marasinghe	Principal Agriculture Scientist (PAS) (Toxicology)	Office of the Registrar of Pesticides (ROP), Peradeniya	Leader
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	5	Ms. K. Pushpanjie	Assistant Director of Agriculture/Research (ADA/R)	Agriculture Research Station (ARS), Seethaeliya	Member
Group 2: Fertilizer	6	Mrs. N. Renuka Silva	Principal Agriculture Scientist (PAS) (Soil Sci.)	Horticultural Crops Research and Development Institute (HORDI), Peradeniya	Leader
	7	Dr. K. M. S. Kodikara	Deputy Director / Research (DD/R)	Regional Agriculture Research Development	Member

				Center (RARDC), Bandarawela	
	8	Ms. M. A. P. Mayakaduwa	Assistant Director of Agriculture (ADA)	Agriculture Research Station (ARS), Seethaeliya	Member
	9	Mrs. T. M. P. G. S. P. Tennakoon	Additional Director (AddlD)	National Agriculture Information and Communication Centre (NAICC), Peradeniya	Member
Group 3: GAP	10	Mr. L. K. S. T. Kumara	Deputy Director (DD)	Division of Agri Business (AgBiz), Peradeniya	Leader
	11	Dr. (Ms.) H.R.U.T. Erabadupitiya	Deputy Director (DD)	Seed Certification Service (SCS), Peradeniya	Member
	12	Mr. K.M. D. W. Prabath Nishantha	Additional Director (AddlD)	Plant Protection Service (PPS), Peradeniya	Member
	13	Mrs. P. H. Ranaweera	Assistant Director of Agriculture/Research (ADA/R)	Horticultural Crops Research and Development Institute (HORDI), Peradeniya	Member
	14	Mr. A.S.M. Roshan	Assistant Director of Agriculture (ADA)	Division of Agri Business (AgBiz), Peradeniya	Member
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	18	Mrs. M.M.N. Weerasooriya	Subject Matter Officer (SMO)	DDA Office, M C Road, Matale	Field Officer – Matale

	19	Mrs. U.K.S.T. Kumari	Head Quarter Agriculture Instructor (AI)	ADA Office, Pundaluoya	Field Officer – Nuwaraeliya
	20	Mrs. W.A.B. Priyangika	Subject Matter Officer (SMO)	ADA Office, Puttalama	Field Officer – Puttalama
IT	21	Mr. K.A.U.N.N. Bandara	Development Officer	National Agriculture Information & Communication Center,Gannoruwa	Gannoruwa

III. Course Facilitators

- **Asst. Prof. Audthasit Wongmaneeroj** – He is an Asst. Professor at the Department of Soil Science, Faculty of Agriculture, Kasetsart University Kampaengsen Campus. He obtained Master's Degree in Soil Science at Kasetsart University. He is an expert in soil fertility, fertilizer production and usage, and precision agriculture. His research projects include fertilizer recommendation, and site-specific nutrient management.
- **Assoc. Prof. Dr. Sopon Uraicheun** – He is an Assoc. Professor at the Department of Entomology, Faculty of Agriculture, Kasetsart University. He also holds the position of being the Executive Director of the National Biological Control Research Center and the Vice President of Thailand Society of Sugar Cane Technologies. He obtained his Doctor's Degree in Evolutionary Biology and Ecology at Ecole Nationale Superieure Agronomic de Montpelier. His expertise is in the field of Agricultural Entomology/ Biological control and integrated management.
- **Assoc. Prof. Dr. Chainarong Rattanakreetakul –** He is an Assoc. Professor at the Department of Plant Pathology, Faculty of Agriculture, Kasetsart University Kampaengsen. He obtained his Doctor's Degree in Plant Pathology at Georg-August University in Germany. His research interest and expertise is Good Agricultural Practices, Inspection and Certification System, Plant Defence Mechanism, and Plant Natural Product Active Substances.
- **Dr. Pisut Keawmanee –** He is a Lecturer at the Department of Plant Pathology, Faculty of Agriculture, Kasetsart University Kampaengsen Campus. He obtained Doctor's Degree in Plant Pathology at Kasetsart University. His expertise include agricultural quality standard, plant disease management and mycotoxin reduction, induce resistance in plant, pesticide residue analysis, utilization of natural plant

extract and biological agent for plant disease control. He has a number of research and publications in line of his expertise.

IV. Program Structure

This training program is a combination of classroom sessions and field visits to pertinent places and agencies related to the use and appropriate use of pesticides and fertilizers and development and implementation of good agricultural practices in the farms. Active discussions with the facilitators and farm officers and farmers have been done to maximize learning. At the end of the course, the participants are expected to synthesize lessons learned in the classroom and in the field to develop a draft plan for refinement and possible implementation back on the job.

V. Highlights of the Program (Daily activities)

6 May 2024 (Monday)

The group arrived at Suvarnabhumi airport, Bangkok, Thailand.

Visit to Or Toh Kor Market - From the airport, they proceeded to Or Toh Kor Market at Chatuchak where they had initial observation and experience on fresh fruits produced and fruit products sold on markets in Thailand. After an hour of visit, the group went to BigC Supermarket to do initial purchase of what they need, had lunch, and travelled to KU Kampaengsen. They settled in at Saen Palm Hotel.

7 May 2024 (Tuesday)

Opening Program – During the opening of the course, the Vice President of Kasetsart University, Kampaengsen Campus, Assoc. Prof. Dr Anuchai Pinyopummin greeted and welcomed the participants of the course. He also introduced NAETC, Office of Extension and Training Kampaengsen, and the whole Kasetsart University. Other officers present during the opening ceremony include Dr. Kanyarat Chiewvech, Director of NAETC Extension and Training Kampaengsen; Assoc. Prof. Chukiat Ruksorn, the ECDP Director; Assoc. Prof. Audthasit Wongmaneeroj, the facilitator/Prof. from Soil Science Department of KU, and the JICA officers headed by the Chief Advisor, Mr. Singa Kimura. The VP also handed over a souvenir from NAETC to each participant and the group also gave a token for the VP and other officers.

Classroom Session on the Overall experiences of issues, solutions of IPNS in Thailand; and Introduction to nutrient management for crop production (field crop, vegetable and fruit tree) - Just after the opening program in the morning, the session started and was facilitated by Assoc. Prof. Audthasit Wongmaneeroj, the expert from the Dept. of Soil Science, Kasetsart University Kampaengsen.

Classroom Session in the afternoon focused on the overall experiences of issues, solutions of IPM approaches in Thailand and also the introduction of user-friendly guide for farmers of pest identification and control packages/tools in Thailand, facilitated by Assoc. Prof. Dr. Sopon Uraicheun from the Department of Entomology. After every session, participants were encouraged to raise their questions and comments to give more clarity to the topics.

8 May 2024 (Wednesday)

Classroom session on the nutrient management package to maximize profit for crop (rice) based on chemical fertilizer and to integrate nutrient management or site-specific nutrient management (microbial – organic-chemical fertilizer by Prof. Audthasit Wongmaneeroj. Case studies have been presented.

Another session in the afternoon on the **rapid test kits for plant disease identification and the introduction of pesticides information management system on digitalizing registration of companies and products, issuance of import licenses, licensing dealers, and service companies, etc**. This was facilitated by Assoc. Prof. Dr. Sopon Uraicheun.

9 May 2024. (Thursday)

Cultural Visit in Bangkok- The participants were given a **chance to explore Thailand and learn its culture by visiting The Temple of the Emerald Buddha (Wat Prakaew) and the Grand Palace** which is situated in the heart of Bangkok. Wat Prakaew, officially known as Wat Phra Si Rattana Satsadaram, is regarded as the most sacred temple in Thailand and is one of the most visited landmarks in Bangkok. Before the end of the day, they were able to visit Prathunam market in Bangkok.

10 May 2024 (Friday)

The visit to the Central Laboratory Thailand Company Limited. - The visit gave the participants a chance to discuss with the officers of the lab regarding their main function and their job, and learned about pesticide residues analysis, certifications, and others. They visited the laboratory itself and observed the facilities and staff while doing the work. Aside from the warm welcome the lab officers have given them, they were also glad to answer questions being raised with them.

11 May 2024 (Saturday)

The Visit to the Community Rice Center, Suphaburi Province. - The participants were able to meet and discuss with the farmer's group members about the rice and mango production in GAP. Mr. Pichit Kiatsomporn (Chairman of the CRC) introduce the history of the foundation, informed of their function for the other farmers, and discussed best practices they are applying in the farm such as the use of drone, water management

technique, soil analysis and crop analysis, use of fertilizers and use of fertilizer mixing charts, mango bagging strategies, irrigation system, and the like.

Mango Farms Visit - A visit and further discussion have been held at the farm in the afternoon during the mango farms visit. The participants were able to observe the farm set-up, the irrigation system, and further discussed with the farmers and the professor about the Gap practices, challenges, and success in the farms.

12 May 2024 (Sunday)

A self-development activities day for the participants. They visited Chatuchak Weekend Market and did their shopping.

13 May 2024 (Monday)

Session on the Promotion of GAP System for business sector, and Farm Data Required by the GAP system- It was facilitated by Assoc. Prof. Dr. Chainarong Rattanakreetakul, from Dept. of Plant Pathology. The Professor highlighted the importance of farm data recording to be done by farmers, and share their records to their children for future preference. Otherwise, the children will sell their land and buy a room in the city.

W**rap-up session** (Part 1) has been done to review the lessons the participants have in the past few days.

14 May 2024 (Tuesday)

Morning session was facilitated by Assoc. Prof. Dr Chainarong's session. This session enabled them to **discuss harvesting management and the concerned of sanitation in the farm. Content on the personal safety required by GAP system was discussed in the afternoon** which was facilitated by Dr. Pisut Keawmanee.

Wrap-up session (Part 2) - After the session, another **wrap-up session** has been done and an action planning was done in groups. They were divided in three (3) groups. After each groups' discussion, they **presented their proposals or action plans** which are subjects for further refinement and further discussion in their country, to which it is expected for them to apply in their own setting in Sri Lanka.

Distribution of Certificates of Participation was also done, and the certificates were handed to them by the Deputy Director of the NAETC, Kasetsart University.

15 May 2024 (Wednesday)

The visit to Wasana Melon Farm, Saraburi Province. The participants were able to learn the best practice management of the farm through the sharing of the General Manager and owner of the farm. The techniques and strategies in developing the farm as a business – Quality, standard, brand, and market. After the presentation and discussion, they were able to visit and observe the farm including the facilities. A further discussion was done after the farm visit.

16 May 2024 – The group departs for Sri Lanka.

VI. Conclusion

Based on the participants' evaluations, feedback, and outputs as well as the observation & evaluation of the NAETC management on the achievement of the course objectives, the Third Country Training for "The Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizers" is commended as a successful one. This has been achieved through the full and active participation and the eagerness of the participants to learn in all aspects that has been included in the program content and even out-of the program life learning and experiences. There is always room for improvement in any event, so NAETC will consider the evaluations seriously and hope to provide better and greater service in the future.

We acknowledge JICA for the excellent cooperation in organizing this study visit. Through the excellent communication with JICA officers, full trust given to NAETC as training provider, and the professionalism of everyone, NAETC Kasetsart University has managed to arrange things needed and implement the program smoothly.

ATTACHMENT 1

Participant's Challenges in Sri Lanka and Expectations from Thailand Training

Area	Challenge	Expectation
IPNS	・ Department of Agriculture (DOA) recommendations are available only for straight fertilizer (N,K,P), but not for other types of fertilizer (i.e. liquid fertilizer). ・ Less awareness for IPNS and soil testing among farmers. ・ Application of higher dosages of fertilizer by farmers without considering the DOA recommendation and crop nutrient requirement. ・ Neglect the Site-Specific Soil Fertility Management system by farmers. ・ Nutrient retention or accumulation in soil which causes nutrient imbalances in the soil. ・ Declining soil fertility in vegetable growing fields due to low attention on soil health. ・ Lack of user-friendly information dissemination tools on IPNS. Eg. Mobile app. ・ Lack of efficient farmer field level soil condition identification IT tools.	・ To get knowledge about the practical aspects of IPNS by farmers. ・ To get an idea about how the fertilizer recommendations are developed in Thailand and its responsible institute. ・ To find out whether any subsidiary program is available to distribute fertilizers to farmers. ・ To get knowledge about fertilizer regulation in Thailand. ・ To get technologies and strategies to encourage farmers to practice site-specific soil fertility management. ・ To get knowledge about technology to increase efficiency of fertilizer and sustainable soil fertility management. ・ To get an idea for more efficient (slow release and with high nutrient contents) fertilizers. ・ To get an idea for nutrient management techniques and other improved technologies in green houses. ・ To get knowledge about methodologies used to disseminate good fertilizer practices to farmers. ・ To get an idea for IT methods for dissemination.
IPM	・ Poor extension service to improve IPM. ・ Farmer's reluctance to adopt IPM. ・ Misuse of pesticides and invasion of unrecommended pesticides to Sri Lanka. ・ Requirement of practical alternative technologies for IPM.	・ To obtain knowledge about successful implementation methods of IPM. ・ To get knowledge about various alternative pest management technologies. ・ To explore the pesticide regulation mechanism in Thailand.

ATTACHMENT 1

Area	Challenge	Expectation
	・ Lack of appropriate pest identifying, monitoring and prediction systems. ・ As tropical country, high temperature leads to frequent pest out breaks.	・ To get knowledge about pest identifying, monitoring and prediction system used in Thailand. ・ To get an idea for development of threshold level for correct decision making. ・ To get knowledge about Rapid pesticide residual analysis technique. ・ To get an idea for how to select suitable pesticide and bio-pesticide for particular pest.
GAP	・ Convincing farmers to follow GAP. ・ Need for more awareness-making through field demonstration of GAP. ・ Need for promotion of GAP agricultural produce consumption, local marketing, and exportation. ・ Mainly rely on insecticides without considering other pest management practices. ・ Poor field sanitation. ・ Lack of attention for personal protection while spraying agro chemicals. ・ Poor practices in proper waste disposal methods with crop residues & pesticide containers. ・ Poor practices in proper waste disposal methods with crop residues & pesticide containers.	・ To experience the GAP popularity in Thailand. ・ To get experience about GA practices relevant to P & F use in vegetable cultivation in Thailand. ・ Knowledge on marketing chain practiced in Thailand. ・ Identification simple and specific field sanitation technologies adapted by farmers in Thailand. ・ To get an idea for Farmer friendly personal protective methods suitable for a tropical agricultural country. ・ To get an idea for convenient record keeping methods for farmers. ・ To study the Thai farmer perception on GAP and the demand for GAP produce in the Thai.

ATTACHMENT 2

Comments on Lecture Topics and Activities on the Training Program

The Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizers in Sri Lanka (SAFE)

Program Code	Lecture topics	Comments	Reply
A-2	Introduction to nutrient management for crop production (field crop, vegetable and fruit crops)	Please exclude lecture on rice, sugarcane and cassava since they are not the Project's target products. Our target products are fruits and vegetable only.	Understanding the concept of nutrient management essential begins with a focus on simple crop cycles, starting with annual crops such as rice or field crop. Gradually progressing to more complex life cycles, one can then explore perennial crops like fruit trees, which involve intricate stages such as vegetative growth and reproductive growth.
A-3	Case study for nutrient management package for maximizing profit for crop (rice) base on chemical fertilizer.	Since rice is not the target products of our project, please do not include fertilizer recommendation for Rice. Can it be by Dept responsible for veg and fruits?	
A or B	Anytime during lecture or field trip for A and B	Please provide information on feasibility and experience in Thailand on using drone for safe application of pesticide and fertilizer if possible in lecture or field trip for A and B.	Utilizing drone technology to apply micronutrients or trace elements becomes viable once the macronutrient elements have been sufficiently provided.
A-3	Case study for nutrient management package for maximizing profit for crop base on chemical fertilizer.	Please include topic of nutrient management practices in protected houses in Thailand in A-3 lecture and discussion if possible.	Inorganic fertilizer serves as plant nutrients and poses no direct harm to human health. Consequently, a protected house requires fewer compare with insecticides or general plant protection chemicals.
C-2	Farm data required by the GAP system in Thailand.	Please include "Information on GAP related traceability system" in C-2 lecture and discussion if possible.	(none)
C	Field observation on May 15th	Please include "Alternative pest control methods commonly used in Thailand" in field observation if possible.	(none)

ATTACHMENT 3

Summary of Evaluation

A. Classroom Sessions

Topic	Content	Applicability to work	Time spent	Training materials used	Ability of the lecturer	Knowledge of the lecturer	Ability to convey knowledge to listeners	Presentation skills	Ave
Overall experience of issues, solutions of IPNS in Thailand (A1)	4.52	4.38	4.29	4.29	4.81	4.57	4.57	4.57	4.52
Introduction to nutrient management for crop production (field crop, vegetable and fruit tree) (A2)	4.14	4.76	4.57	4.52	4.57	4.81	4.71	4.67	4.60
Overall experiences of issues, solutions of IPM approaches in Thailand (B1)	4.57	4.24	4.38	4.48	4.71	4.19	4.29	4.43	4.41
Introduction of user-friendly guide for farmers of pest identification and control packages _ tools in Thailand (B2)	4.48	4.19	4.33	4.33	4.62	4.29	4.38	4.57	4.39
Case study for nutrient management package to maximize profit for crop (rice) base on chemical fertilizer. (A3)	4.76	4.48	4.57	4.62	4.81	4.57	4.67	4.52	4.63
Integrate nutrient management or site-specific nutrient management (microbial - organic - chemical fertilizer) (A4)	4.81	4.48	4.57	4.57	4.81	4.67	4.57	4.57	4.63
Introduction of rapid test kits for plant disease identification which are popular in Thailand (B3)	4.10	4.10	4.30	4.15	4.50	4.20	4.40	4.25	4.25
Intro of pesticide information management system on digitalizing registration of companies and products, issuance of import licenses, licensing dealers and service companies, etc. (B4)	4.43	4.0	4.24	4.19	4.48	4.24	4.19	4.14	4.24

ATTACHMENT 3

Topic	Content	Applicability to work	Time spent	Training materials used	Ability of the lecturer	Knowledge of the lecturer	Ability to convey knowledge to listeners	Presentation skills	Ave
Promote of the GAP system for business sector (C1)	4.84	4.32	4.74	4.74	4.89	4.68	4.84	4.79	4.73
Farm Data required by the GAP system (C2)	4.79	4.53	4.68	4.68	4.79	4.79	4.79	4.74	4.72
Content of the personal safety required by the GAP system (C3)	4.58	4.32	4.42	4.53	4.74	4.58	4.58	4.53	4.53
Harvesting management and the concerned of the sanitary process in farm (C4)	4.79	4.42	4.63	4.74	4.84	4.58	4.58	4.63	4.65

Comments and suggestions

A1

1. Should give more information on practical IPNS
2. It is better if more examples of Thai practices of safe and appropriate use of fertilizer were included.
3. Excellent presentation!
4. The lecture was interesting and the lecturer delivered the content very well.
5. It was a broad subject and better to discuss as rice (cereals), fruits and vegetables.
6. Strong collaboration for field work.
7. Include videos related to the lectures

A2

1. Reduce basic principles. More practical information.
2. Good.
3. Excellent
4. More content from Thai farming experience on fertilizer use, especially the types of organic matter used should be discussed.
5. The lecture also helped me refresh my knowledge.
6. It would be more useful if those theories were discussed with succeeding case studies, video, etc.
7. May I suggest practical sessions.

ATTACHMENT 3

B1

1. Need more practical examples.
2. Need to know more relevant practical applications used in Thailand.
3. It is important if we could gather more Thai examples to adopt under Sri Lankan conditions.
4. Presentation session covered expected content.
5. This lecture gave theoretical knowledge. It is better they can share the practical experience too.
6. Excellent presentation.

B2

1. More practical examples needed.
2. Need to know more about how Thailand tackle pesticide issues in vegetables cultivation.
3. The material shared in the lecture was interesting, but it didn't quite match with what I expected based on the subject topic (B2).
4. The time wasn't sufficient to cover the entire content. Better to include more farmer field experience on IPM activities.
5. In this lecture didn't discuss the field practices and farmer adaptation to IPM practices.
6. Strong collaboration for field work.

A3

1. An informative lecture.
2. Applicable for GAP and IPNS
3. Lecture was clear and gave relevant information on IPNS and its application.

A4

1. Very informative and clearly explained.
2. An informative lecture and a good discussion.
3. An informative lecture.
4. It is better if more time spent on the Web application tool on fertilizer recommendation.

B3

1. Lecture was on pest identification and monitoring. The content of the lecture is important for refreshing

C1

1. Lecture was nice
2. Clearly explained
3. Good information

ATTACHMENT 3

C2

1. Better to stick with the topic, seen deviation from the topic.
2. Well organized lecture
3. Clearly explained and gave clear background how to audit GAP farms
4. Good information

C3

1. Properly organized

C4

1. Better if more QGAP and Thai GAP experience is discussed at the session

B. Cultural Visit

Visit to Wat Prakaew and Grand Palace

Interesting	Usefulness to work	Usefulness to oneself	Satisfaction on the place visited	Time allotted for the visit	Knowledge gained	Average
4.85	3.35	4.55	4.75	4.55	4.33	4.39

Comments

- Very well treated and thank you very much.
- It was a well-organized event. Thank you.
- Organized very well.
- Better if we can see inside.

C. Study Visit

	Interesting	**Usefulness to work**	**Usefulness to oneself**	**Satisfaction on the place visited**	**Time allotted for the visit**	**Knowledge gained**	**Average**
Community Rice Center Suphanburi (A)	5	4.74	4.74	4.74	4.79	4.84	4.81

ATTACHMENT 3

	Interesting	Usefulness to work	Usefulness to oneself	Satisfaction on the place visited	Time allotted for the visit	Knowledge gained	Average
Farmer's Field in Saraburi Province (A)	4.89	4.63	4.53	4.68	4.63	4.79	4.69
Study Visit to: Central Lab Thailand (B5)	4.90	4.42	4.58	4.79	4.58	4.79	4.68
Vegetable farm with experience working with export company, Pesticide-free vegetable farmers' group at Wasana Melon Farm (C)	4.84	4.63	4.79	4.74	4.79	4.84	**4.77**

Comments and suggestions

A (Community Rice Center Suphanburi)

1. Better if we could have seen paddy fields also
2. EXITING INFORMATION GATHERED DURINGVTHE VISIT.
3. It's very interesting; they nicely manage that
4. Very good arrangement

A (Farmer's Field in Saraburi Province)

1. Although most of the practices are almost similar to the practices in Sri Lanka, the maintenance of the field on good condition during a dry spell is rewarding.
2. Better to visit to see other crops too,like ,rice, banaba, orrange or vegetable
3. Well organized
4. Good information

B5 (Central Lab Thailand)

1. Well organized

ATTACHMENT 3

2. It was a very fruitfull visit. Better if more time availed to visit the labs.

3. It is interesting to see an accredited and recognized labor5facility in Thailand. We would like to have future collaborations with the lab to exchange information.

4. It is very interesting to visit such huge laboratory facility. The way proceed with the systems are much important for us to implement

5. Very good opportunity for us

6. These kind of practical knowledge and field visits are most important as the scientist

C (Wasana Melon Farm)

1. Great visit, though it's bit far away

2. Better to add vegetable farm to study visit.

3. Well organized

Attachment 4 - Documentation

Opening Ceremony

At Tan King room, Training building, National Agricultural Extension and Training Center, Nakhon Pathom

7th May 2024



Attachment 4 - Documentation

Classroom Session (Lecture/Discussion)

May 7th

 Overall experiences of issues, solutions of IPNS in Thailand	 Overall experiences of issues, solutions of IPNS in Thailand
 Introduction to nutrient management for crop production (field crop, vegetable and fruit tree).	 Overall experiences of issues, solutions of IPM approaches in Thailand as an introduction
 Introduction of user-friendly guide for farmers of pest identification and control packages / tools in Thailand	 Group photo

Attachment 4 - Documentation

Classroom Session (Lecture/Discussion)

May 8th

 Case study for nutrient management package for maximize profit for crop (rice) base on chemical fertilizer.	 Case study for nutrient management package for maximize profit for crop (rice) base on chemical fertilizer.
 Integrate nutrient management or site-specific nutrient management (microbial - organic - chemical fertilizer).	 Introduction of rapid test kits for plant disease identification which are popular in Thailand
 Introduction of rapid test kits for plant disease identification which are popular in Thailand	 Introduction of pesticide information management system on digitalizing registration of companies and products, issuance of import licenses, licensing dealers and service companies, etc.

Attachment 4 - Documentation

Cultural Visit

Temple of Emerald Buddha (Wat Phra Kaew) and Grand Palace, Bangkok

May 9th








Attachment 4 - Documentation

Study Visit

Observation of pesticide residues analytical facilities

At Central Laboratory (Thailand) Company Limited BKK

May 10th








Attachment 4 - Documentation

Study Visit

Community Rice Center, Supanburi Province and Farmer field in Supanburi province

May 11th



Attachment 4 - Documentation

Classroom Session (Lecture/Discussion)

May 13th

 Promote of the GAP system for business sector	 Promote of the GAP system for business sector
 Promote of the GAP system for business sector	 Farm Data required by the GAP system
 Farm Data required by the GAP system	 Farm Data required by the GAP system

Attachment 4 - Documentation

Classroom Session (Lecture/Discussion)

May 14th

 Content of the personal safety required by the GAP system.	 Content of the personal safety required by the GAP system.
 Content of the personal safety required by the GAP system.	 Harvesting management and the concerned of the sanitary process in farm
 Harvesting management and the concerned of the sanitary process in farm	 Harvesting management and the concerned of the sanitary process in farm

Attachment 4 - Documentation

Study Visit

Vegetable farm with experience working with export company, Pesticide-free vegetable farmers' group At Farm Fresh by Wasana Melon Farm

May 15th








Attachment 4 - Documentation

Closing Ceremony and Certificate conferment













2.3 Activities related to output 3

Attachment-27

Details of TOT and Farmer Training

Training Methodology of the SAFE Project

The safe use of pesticides and fertilizers involves large amount of knowledge and practice. Taking into account of the capacity of two key players namely extension officers and farmers in promoting safe and appropriate use of pesticides and fertilizers, it is essential to carefully develop a training methodology. Thus the training methodology that was elaborated and tested by the SAFE project is described in this document.

In the context of DOA and PDOAs, there are 2 levels of extension officers; SMOs and AIs. SMOs being attached to administrative offices such as Deputy Director's Offices and Segment Offices oversee the AIs who are directly responsible of training and extension activities in respective AI ranges. The SAFE project identified SMOs to be trained as Master Trainers (MTs) and AIs as Farmer Trainers (FTs) in capacity building of extension officers and in the process of training of farmers. Accordingly 3 types of training were identified; Master Trainer training, Farmer Trainer training and Farmer training.

While FTs were identified as trainers for Farmer training, MTs were identified as trainers for Farmer Trainer training. The experts of DOA working on subjects related to pesticides, fertilizers, and Good Agriculture Practices served as trainers for Master Trainer training. Further, a follow up training for MTs and FTs was conducted at the end of these 3 types of training to capture the lessons learned during 3 types of training and to fill the knowledge gaps. The Fig. 1 illustrates the entire training arrangement.

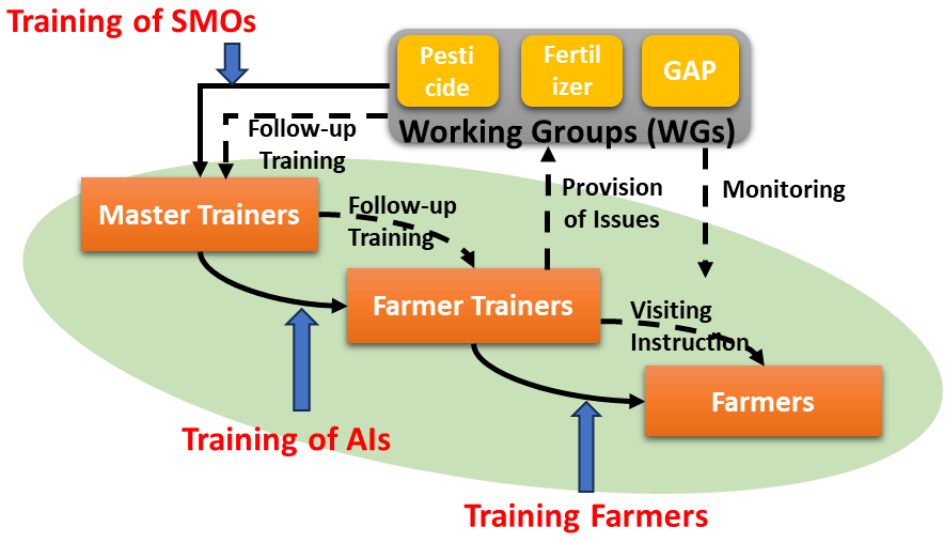


Fig. 1: Entire training arrangement for capacity building of extension officers and farmers on safe use of pesticides and fertilizers.

1. Master Trainer training

SMOs being the overseers of AIs must receive quality training to train AIs. As such, training content as well as training delivery should be carefully arranged. Accordingly, the Project facilitated the preparation of well-organized training for SMOs.

i. Structure of Master Trainer training

This training was comprised of 4 subjects to raise understanding centered on 3 aspects in safe and appropriate use of pesticides and fertilizer namely fertilizer, pesticides and good agricultural practices, and a lecture to build training capacity of the trainees. The technical content for all subjects was included in the 106 page large Training Text Book prepared in Sinhala and English languages. Cover page of the book is shown in Fig. 2.

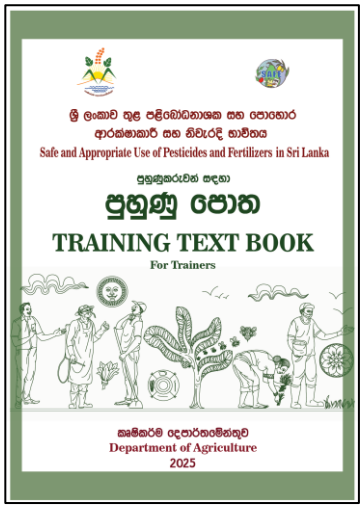


Fig. 2: Cover page to the Training Text Book

ii. Master Trainer selection and completion of training

MTs were selected according to following procedure.

1. Under the direction of the Provincial Director of Agriculture, the Deputy Director nominated 5 candidates according to the criteria given below in a long list for each district.
   - The candidates should be Subject Matter Officers (SMOs) who work in area where vegetable and/or fruits cultivation are prominent.
   - One of the candidates should be the one already identified as District Support Officer of the SAFE project.
   - In Districts where the target area overlaps with the JICA SHEP & SSC project, at least 1 of the candidates shall be the same SMOs as the JICA SHEP & SSC project.
   - The candidates should be SMOs who are responsible and able to provide trainings to Farmer Trainers and follow the project instruction of reporting.
   - Equal or balanced representation of male and female is expected.
2. Working Group formed to coordinate training under the SAFE project selected 3 MTs per district based on the long list.

Training was held at the ISTI, Gannoruwa for 2 days as a residential program for 15 MTs selected from 5 districts; Anuradhapura, Puttlam, Matale, Nuwaraeliya and Badulla. Subjects were taught in several lectures by experts of DOA working on technical areas related to the above subjects.

iii. Evaluation of Master Trainer training

The effectiveness of the training was evaluated using a simple set of questions comprising of

10 questions. The answers for each question were to be given on a scale from 1 to 10 depending on the knowledge or skill level on the aspect relevant to each question. The evaluation sheet prepared for the evaluation showing the arrangement of questions, the answering structure and other information is shown in Fig. 3. All trainees filled the evaluation sheet at the beginning and at the end of the training.

Evaluation Sheet for Trainer Training

Name: _____ . SMO, AI, TA, Date _____ .

No.	Questions for Evaluation	Poor ⟷ Well
1	I know about the effects of pesticides on the environment and human health.	1 2 3 4 5 6 7 8 9 10
2	I know that over–application of fertilizers is having a negative impact on the environment and causing problems for health.	1 2 3 4 5 6 7 8 9 10
3	I know the efficacy of each fertilizer element and how to apply it.	1 2 3 4 5 6 7 8 9 10
4	I able to conduct soil diagnosis and calculate the amount of fertilizer application.	1 2 3 4 5 6 7 8 9 10
5	I know why plant diseases occur and what to do about them.	1 2 3 4 5 6 7 8 9 10
6	I know several options for pest control and can accurately advise farmers.	1 2 3 4 5 6 7 8 9 10
7	I know several methods of pest control other than pesticides and can advise farmers.	1 2 3 4 5 6 7 8 9 10
8	I can explain why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.	1 2 3 4 5 6 7 8 9 10
9	I can explain that record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.	1 2 3 4 5 6 7 8 9 10
10	I know several extension methods to farmers and are able to select, prepare and implement effective extension methods in line with farmers' needs.	1 2 3 4 5 6 7 8 9 10

Fig. 3: Evaluation sheet

iv. Agenda of MT training

The agenda of the training is given below.

Agenda of Master Trainer training

Day 01	
Opening session	
08.30 – 08.45	Registration
08.45 – 09.00	Welcome and objectives
09.00 – 09.15	Trainee pre evaluation
Lecturing session 1	
Time	Subject
09.15 – 10.15	**The influence of pesticides and fertilizers on environment and human**
10.15 – 10.30	Tea
10.30 – 12.30	**Soil management and fertilizer use**
12.30 – 01.30	Lunch
01.30 – 03.00	**Pest management and pesticide use**
03.00 – 03.45	Tea
03.45 – 04.45	**Pest management and pesticide use – cont.**
Day 02	
Lecturing session 2	
08.30 – 10.30	**Production management by Good Agriculture Practices**
10.30 – 10.45	Tea
10.45 – 12.45	**Extension approach**
12.45 – 01.45	Lunch
Closing session	
01.45 – 02.15	Reflection and discussion

02.15 – 02.30	Trainee post evaluation
02.30 – 02.50	Training plan of SAFE Project
02.50 – 03.50	Planning of Farmer Trainer training

2. Farmer Trainer training

Farmer Trainers must be well knowledgeable in order train farmers. Thus, the project facilitated comprehensive training for FTs too.

i. Structure of Farmer Trainer training

For effective training, the structure of the training was as same as training for MTs, i.e. same subjects, same technical content, same Training Text Book, similar evaluation and same agenda.

ii. Farmer Trainer selection and completion of training

FTs were selected according to following procedure.

1. The MTs nominated 15 candidates in long list (Table 1) adhering to the criteria given below and approved by the Deputy Director in each district.
   - The candidates should be AIs or TAs who work for an AI range on the basis of one per range, where vegetable and/or fruits cultivation are prominent
   - In Districts where the target area overlaps with the JICA SHEP & SSC project, at least 5 of the candidates shall be the same AIs/TAs as the JICA SHEP & SSC project.
   - The candidates should be AIs or TAs who are responsible and able to provide trainings to farmers and follow the project instruction of reporting)
2. Working Group formed to coordinate training under the SAFE project selected 10 FTs per district based on the long list.

Table 1: Long list of candidates of Farmer Trainers

No.	Name of the AI	AI range	Major crop group (Veg / Fruit)	Total service period (year)	Involvement of SAFE or SHEP (Yes or No)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Training was conducted at a convenient place such as DD Office or District Training Center in each district. The trainers were MTs in each district. MTs conducted one or more lectures

to cover all subjects. Some experts who conducted the lectures in MT training were present depending on the requests made by MTs to support them during Farmer Trainer training.

3. Farmer training

Farmer training is the most important part of training plan as they are the producers of safe food. Accordingly, the training was designed and conducted in a systematic way to enable the farmers to gain sufficient knowledge and skills.

i. Structure of Farmer training

Farmer training is comprised of 3 steps each having different activities enabling the farmer to gather knowledge, practice and solve problems ensuring the higher effectiveness. Accordingly, the structure is given below.

Day	Activity
Step-1 ($^1/_2$ day)	**Introduction** 【Part 1】 ● Creation of awareness on the importance of safe and appropriate use of pesticides and fertilizers. 【Part 2】 ● Discussion in each group (1 FT and 5 farmers) on selection of practice for Step-2 (practical)
Step-2 ($^1/_2$ day)	**Practical** ● Conducting the practical on the practice selected by FT and farmers during Part 2 of Step-1
Step-3	**Instructions** ● Giving instructions on farmer fields over a season to solve problems during adoption of practice

Step-1

Step-1 is comprised of 2 parts as a half a day activity at an extension office for 3-4 farmer groups from 3-4 FTs jointly by respective FTs under the supervision of relevant MT. The description of each part is given in Table 2.

Table 2: Description of Step-1

Part	Subject	Contents	Method	Material
Part 1	Awareness on the importance of safe and appropriate use of pesticides and fertilizers	• Health and environment hazard • Risk of using banned chemical • Importance of using PPE • Advantage of using record keeping • (Other if requested from MTs and FTs)	➢ Playing animations	✓ NAICC animation video
			➢ Describing posters	✓ SAFE posters ✓ CropLife posters
			➢ Role playing	✓ PPE kit
			➢ Demonstration	✓ Empty/dummy containers of banned chemicals
			➢ (Other)	
Part 2	Discussion in each group on selection of a	• Farmer's problems related to pesticides and fertilizers	1. Briefing by FT the objectives of exercise/identification of the most agreeable practice	✓ Format for the planning of Step-2

	training practice in Step-2 as practical	• Training practices in Step-2	2. Listing of farmer's problems - by farmers on cards - by FTs on a w/board 3. Grouping the problems by FTs 4. Prioritizing the problems by farmers 5. Tallying/matching with practices* 6. Agreeing on the most potential matching practice 7. Activity breakdown for implementation of the most potential practice	

* Practices are as below

1. Fertilizer application based on soil testing and improved nutrient management packages for selected crops
2. Fertilizer application in protected agriculture
3. Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards
4. Physical control of pest attacks caused by moths -Yellow light application
5. A package of field sanitation practices
6. Crop record keeping
7. Safe spraying of pesticides

Several materials are required to conduct the Step-1 as given in the column 'Materials'. It is expected that the MTs and FTs prepare them for their farmer training. However, the format for the planning of Step-2 is a standard one it is attached (Attachment 1).

Step-2

Step-2 is comprised of a half day activity in the field for a farmer group to be performed by the relevant FT in order to give a hands-on-experience / practical. The practice for practical is the one selected by farmer group during the discussion alias Part 2 of Step-1.

When conducting the practical, the activities the FT has to do and the materials to use for each practice are given below with the relevance of the practice in terms of farmer's problems.

Practice 1: **Fertilizer application based on soil testing and improved nutrient management packages for selected crops**

Farmer's Problems

- No response to yield by fertilizer applied
- Low yield and high cost on fertilizer in open field cultivation

Activity Breakdown

- Introduction of fertilizer application based on soil testing
- Soil sample collection
- Handing over soil samples to laboratory
- Understanding the soil testing result
- Application of fertilizer based on the soil testing result

Training Materials

- Handout on fertilizer application based on soil testing
- Guides on area specific nutrient management for capsicum, cabbage, and tomato prepared by SAFE

Practice 2: **Fertilizer application in protected agriculture**

Farmer's Problems

- Low yield and high cost in protected agriculture

Activity Breakdown

- Introduction of fertilizer application in different media
- Fertilizer application (solid fertilizer) in soil media
- Fertigation (soluble fertilizer) in soilless media

Training Materials

- Handout on fertilizer use for different cropping media

- KOPIA manual on media & nutrient management in protected house cultivation updated by SAFE

Practice 3: **Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards**

Farmer's Problems

- No skill on identification of pest and disease
- Blindly following instruction from pier farmer or pesticide seller etc.
- Unable to receive immediate instruction from relevant officers

Activity Breakdown

- Explanation on importance of skill on identification of pests and diseases
- Introduction of pictorial cards as a tool for identification
  -Identification practice at field by using pictorial cards
- Introduction of how to select appropriate pesticides
  -Using pictorial cards by farmers
  -Using recommendation manual by AIs

Training Materials

- Pictorial cards prepared by SAFE
- Pesticide recommendation manual prepared by SAFE
- Guide on sticky trap prepared by SAFE

Practice 4: **Physical control of pest attacks caused by moths - Yellow light application**

Farmer's Problems

- High damage, yield and quality loss caused by relevant moth on cabbage, brinjal, and okra
- High cost of pesticide usage against relevant moths

Activity Breakdown

- Introduction on yellow light application
- Understanding specification of the yellow light system
- Installation of the system
- Operation and maintenance of the system

Training Materials

- DOA Leaflet on yellow light application
- Technical material on yellow light application developed by SAFE
- Video on yellow light application developed by DOA and SAFE

Practice 5: **A package of field sanitation practices**

Farmer's Problems

- Severe and frequent incident of pests and diseases
- Early and continuous incident of pests and diseases
- Increasing cost of controlling pests and diseases

Activity Breakdown

- Discussion on "why differs from general field sanitation"?
- Importance of field sanitation practices
- A package of field sanitation practices of fruit as an example of Guava
- A package of field sanitation practices of vegetable as an example of Brinjal

Training Materials

- Handout on a package of practices for field
- Video on a package of practices for field sanitation developed by SAFE
- Technical material on field sanitation developed by SAFE

Practice 6: **Crop recordkeeping**

Farmer's Problem

- No idea about pesticides and fertilizer applied before
- No idea about how to manage cost of pesticides and fertilizer

Activity Breakdown

- Introduction of importance of crop recordkeeping
- Introduce and explain How to use the recordkeeping format
- Exercise on filling the recordkeeping format properly

Training Material

- Handout on importance of crop recordkeeping
- Finalized 2 types of crop recordkeeping format developed by SAFE
  - one format for beginner farmer
  - one format for any certification including SL GAP

Practice 7: **Safe and correct spraying of pesticides**

Farmer's Problems

- Having health problems due to unsafe spraying of pesticides
- Having suspicions on health risk due to pesticide use

Activity Breakdown

- Introduction on health risk by unsafe spraying of pesticides
- Techniques to be adapted
  - Safety kit (PPE)
  - Inspection of sprayer
  - Cleaning sprayer after use
  - (Others if necessary)

Training Materials

- Handout on health risk by unsafe spraying
- Posters prepared by SAFE
- Safety kit (PPE) for demonstration

Step-3

Step-3 is comprised of visiting each farmer by FT time to time over a period of a cropping season to solve the problems encountered by farmers when adopting the practice.

ii. Farmer training implementation strategy

In order to prepare the FTs to do the Farmer training in an effective way it is essential to make the FTs ready for it namely on how they should do the training and what they should train the farmers on. Accordingly, 2 events were arranged.

- Preparatory workshop
- Technical training

Preparatory Workshop

The purpose was to discuss and decide "Contents", "Methods", and "Materials" of Step-1 together with essential orientation and practical guidance ensuring that MTs and FTs were well-prepared and confident to engage effectively specially in the upcoming Step-1s. In order to ensure an effective workshop, following agenda was adopted.

Date:
Place:

08.30 – 09.00	*Registration*
09.00 – 09.10	*Welcome & objectives*
09.10 – 09.40	*Explanation on organizing farmer training*
09.40 – 10.00	*Tea Break*
10.00 – 12.30	*Practicing for conducting Step 1 of farmer training*
12.30 – 01.00	*Explanation on reporting (planning & implementation)*
01.00	*End*

Technical training

The purpose is to give technical information/ knowledge and practical skills of the practices listed for farmer training Step-2 so that MTs and FTs become competent enough to do the Step-2 (practical) to farmers. In order to ensure an effective training, following agenda was adopted. The training was arranged in Peradeniya and all lectures and practical were conducted by experts in the relevant areas drawn from research institutes of the DOA.

Date:
Place:

08.30 – 09.00	*Registration*

09.00 – 09.10 *Welcome & objectives*
09.10 – 09.40 *Fertilizer application based on soil testing*
09.40 – 10.00 *Fertilizer application in protected agriculture*
10.00 – 10.30 *Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards*
10.30 – 10.45 *Tea Break*
10.45 – 11.15 *Physical control of pest attacks caused by moths -Yellow light application*
11.15 – 12.00 *A package of field sanitation practices*
12.00 – 12.30 *Crop recordkeeping*
12.30 – 01.00 *Safe spraying of pesticides*
01.00 – 02.00 *Lunch Brake*
02.00 – 04.30 *Practical on Training Topics*
04.30 *End*

iii. Farmer selection and completion of training

Farmers were selected according to following procedure.

1. FT identifies 5 farmers according to following criteria
   - All 5 farmers are located in 1 village / tract
   - Farmers are involved in growing vegetables or fruits
2. MT approves it

FTs in each district conducted the farmer training as per the 3 step structure of Farmer training. They received the support of the MTs on preparation and implementation of the training.

iv. Monitoring of Farmer training

Farmer training was monitored using 2 criteria namely proper coordination with MTs by FTs for training and feed back to MTs by FTs after training as FTs were expected to conduct the training with the support of MTs.

The check list that was used to determine these 2 criteria is as follows.

Proper coordination	Feed back to MTs
If FTs inform / request from MTs before implementation of training ➢ the plan (date and purpose) of Step-2 and Step-3 training ➢ materials for the training ➢ technical information for the training ➢ participation for the training	If FTs report to MTs after implementation of the training ➢ how FTs facilitated farmer's understanding ➢ farmer's reaction in the training ➢ any improvement for next training

The information collection was done in the form of submissions by MTs during Assessment workshops that were held after completion of Step-2 in each district. Each MT was expected to present the above information according to a specific format (Attachment 2). The agenda of the assessment workshop was as follows:

Date:
Place:
08:30 – 09:00 *Registration*
09:00 – 09:15 *Welcome & Objectives*
09:15 – 11:30 *Presentations by MTs (20 minutes each) and discussion (20 minutes each)*
11:30 – 12:00 *General discussion and Closing*

iv. Evaluation of Farmer training

Evaluation of Farmer training was done once Step 3 was half way through using questionnaire survey. Questionnaire is attached as Annexure 3. The questionnaire collects both base line and end line data at the same time enabling to evaluate the training. Each FT surveyed all the farmers trained by him in this questionnaire survey. Project collected all the questionnaires and responses were tabulated and analyzed. A report was prepared.

4. Follow-up training

After completion of all training, the follow-up training was organized to further enhance the training capacity of the MTs and FTs through reviewing the entire training arrangement in terms of identifying issues/problems and good/positive things, background/reasons for those, and suggestions for improvements to training contents and activities. Explanation on results of the farmer training evaluation and a lecture on further information relevant to training theme were also included into the training. In order to ensure an effective training, following agenda was adopted. The training was arranged in Peradeniya.

Date:
Place:

08.30 – 09.00	*Registration*
09.00 – 09.10	*Welcome & objectives*
09.10 – 09.40	*Results of Farmer Training evaluations*
09.40 – 10.10	*Lecture*
10.10 – 11.30	*District-wise group discussion on Training* ✓ *Issues/problems and good/positive things* ✓ *Background / reasons for issues/ problems and good/positive things* ✓ *Suggestions for improvement*
11. 40 – 01.20	*Presentation of outcomes and discussion*
01.20 – 01.30	*Recap and Closing*

Attachment 1:

Planning Format for Farmer Training Step-2 (To be used during Farmer Training Step-1)

District:_____ AI Range:_____ Date of Step 1:_____

1. Name/s of Farmer Trainer and Farmers

Farmer Trainer	Farmer

2. Farmer's problems (grouped) related to safe and appropriate use of pesticides and fertilizers, and order of importance/potential – pl. mark as A, B, C, … starting with most important group

Group 1	Group 2
Group 3	Group 4
Group 5	Group 6

3. Most potential practice (selected from the list on other side of the page):

……..……

4. Plan for Step-2 (practical)

Date: Location: Starting time:

No.	Activity Description	Materials/Stationaries to be arranged by the group
1		
2		
3		
4		
5		

Attachment 2:



Name of Master Trainer (MT):
Relevant Farmer Trainers (FTs) and AI ranges :

	Name of Farmer Trainer	Name of AI Range
1		
2		
3		
4		

Step 01 Training

General Details

Date of Training:
Location:

AI Range	No. of Farmers Participated	Practice/s Selected

Technical Details

Farmers' reactions	
Good points identified during the training	
Problems identified during the training	
Suggestion to improve the training	

Photos

1st Step 02 Training

General Details

Name of Farmer Trainer (FT):
AI range:
Date of Training:
Location:
Participants:

Farmers	Others (MTs / FTs / WG Members / Project Staff)
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Technical Details

Name of the practice	
Activity description	1.
	2.
	3.
	4.
	5.
Farmers' reactions	
Good points identified during the training	
Problems identified during the training	
Suggestion to improve the training	

Photos

Thank you

Attachment 3:

Evaluation Sheet for Farmer Training & Practices

Province	
Date	
Farmer	
GAP	Yes (Type:) No
Interviewer	
Pesticide	
Q1.	Pesticide use
Answer 1-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 1-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q2.	Pesticide storage
Answer 2-1	Before Training (1) Inside house, (2) Storage outside, (3) Storage on farm, (4) Temporal huts
Answer 2-2	After training (1) Inside house, (2) Storage outside, (3) Storage on farm, (4) Temporal huts
Q3.	Personal Protected Equipment (PPE) use
Answer 3-1	Before Training (1) Mouth guard using cloth, (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hats, (7) Eye gurgle, **(8) No PPE** *More than one answer allowed
Answer 3-2	After training (1) Mouth guard using cloth, (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hats, (7) Eye gurgle, **(8) No PPE** *More than one answer allowed
Q4.	Disposal method
Answer 4-1	Before Training (1) To collection center, (2) Incineration, (3) Burying in the ground, (4) Disposal in river or pond, (5) In a disposal bag, (6) Disposal in farm field, (7) To collector *More than one answer allowed
Answer 4-2	After training (1) To collection center, (2) Incineration, (3) Burying in the ground, (4) Disposal in river or pond, (5) In a disposal bag, (6) Disposal in farm field, (7) To collector *More than one answer allowed
Q5.	Is it important to follow the indication on the label of pesticide bottle?
Answer 5-1	Before Training (1) Yes, really thought so, (2) Yes may be so, (3) No
Answer 5-2	After training (1) Yes, really think so, (2) Yes may be so, (3) No

Fertilizer	
Q6.	Fertilizer use
Answer 6-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 6-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q7.	Fertilizer storage
Answer 7-1	Before Training (1) Inside house, (2) Storage outside, (3) Storage on farm, (4) Temporal huts
Answer 7-2	After training (1) Inside house, (2) Storage outside, (3) Storage on farm, (4) Temporal huts
Q8.	Do you want to follow the recommended amounts of fertilizer by DoA?
Answer 8-1	Before Training (1) Yes, really thought so, (2) Yes may be so, (3) No
Answer 8-1	After training (1) Yes, really think so, (2) Yes may be so, (3) No
Others	
Q9.	Record Keeping
Answer 9-1	Before Training (1) Almost every time, (2) Sometimes, (3) None
Answer 9-2	After training (1) Almost every time, (2) Sometimes, (3) None
Q10.	Further Farmer Needs
Answer 10	(1) Methods of soil analysis and soil test fertilization, (2) How to make and apply compost to enhance soil fertilization, (3) New chemical fertilizer, (4) New organic fertilizer, (5) How to use pest resistant varieties, (6) How to use of pest registrant grafted seedlings, (7) Crop rotation methods, (8) Control soil humidity, (9) Crop protection in green house, (10) Soil sterilization methods, (11) Utilize natural enemy insect, (12) New agrochemical, (13) Mixed planting methods, (14) GAP information, (15) New bio pesticides, (16) Pesticides spraying methods, (17) How to use insects, (18) Crop rotation methods, (19) Others ( ) *More than one answer allowed
Q11.	Technology Package Use
Answer 11	(1) Crop handbook, (2)pictorial card, (3) Visualized pesticide recommendation, (4) Manuals provided by project (Manual Name:)
	(5) Others ( )
Q12.	Was this lectures and practices on the safe and proper use of pesticides and fertilizers fruitful?
Answer 12	(1) Yes, (2) Soso, (3)No. Reason( )

Attachment-28

Questionnaire survey result on changes of farmers' awareness and behavior

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Evaluation Results of Output 3 Training program

2025

Overview of Training Program

TOT procedure

2 days Training Program (ETC training)

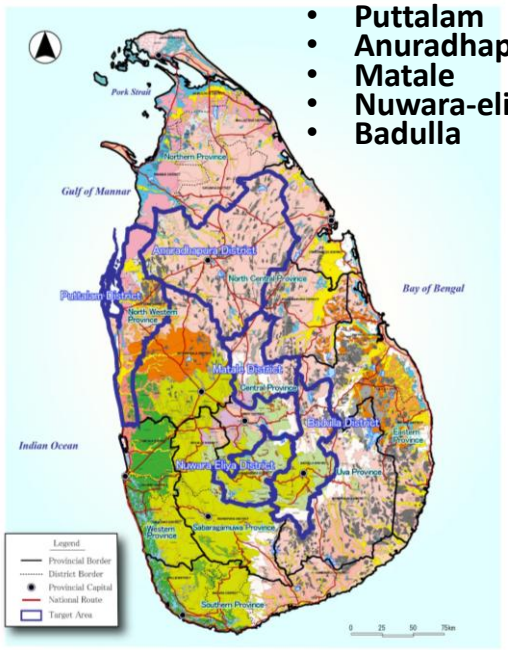


- Extension Training
- Technical Training
- Practice preparation training

3 Steps Training

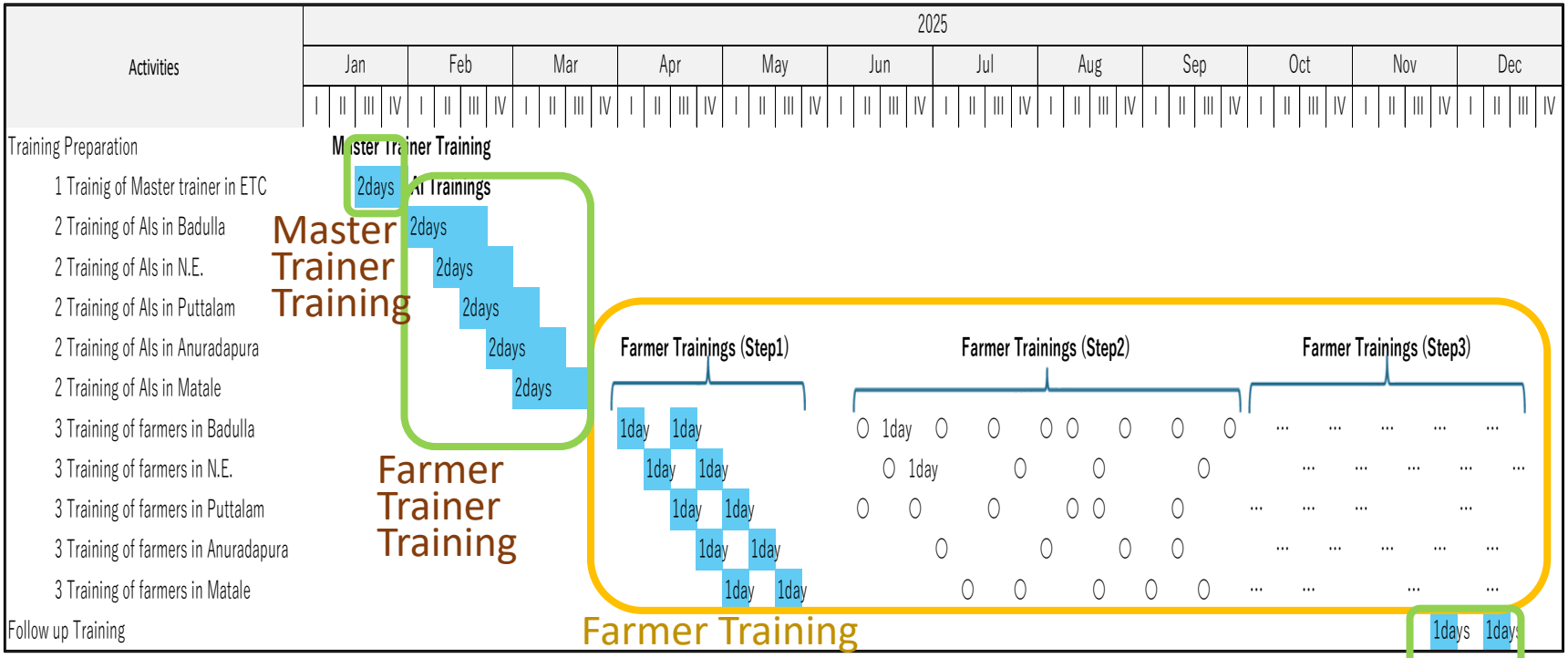
1. Introductory Lecture
2. Practice at field
3. Visiting Instruction

5 Target Districts



- Puttalam
- Anuradhapura
- Matale
- Nuwara-eliya
- Badulla

Schedule of Training program



Training materials

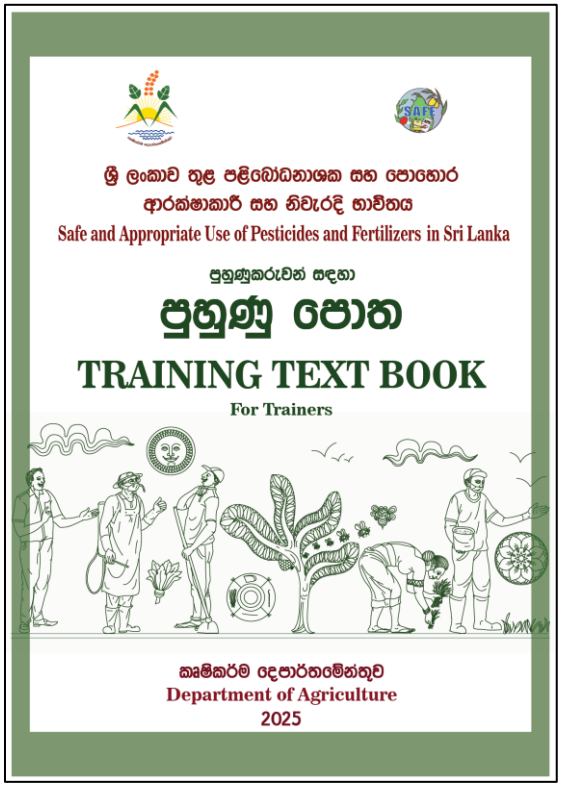
for everyone
especially Farmers



Recommendations, Manuals, Posters, Videos

Sinhala, Tamil & English

for Trainers



Textbook

Sinhala & English

Evaluation by Trainers

Before
Self evaluation
before training



After
Self evaluation
after training

Master Trainer Training
Farmer Trainer Training
2 days lectures

Evaluation Sheet for Trainer Training

Name: _____ . SMO, AI, TA, Date _____ .

No.	Questions for Evaluation	Poor									Well
1	I know about the effects of pesticides on the environment and human health.	1	2	3	4	5	6	7	8	9	10
2	I know that over-application of fertilizers is having a negative impact on the environment and causing problems for health.	1	2	3	4	5	6	7	8	9	10
3	I know the efficacy of each fertilizer element and how to apply it.	1	2	3	4	5	6	7	8	9	10
4	I able to conduct soil diagnosis and calculate the amount of fertilizer application.	1	2	3	4	5	6	7	8	9	10
5	I know why plant diseases occur and what to do about them.	1	2	3	4	5	6	7	8	9	10
6	I know several options for pest control and can accurately advise farmers.	1	2	3	4	5	6	7	8	9	10
7	I know several methods of pest control other than pesticides and can advise farmers.	1	2	3	4	5	6	7	8	9	10
8	I can explain why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.	1	2	3	4	5	6	7	8	9	10
9	I can explain that record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.	1	2	3	4	5	6	7	8	9	10
10	I know several extension methods to farmers and are able to select, prepare and implement effective extension methods in line with farmers' needs.	1	2	3	4	5	6	7	8	9	10

Evaluation by Farmers

Before
Interview via recall during visiting instruction

After
Interview during visiting instruction

Farmer Training
1.Introductory Lecture
2.Practice training
3.Visiting Instruction

Farmer Training Evaluation Sheet

District			Date	
AI Range				
Farmer				
Farmer Type	GAP farmer		If GAP farmer, GAP Type	
	Non-GAP farmer			
Interviewer				

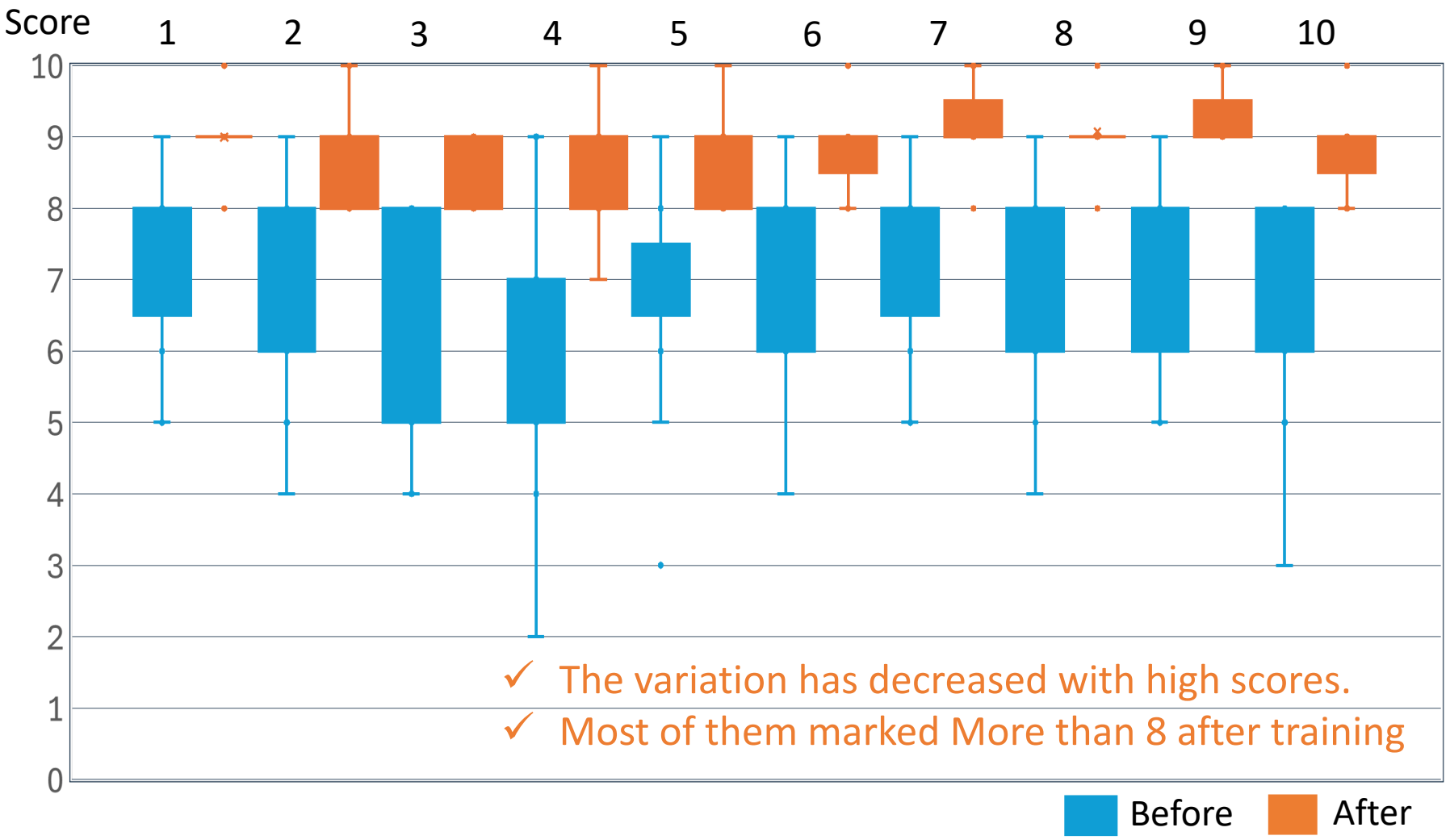
Pesticide	
Q1.	Pesticide use – Quantity/Amount
Answer 1-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 1-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q2.	Pesticide storage
Answer 2-1	Before Training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Answer 2-2	After training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Q3.	Personal Protective Equipment (PPE) use
Answer 3-1	Before Training (1) Mouth cover (using cloth), (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hat, (7) Goggle, (8) Standard PPE set (9) No PPE *More than one answer allowed
Answer 3-2	After training (1) Mouth cover (using cloth), (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hat, (7) Goggle, (8) Standard PPE set (9) No PPE *More than one answer allowed
Q4.	Container disposal method
Answer 4-1	Before Training (1) To collection center, (2) Burning, (3) Burying in the ground, (4) To river or pond, (5) In a disposal bag/container, (6) In farm field, (7) To collector *More than one answer allowed
Answer 4-2	After training (1) To collection center, (2) Burning, (3) Burying in the ground, (4) To river or pond, (5) In a disposal bag, (6) In farm field, (7) To collector *More than one answer allowed
Q5.	Understanding on the importance to follow the instructions on label of pesticide containers?
Answer 5-1	Before Training (1) Yes, really important, (2) Yes may be , (3) don't know
Answer 5-2	After training (1) Yes, really important, (2) Yes may be, (3) don't know

Fertilizer	
Q6.	Quantity of Fertilizer use
Answer 6-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 6-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q7.	Fertilizer storage
Answer 7-1	Before Training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Answer 7-2	After training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Q8.	Understanding on the importance to follow the recommended amounts of fertilizer by DoA?
Answer 8-1	Before Training (1) Yes, really important, (2) Yes may be , (3) don't know
Answer 8-1	After training (1) Yes, really important, (2) Yes may be , (3) don't know
Others	
Q9.	Record Keeping
Answer 9-1	Before Training (1) Almost every time, (2) Sometimes, (3) None
Answer 9-2	After training (1) Almost every time, (2) Sometimes, (3) None
Q10.	Further Farmer Needs
Answer 10	(1) Methods of soil analysis and soil test based fertilization, (2) How to make and apply compost to enhance soil fertility, (3) New chemical fertilizer, (4) New organic fertilizer, (5) How to use pest resistant varieties, (6) How to use of pest resistant grafted seedlings, (7) Crop rotation methods, (8) Control soil humidity, (9) Crop protection in green house, (10) Soil sterilization methods, (11) Utilize natural enemy insect, (12) New pesticides, (13) Mixed planting methods, (14) GAP information, (15) New bio pesticides, (16) Pesticides spraying methods, (17) Others ( ) *More than one answer allowed
Q11.	Technical Materials Use
Answer 11	(1) Crop handbooks, (2) Pictorial cards, (3) Visualized pesticide recommendation, (4) Manuals provided by project (Manual Name:) (5) Others ( )
Q12.	Were the practical/practices on the safe and proper use of pesticides and fertilizers fruitful?
Answer 12	(1) Yes definitely, (2) Yes may be, (3) No (Reason:)

Thank you for your cooperation.

Results of Evaluation

Master Trainer training-1



Results of Evaluation

Master Trainer training-2

Average score

✓ Average: 2.1 Score up!!

Question No.	1	2	3	4	5	6	7	8	9	10
Before	7.3	7.1	6.3	5.9	6.7	7.1	7.3	6.8	7.0	6.7
After	9.0	8.9	8.7	8.3	8.5	9.0	9.1	9.1	9.2	8.9
Score up	1.7	1.8	2.4	2.4	1.9	1.9	1.9	2.3	2.2	2.1

The average scores of No.3, 4, 8 and 9 have significantly increased.

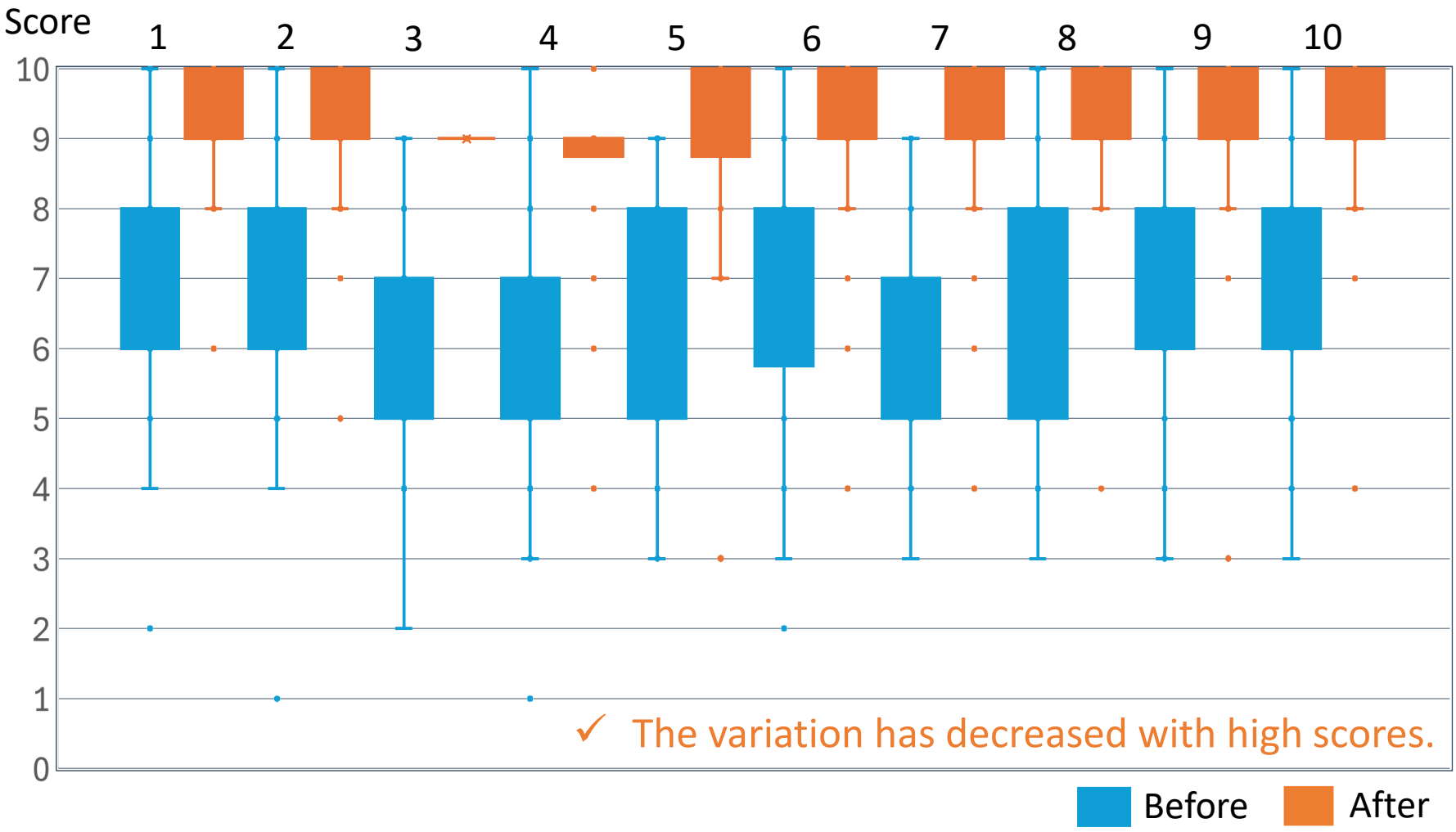
- No.3 the efficacy of each fertilizer element and how to apply it.
- No.4 the efficacy of each fertilizer element and how to apply it.
  No.8 the reason why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.
- No.9 the reason why record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.

The average scores of No.7, 8 and 9 were significantly high after the training.

- No.7 several methods of pest control other than pesticides and can advise farmers.
  No.8 the reason why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.
- No.9 the reason why record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.

Results of Evaluation

Farmer Trainer training-1



Results of Evaluation

Farmer Trainer training-2

Average score

✓ Average: 2.6 Score up!!

Question No.	1	2	3	4	5	6	7	8	9	10
Before	7.0	7.1	5.9	5.6	6.4	6.5	6.3	6.6	6.8	6.8
After	9.4	9.3	8.9	8.8	9.0	9.1	9.1	9.2	9.3	9.2
Score up	2.3	2.2	3.0	3.2	2.5	2.6	2.7	2.6	2.5	2.4

The average scores of No.3 and 7 have significantly increased.

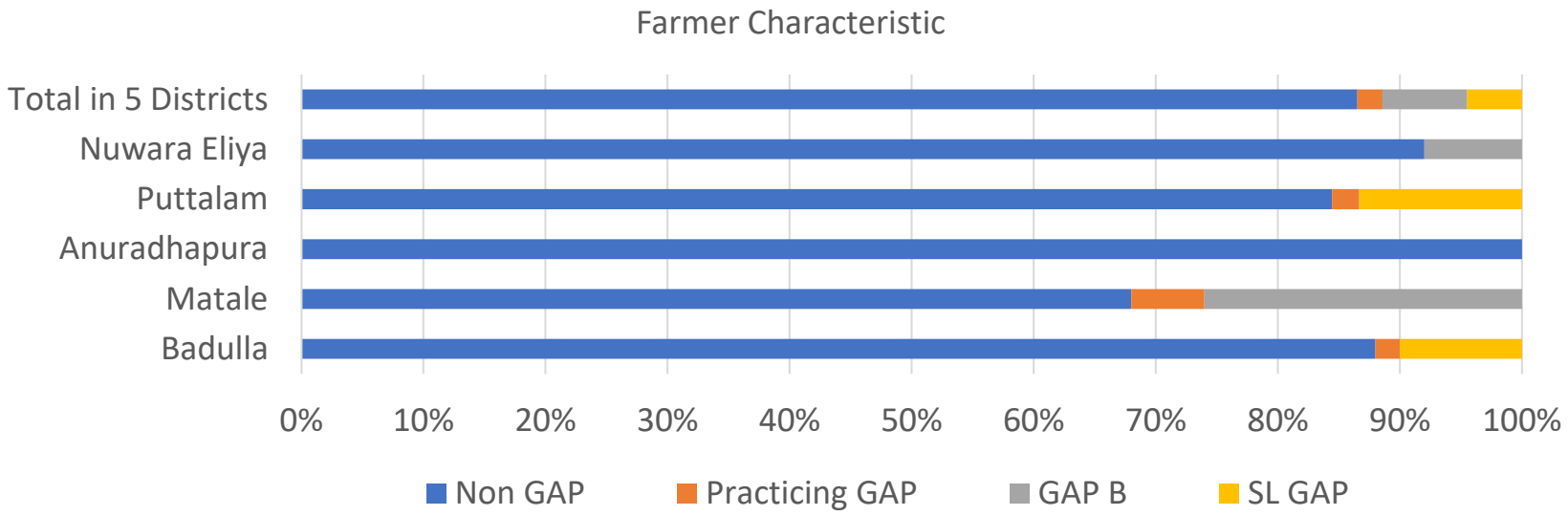
- No.3 the efficacy of each fertilizer element and how to apply it.
- No.7 several methods of pest control other than pesticides and can advise farmers.

The average scores of No.1, 2, 6, 7, 8 9 and 10 were significantly high after the training.

- No.1 the effects of pesticides on the environment and human health.
- No.2 over-application of fertilizers is having a negative impact on the environment and causing problems for health.
- No.6 several options for pest control and can accurately advise farmers.
- No.7 several methods of pest control other than pesticides and can advise farmers.
  No.8 the reason why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.
- No.9 the reason why record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.
- No.10 several extension methods to farmers and are able to select, prepare and implement effective extension methods in line with farmers' needs.

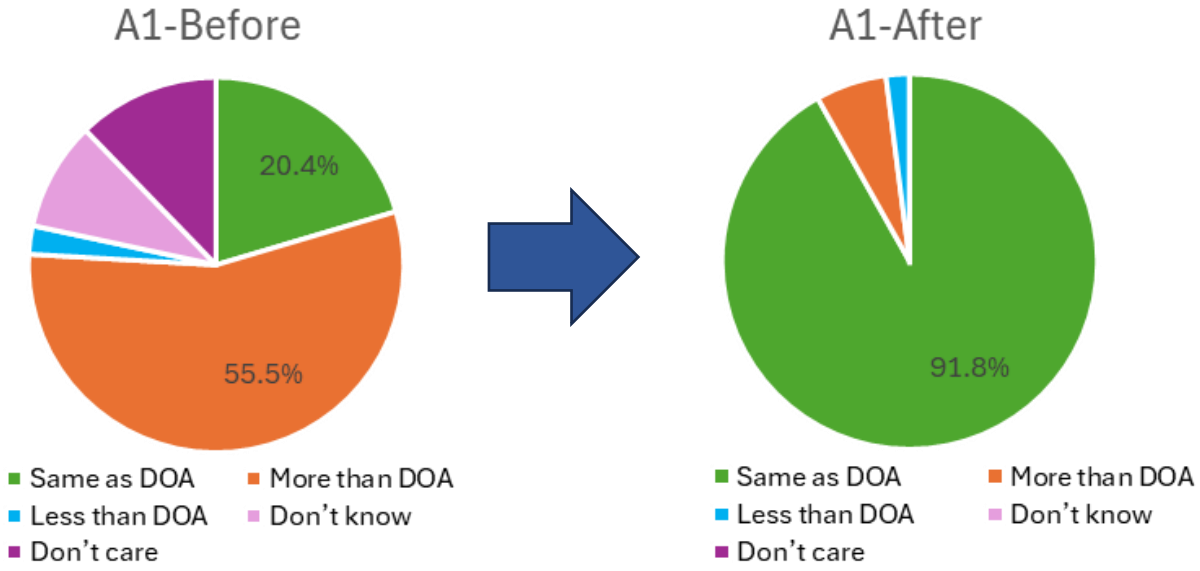
Results of Evaluation - Farmer Evaluation -

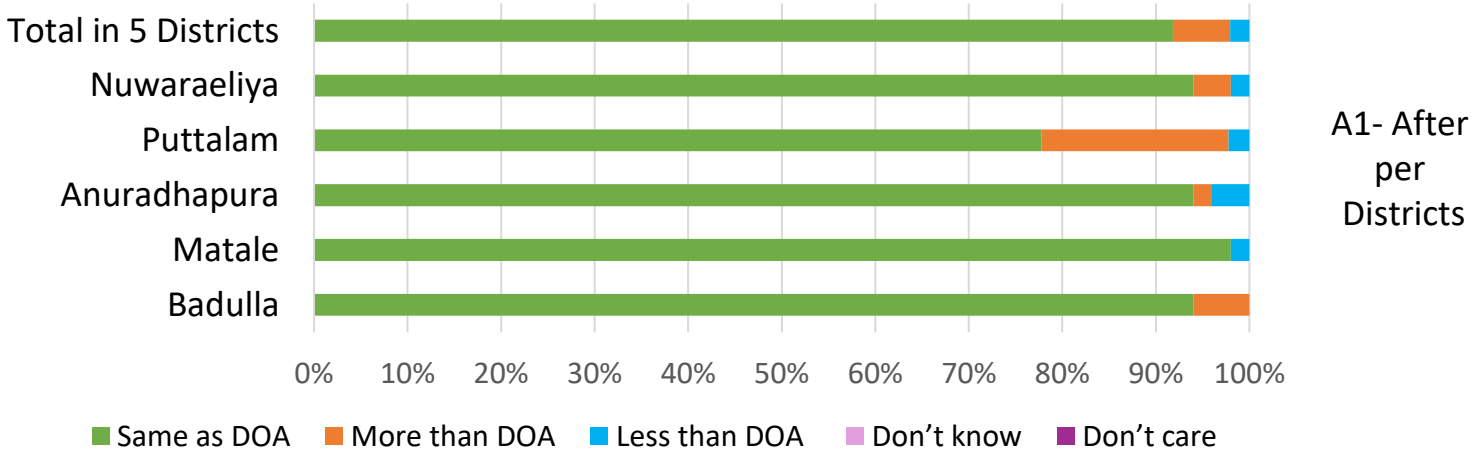
Characteristic of Farmers



	Badulla	Matale	Anuradhapura	Puttalam	Nuwaraeliya	Total
Non GAP	44	34	50	38	46	212
Practicing GAP	1	3	0	1	0	5
GAP B	0	13	0	0	4	17
SL GAP	5	0	0	6	0	11
Total	50	50	50	45	50	245

Results of Evaluation - Farmer Evaluation - **Pesticide Use**

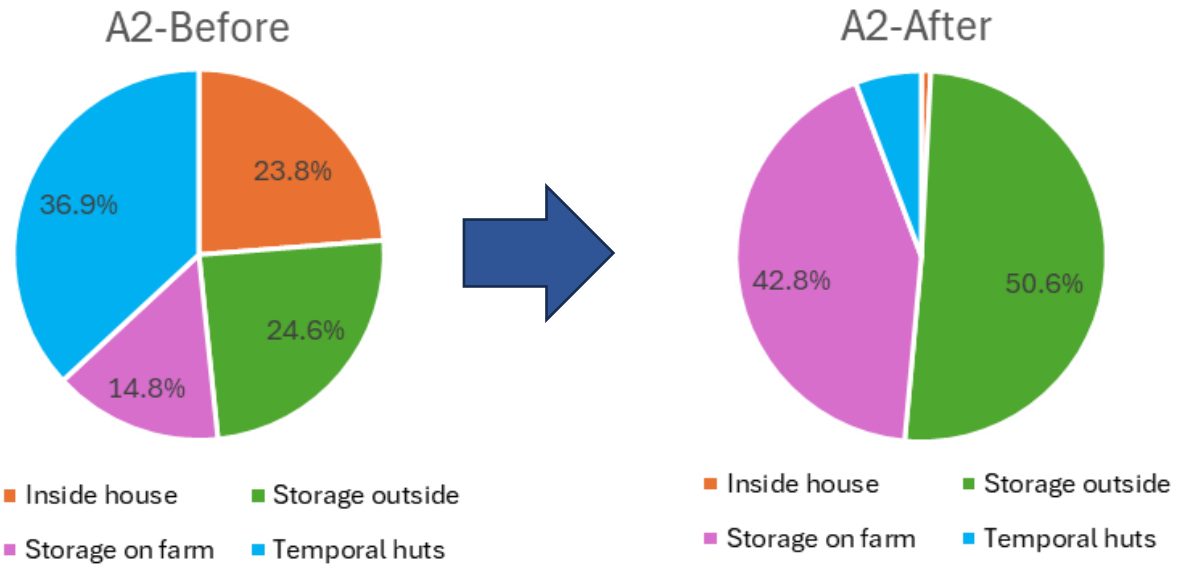


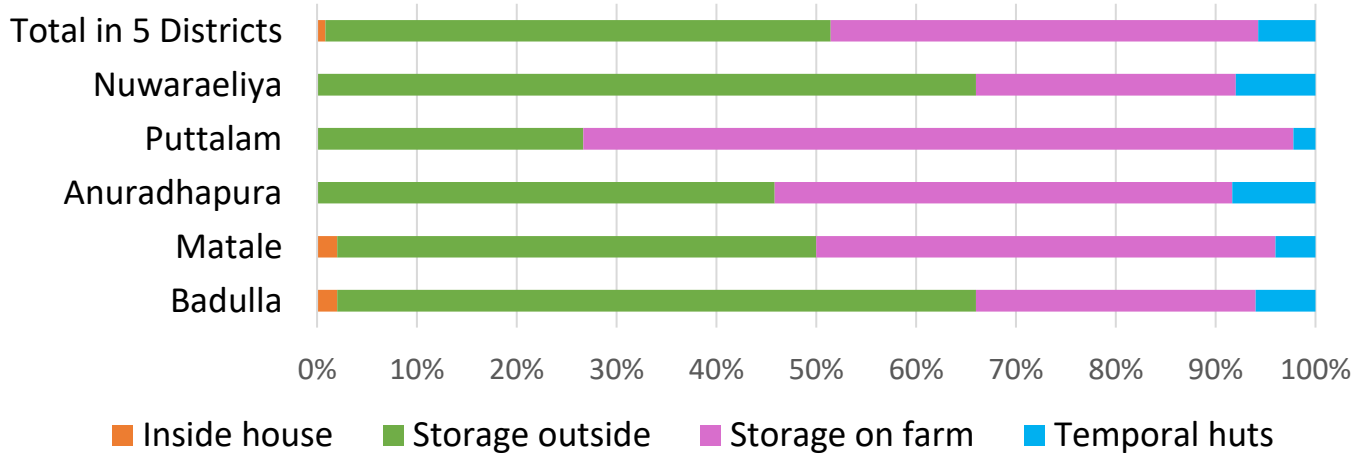


A1- After per Districts

Results of Evaluation - Farmer Evaluation -

Pesticide Storage

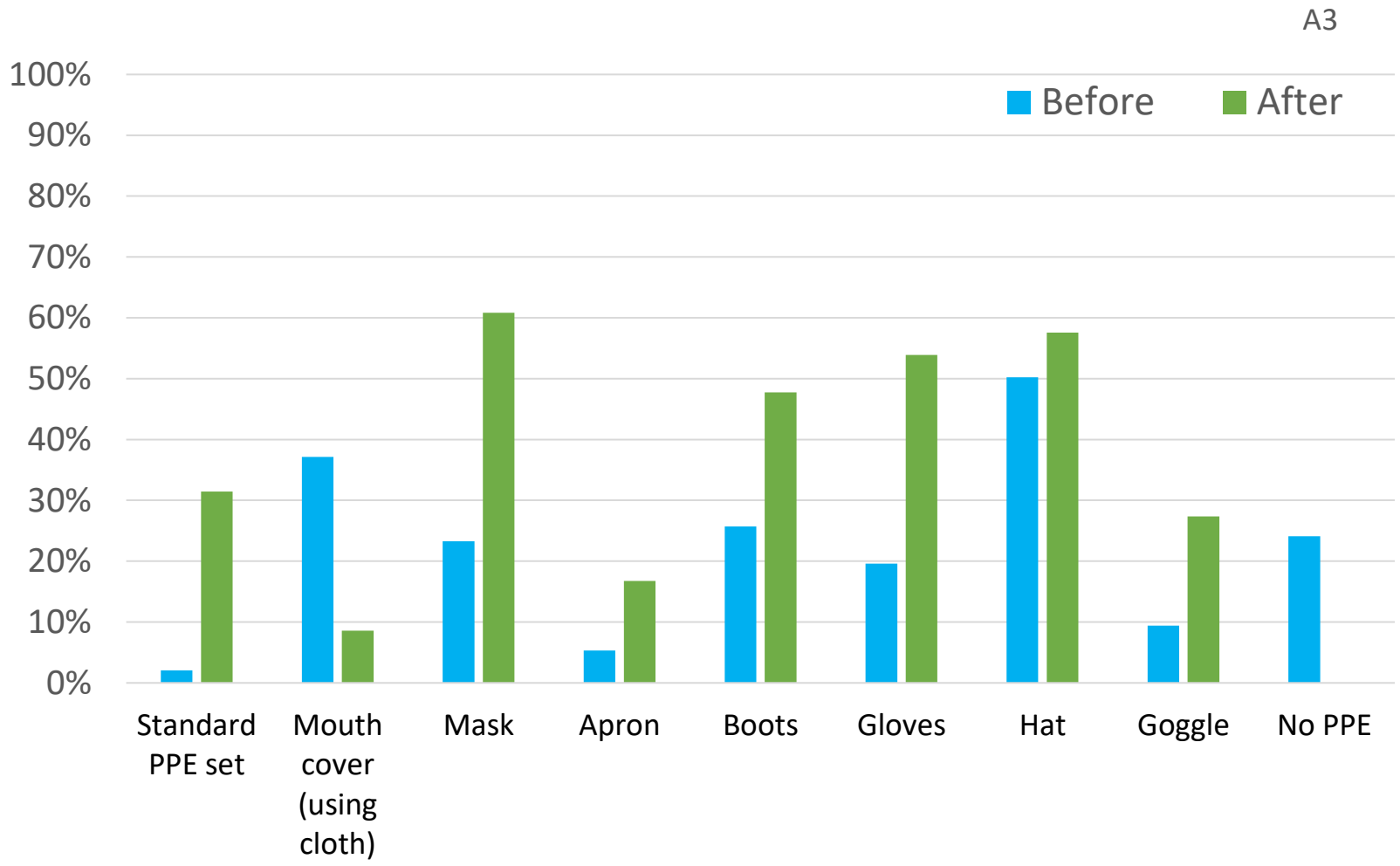




A2- After per Districts

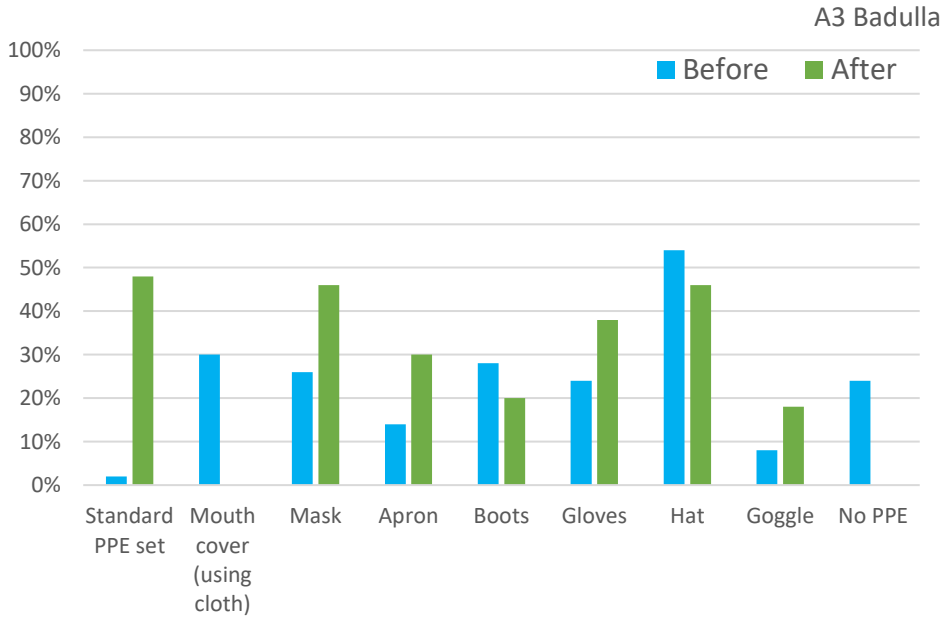
Results of Evaluation - Farmer Evaluation -

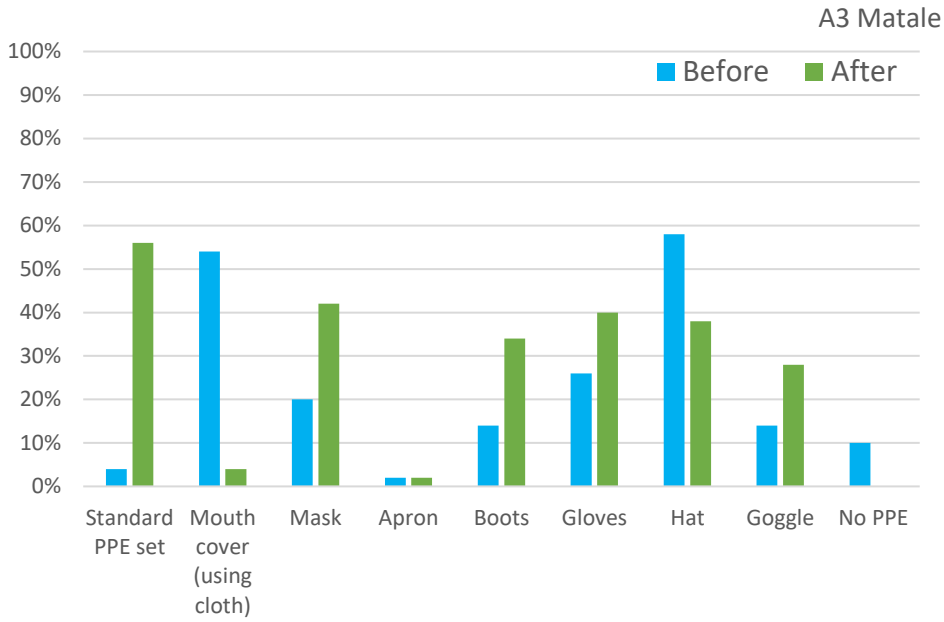
PPE Use



Results of Evaluation - Farmer Evaluation -

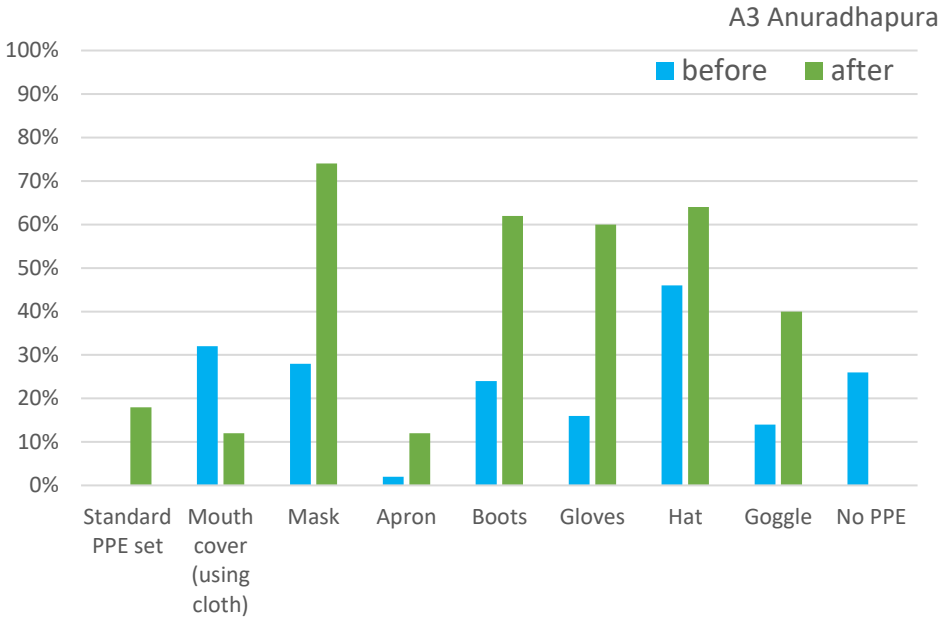
PPE Use per districts-1

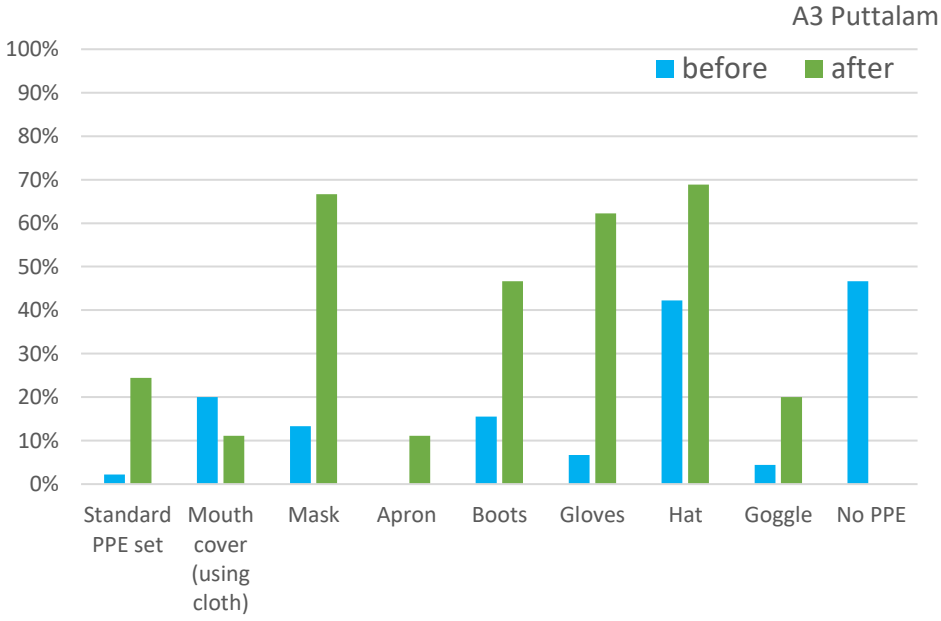




Results of Evaluation - Farmer Evaluation -

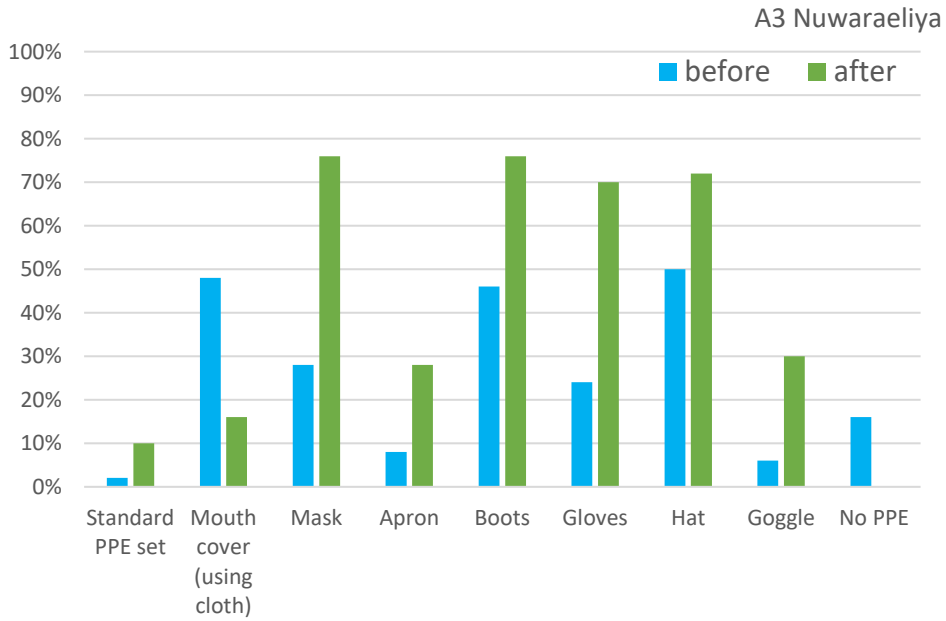
PPE Use per districts-2





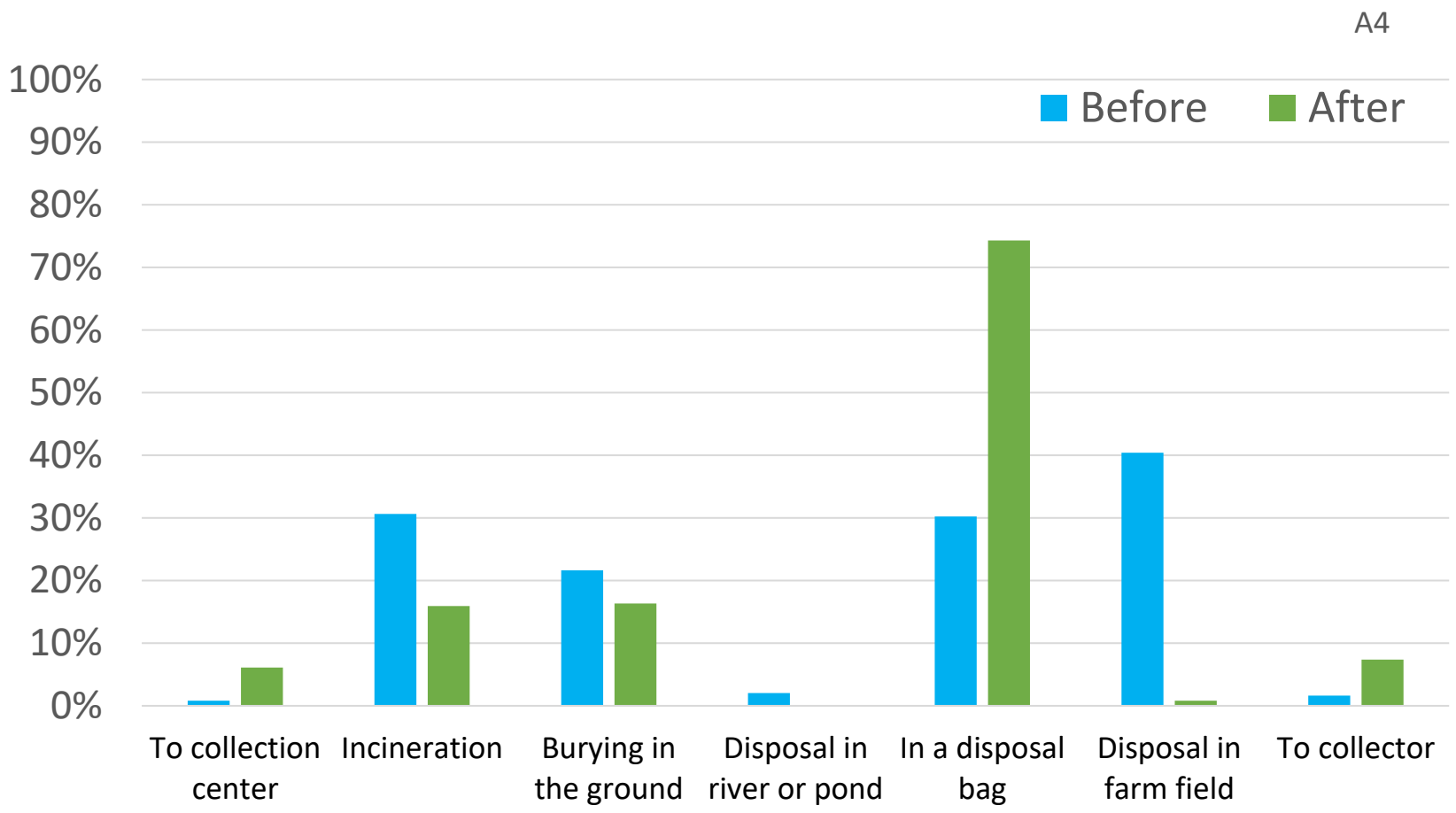
Results of Evaluation - Farmer Evaluation -

PPE Use per districts-3



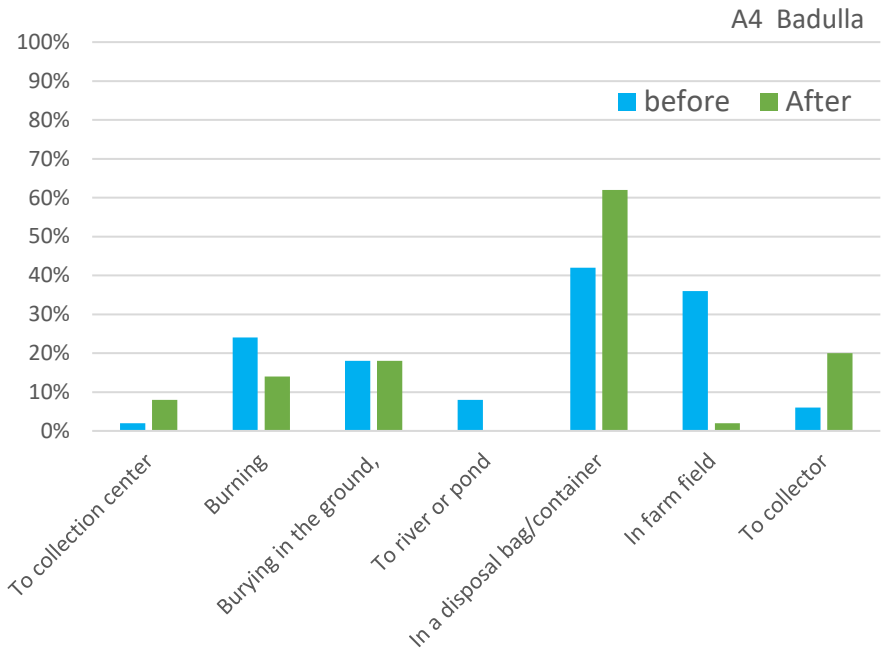
Results of Evaluation - Farmer Evaluation -

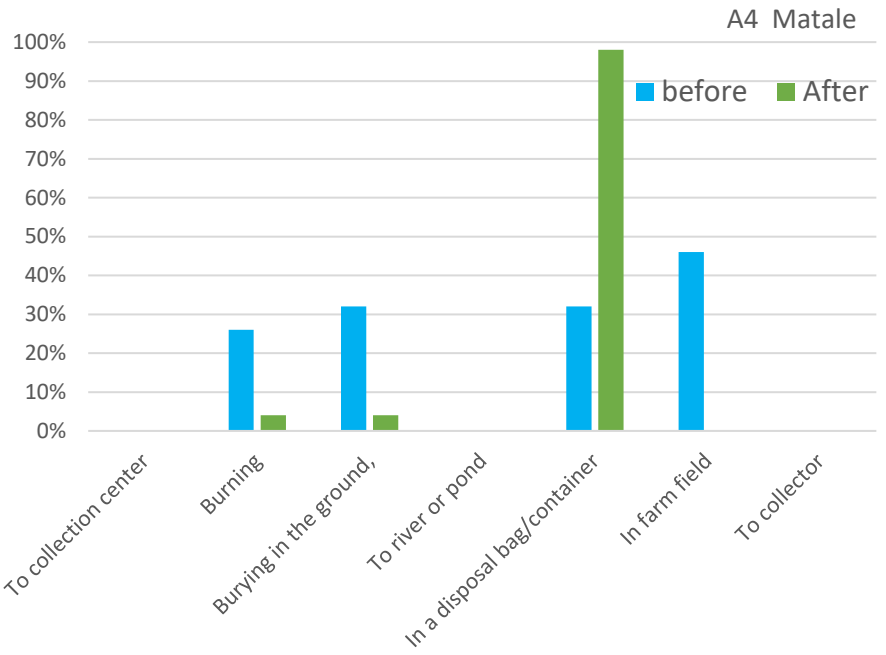
Container disposal method



Results of Evaluation - Farmer Evaluation -

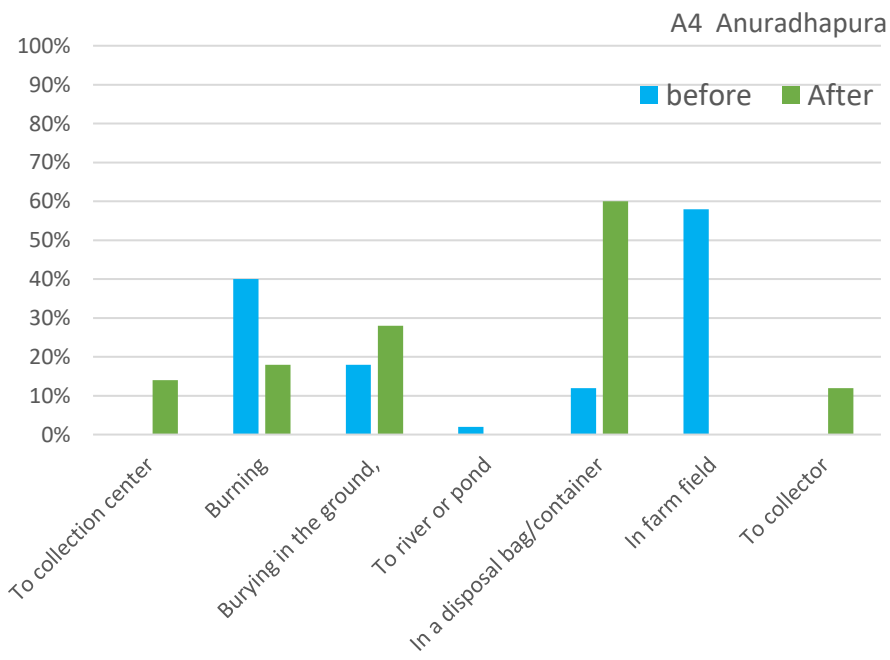
Container disposal method per districts-1

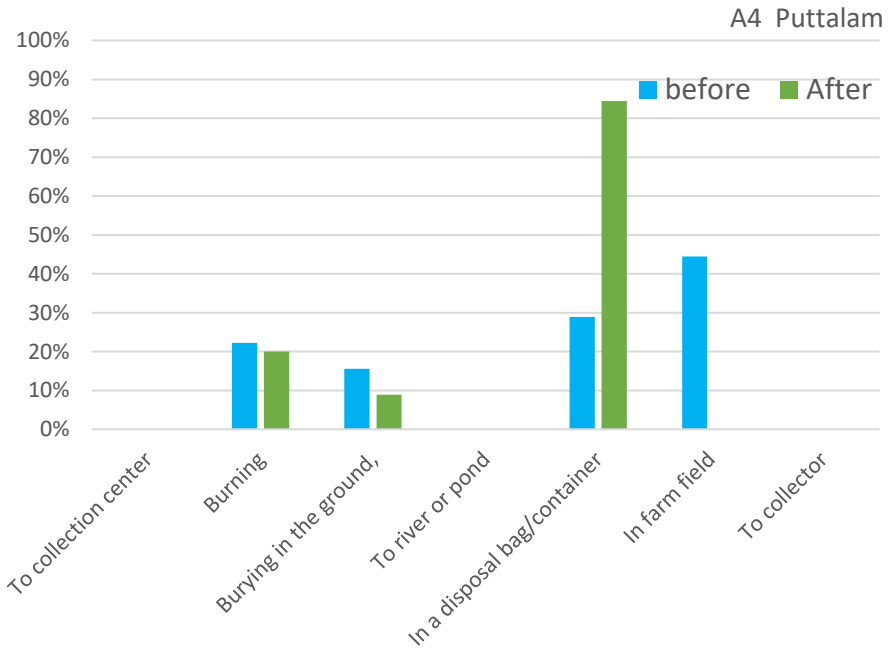




Results of Evaluation - Farmer Evaluation -

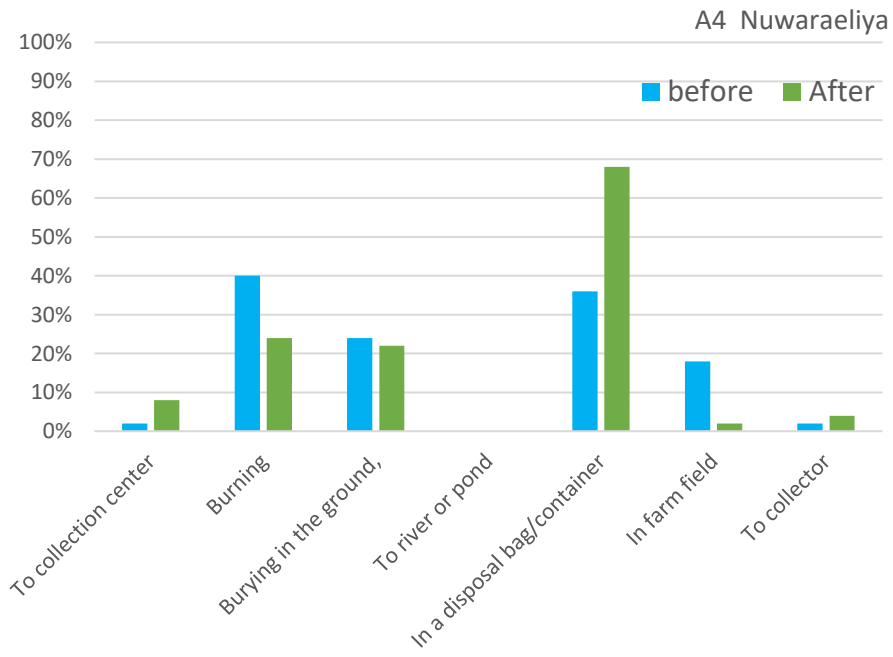
Container disposal method per districts-2





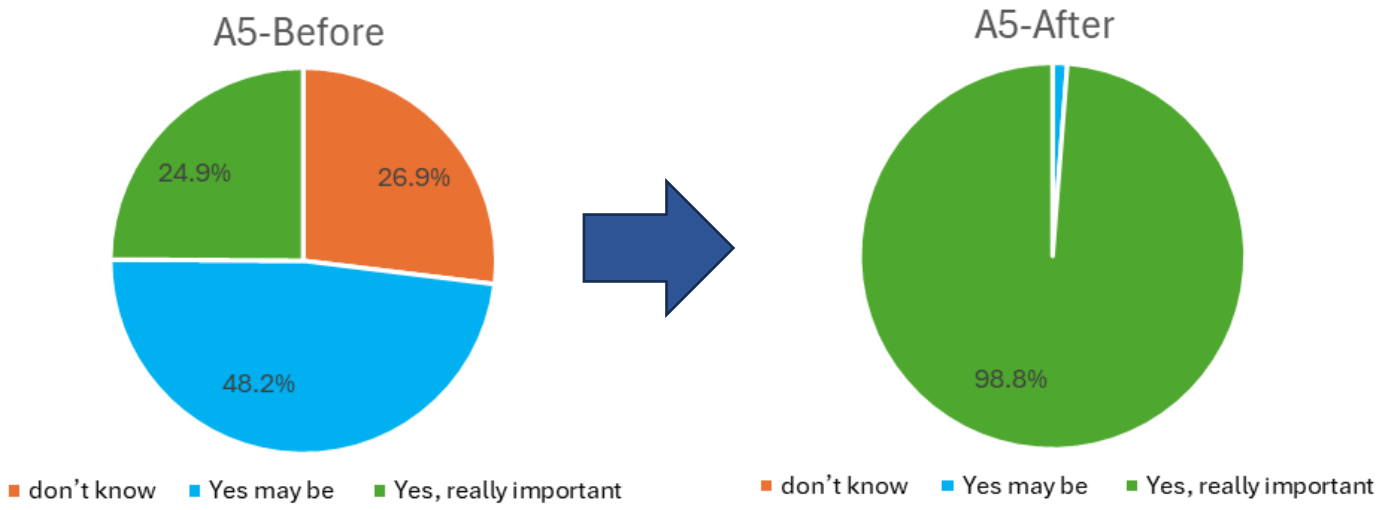
Results of Evaluation - Farmer Evaluation -

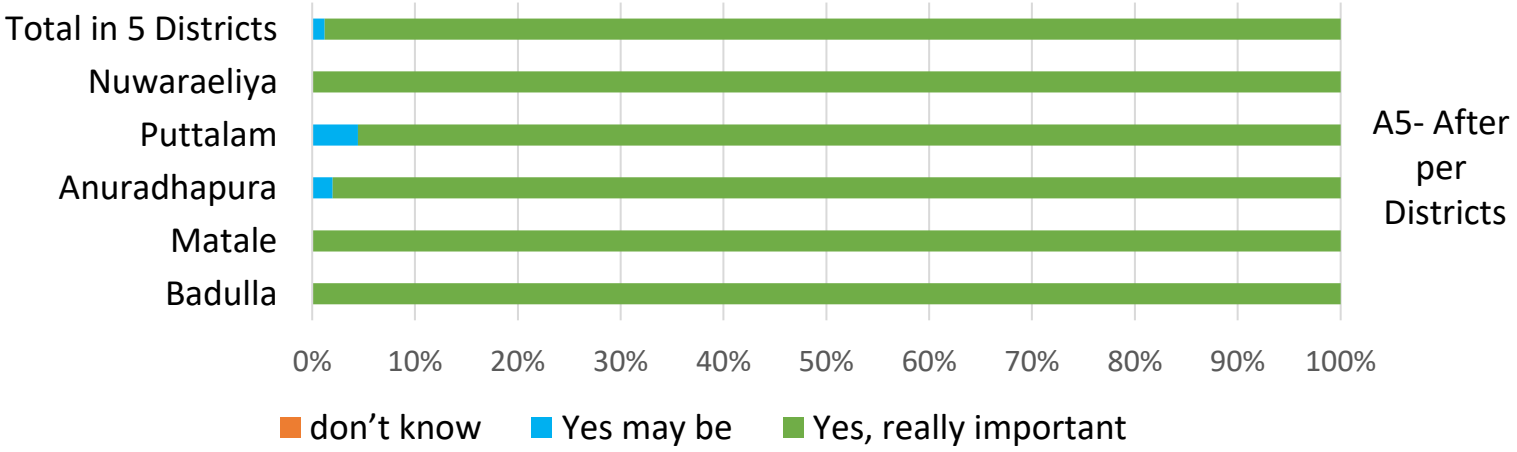
Container disposal method per districts-3



Results of Evaluation - Farmer Evaluation -

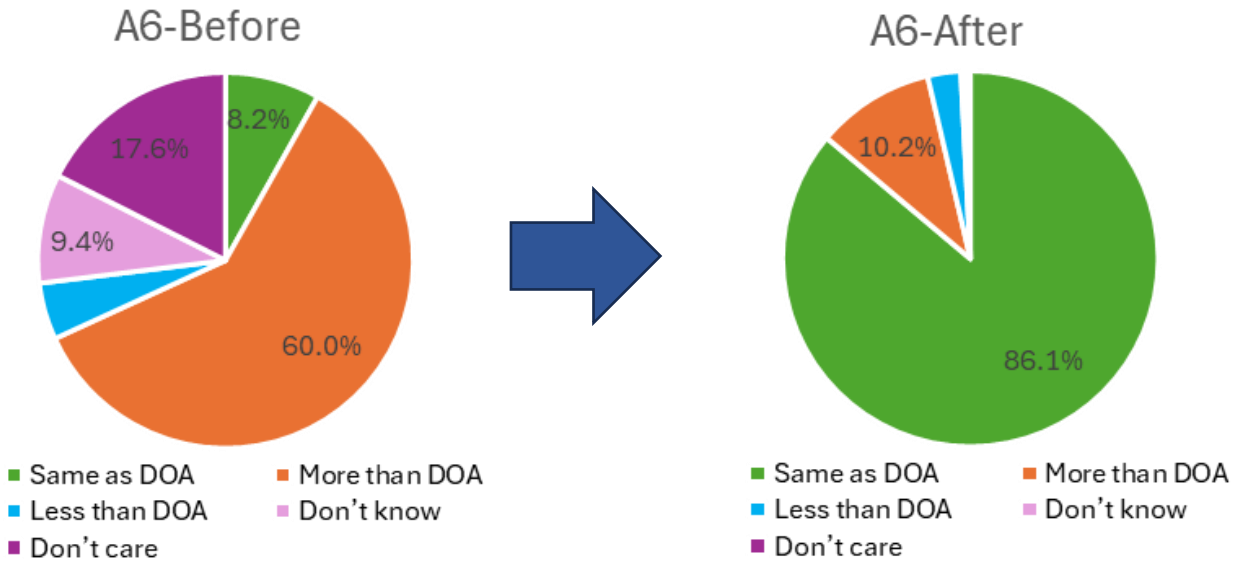
Importance of Pesticide Label confirmation

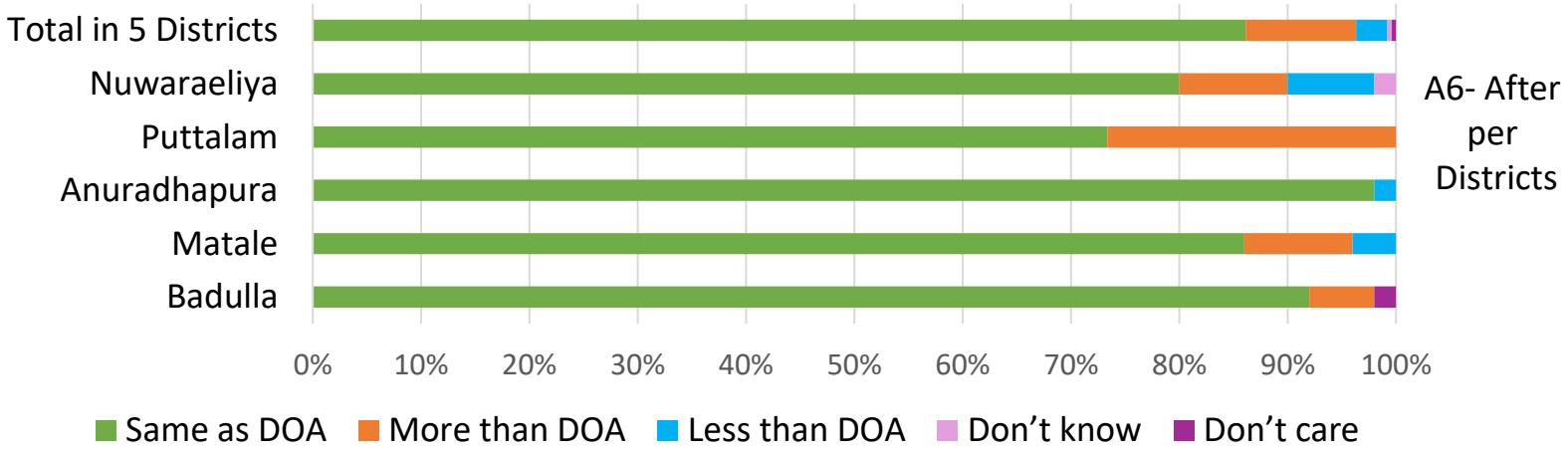




Results of Evaluation - Farmer Evaluation -

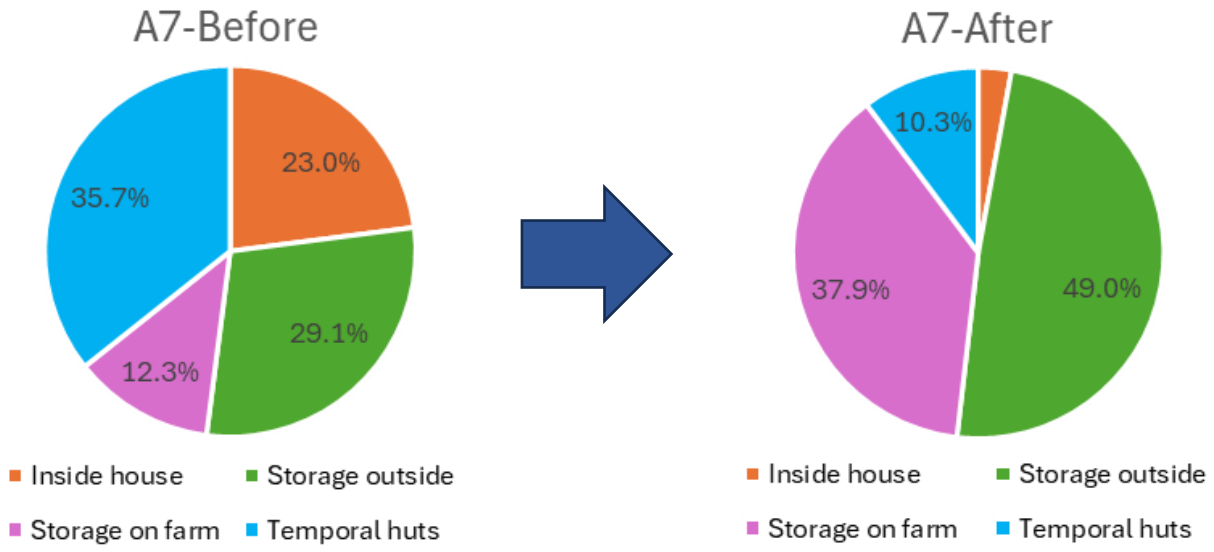
Fertilizer Use

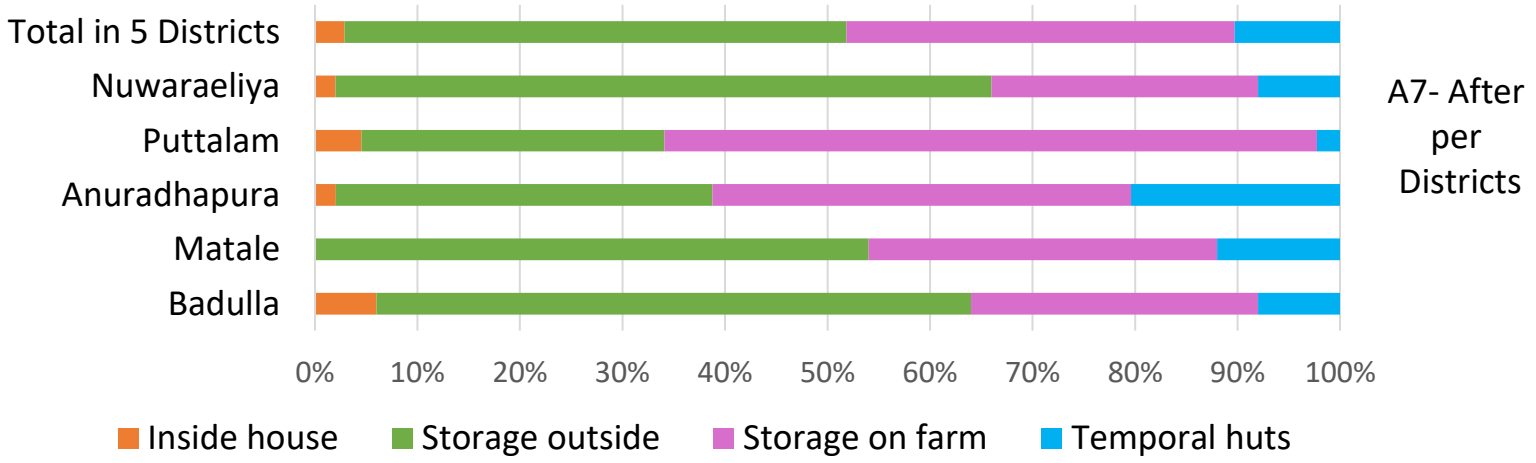




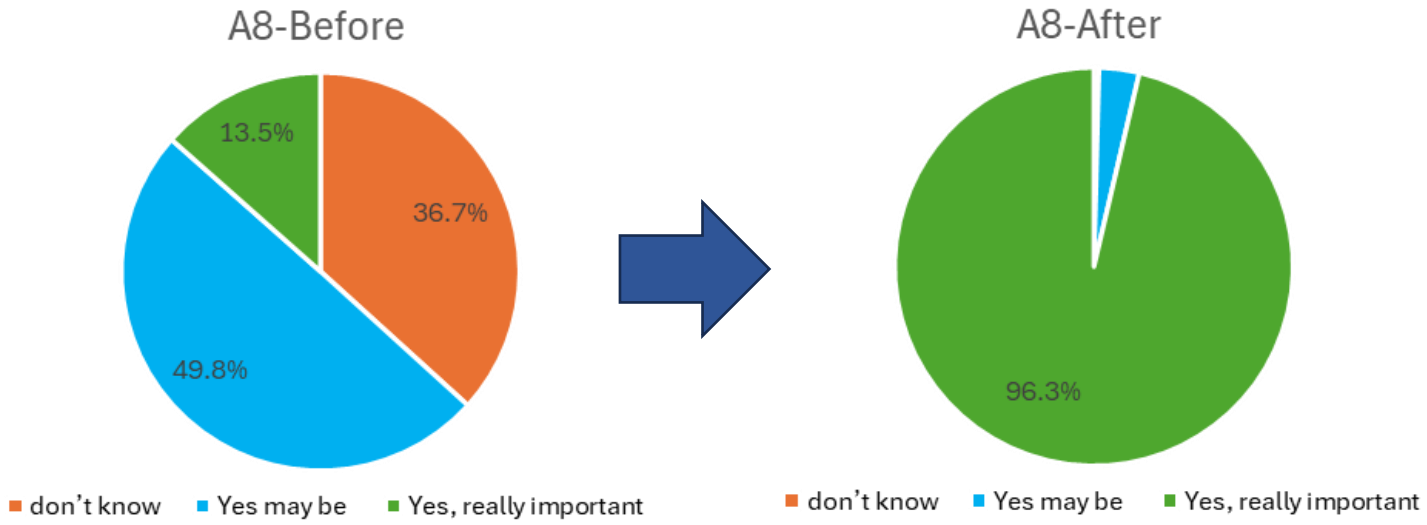
Results of Evaluation - Farmer Evaluation -

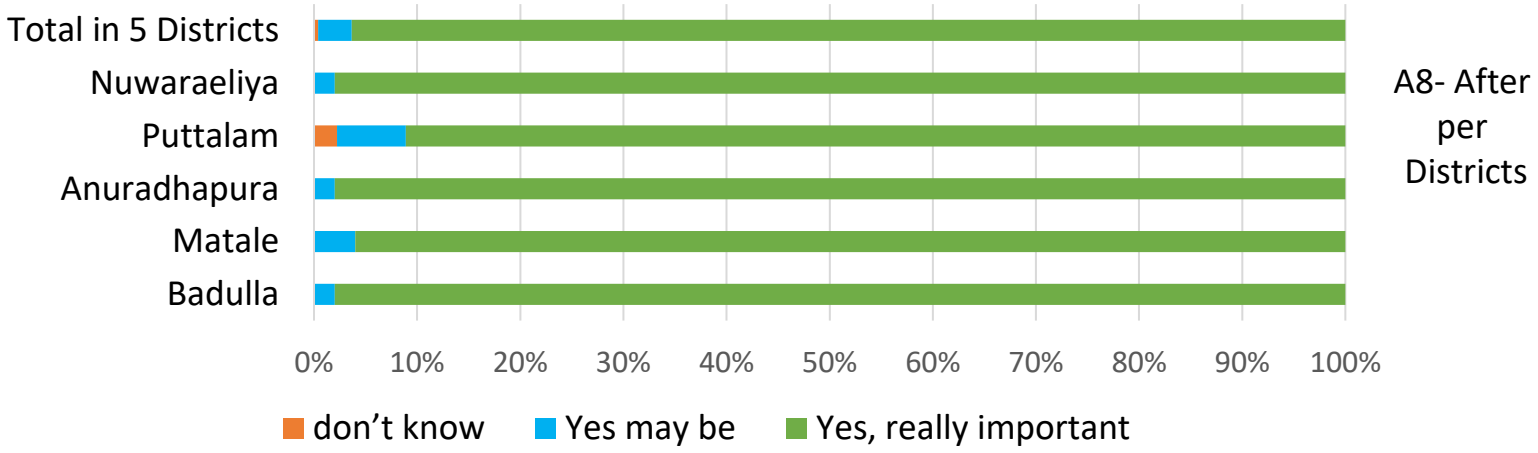
Fertilizer Storage





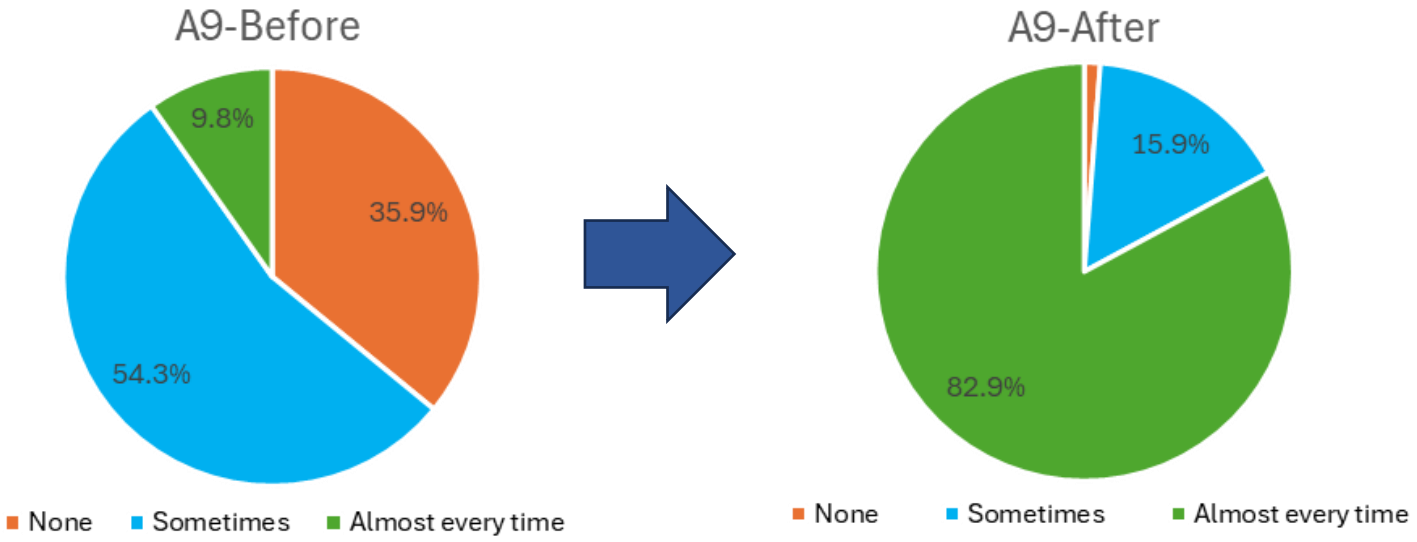
Results of Evaluation - Farmer Evaluation - **Importance of following Fertilizer Recommendation**

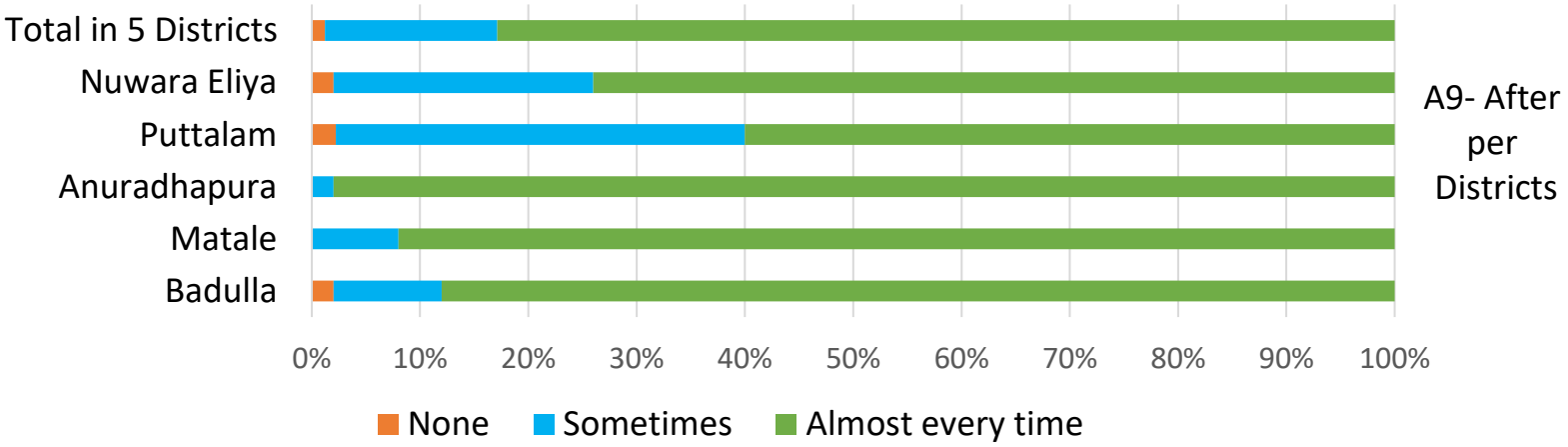




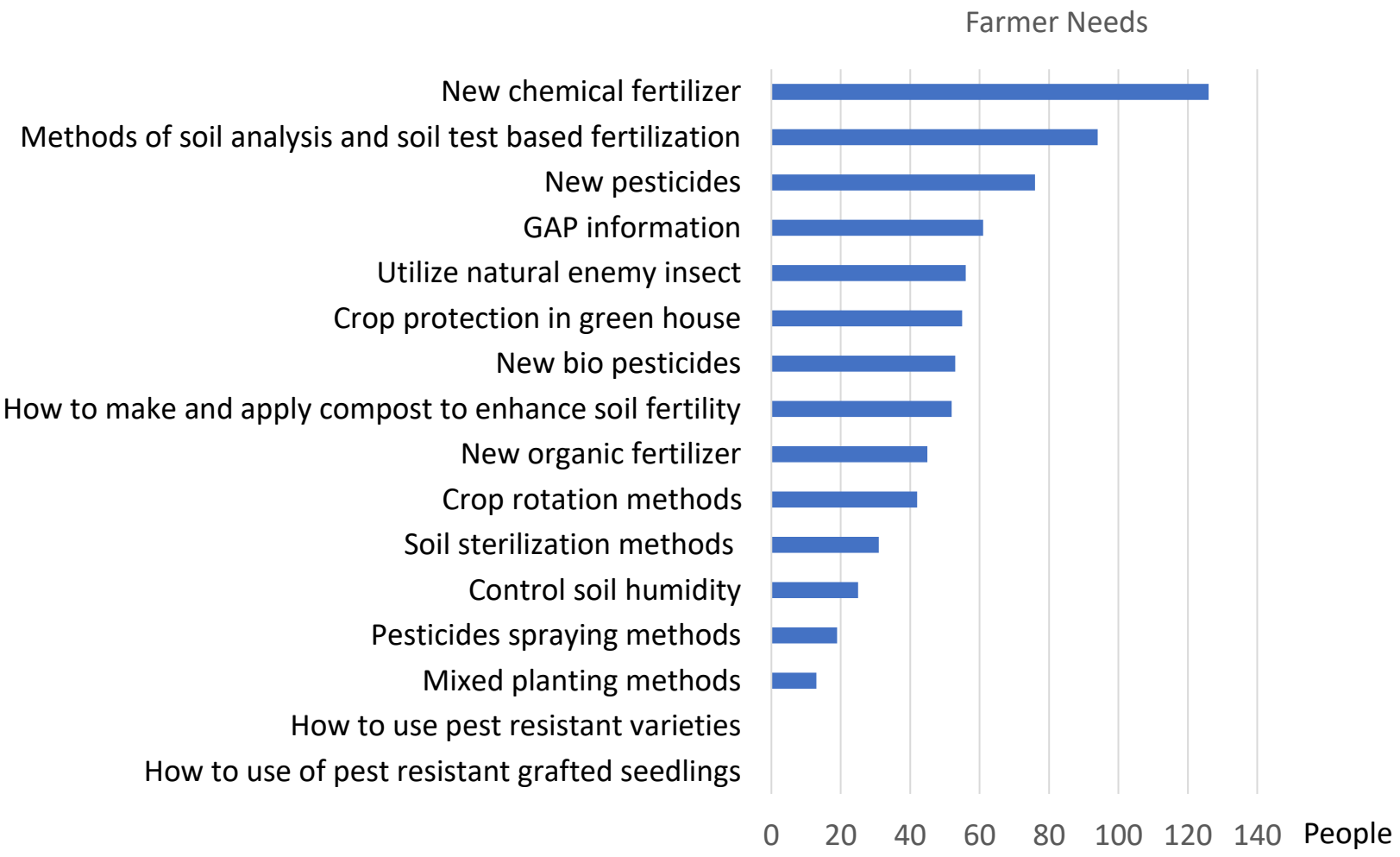
Results of Evaluation - Farmer Evaluation -

Record Keeping



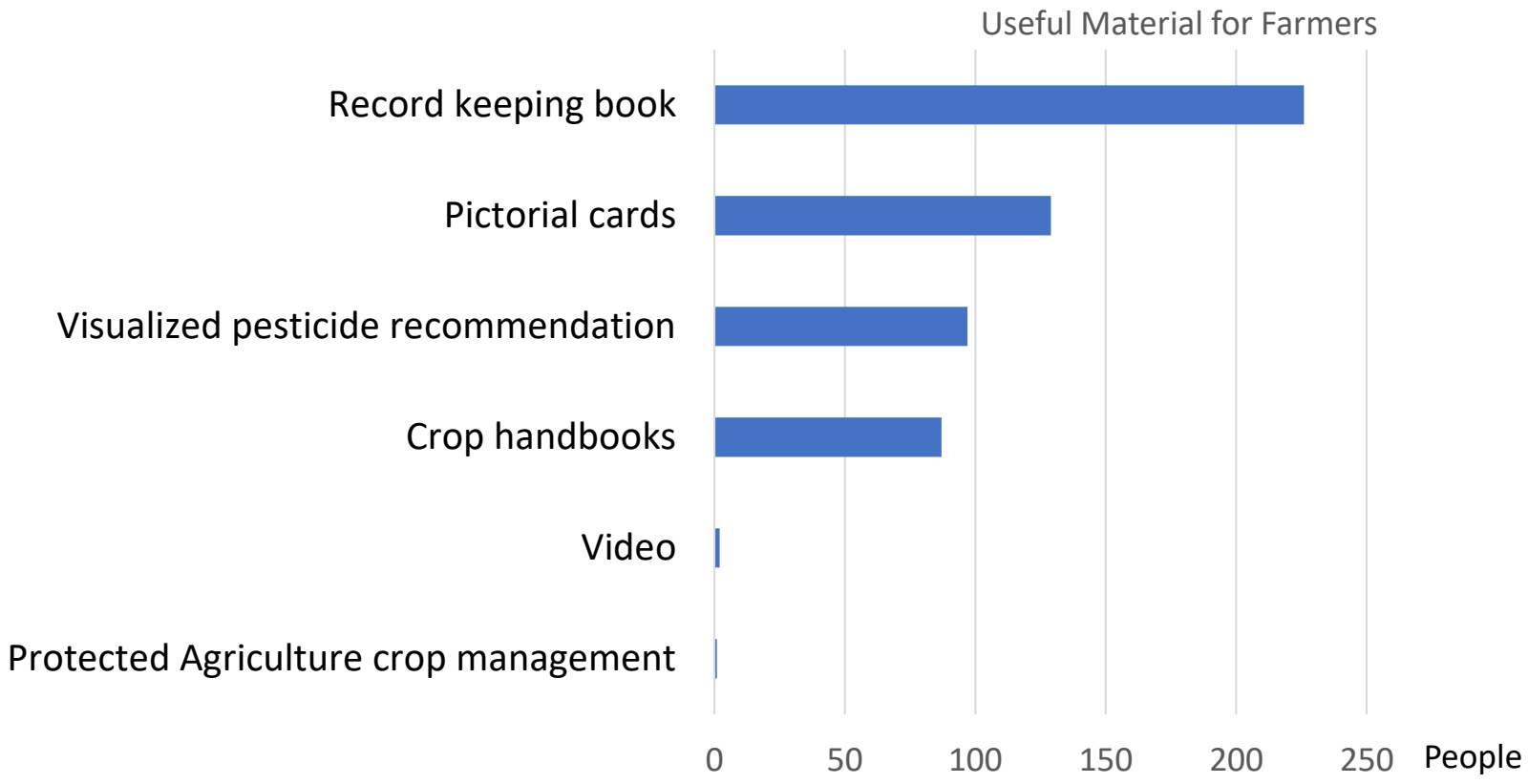


Results of Evaluation - Farmer Evaluation - **Farmer Needs**



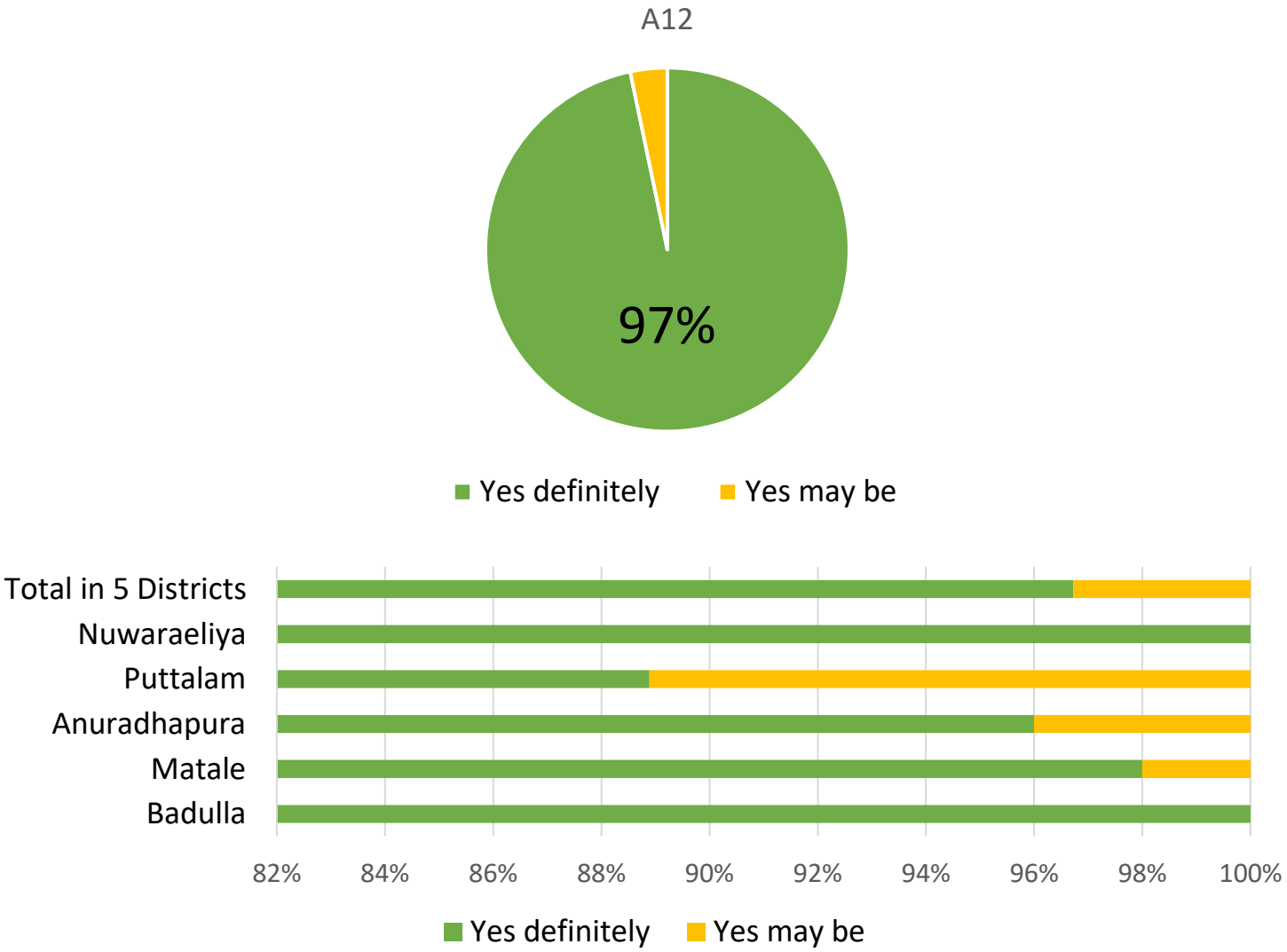
Results of Evaluation - Farmer Evaluation -

Useful Material for Farmers



Results of Evaluation - Farmer Evaluation -

Practice satisfaction



Summary of Evaluation Results

- Farmers' behaviour regarding the use and storage of pesticides and fertilizers has significantly improved.
- Over half of people have started wearing masks and gloves, but the use of PPE sets remains at just 30 %.
- Container disposal has seen almost zero dumping in fields, but the use of disposal bags remains at just 70%.
- Most farmers have developed the habit of record keeping.
- Most farmers are satisfied with the training program.

2.4 Activities related output 4

Attachment-29

Presentation material for Experience Sharing Seminar

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

OVERVIEW

23 January 2026

Dr. J.P. Marasinghe
Project Coordinator

1

1

Project Background

Agriculture, forestry, and fisheries account for 8.7% of GDP (World Bank, 2021), and farmers account for 23.7% of the working population (ILO, 2020).

Although the farmers have access to various pesticides and fertilizer, sufficient guidance and the technical know-how on the safe and appropriate use of them are limited.

These have been reported to cause health hazards and environmental problems in the country.

2

2

Project Goal and Objectives

Goal: To promote practice of safe and quality crop production among farmers

Objective: To strengthen the capacity of the stakeholders and institutions for promoting safe and quality crop production

5 target Districts



3

3

Expected Project Outputs

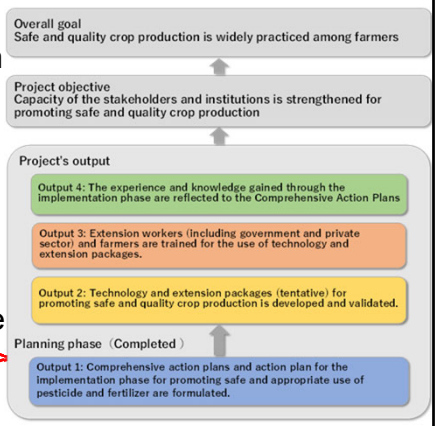
Output 1 – A **Comprehensive Action Plan** and action plan for implementation

Implemented during April 2020 - March 2021 (1st Phase)

Output 2 – Developed/ validated a set of **technology and extension activities/ packages**

Output 3 – Trained **extension officers and farmers** for the use of identified extension & technology activities/ packages

Output 4 – Revise the **Comprehensive Action Plan using the e**xperience and knowledge gained through the project.



Oct 2023 – March 2026 (2nd Phase)

4

4

Project Outline

Project implementation framework

Implementation agency:	Department of Agriculture/ Registrar of Pesticides(ROP), MOA
Cooperating organizations:	Provincial Directorate of Agriculture(PDOA) Horticultural Crop Research and Development Institute (HORDI) Seed Certification Service(SCS) Extension and Training Center (ETC) National Agriculture Information and Communication Centre (NAICC) Fruit Research and Development Institute Farmers
Implementation period:	(Planning phase) April 2020- March 2021 (Implementation phase) September 2023 – March 2026
Target Area	Five target districts for pilot activities (Nuwara-Eliya, Anuradhapura, Matale, Badulla, and Puttalam) and nationwide

5

5

Project Outline

Formation of 5 working groups (WGs) by the SAFE project

	WG1	WG2	WG3	WG4	WG5
Category/Subject area	Pesticides	Fertilizer	Good Agricultural Practice	Training	Comprehensive Action Plan
Leading organization	RoP	HORDI	Agri Biz	NAICC	MOA/DOA
Collaborating organization	HORDI, PPS, RARDC, ARS,NAICC, PDOA	FRDI, RARDC, ARS, PDOA	PPS, SCS, FRDI, HORDI, PDOA	ETC, ROP, Agri BIZ, HORDI	ROP/HORDI/NAICC/PDOA/

WG1, WG2 and WG3 (20 officers)

WG4 (7 officers)

WG5 (10 officers)

6

6

WG1-3 highlights: List of activities under WG1,2 and 3 (Output2)

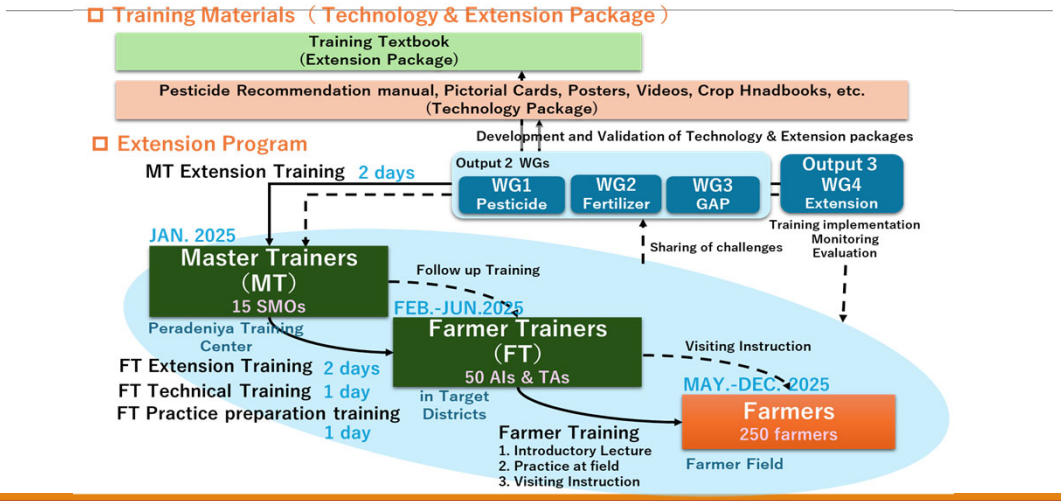
Category	Activities	Responsible organization
WG1 (pesticide)	P1: Upgrading of the Pesticide Recommendation manual in user-friendly manner	ROP
	P2: Development of user-friendly pictorial cards with QR codes	HORDI, ARS, RARDC
	Testing of color sticky traps as a monitoring method	HORDI, RARDC, ARS,
	Validation of rapid test kit (Immuno Strips) for disease identification	ARS, HORDI
	Validation of effectiveness of reported less-effective pesticides in Kalpitiya	ROP, PPS
	Testing of pesticide residues in Kalpitiya area	HORDI
WG2 (fertilizer)	Development of area specific nutrient management packages for cabbage, capsicum and tomato	HORDI, ARS, RARDC,FRDI
	Development of nutrient management packages for protected agriculture crops	RARDC, ARS
	Development of fertilizer recommendation based on leaf N status, for N management	HORDI
WG3 (GAP)	Sensitization on safe use of pesticides and fertilizer	Agri-BIZ, SCS
	Evaluation of the effect of field hygiene in pest and disease management	HORDI, FRDI
	Promoting of yellow lighting bulb application as a non-chemical method of pest and disease control	PPS

7

7

WG4 highlights: Overview of Training Program under SAFE project (Output3)

Training program of the SAFE is mainly consisted of 3 different categories of programs which were for master trainers(SMOs), farmer trainers (Ais &TAs), and farmers.



8

8

WG5 highlights: Study visit program in Japan (Output4)



Visited GAP-certified onion farmers and observed their field practices, pesticide storages, and record keeping methods.



Explanation by FAMIC on pesticide registration and detection of pesticide residues



Certification were awarded by JICA-HQ Director

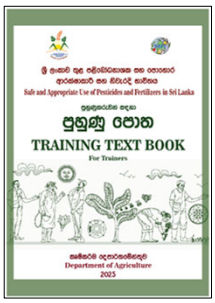
9

9

Output produced under WG 1-3 activities

The training materials used in the training programs were developed by WG 1–3 as part of Output 2 activities.

Extension Package for Trainers



Textbook

Sinhala & English

OUTLINE

1. The influence of Pesticides & Fertilizers on the environment and humans
2. Soil management and Fertilizer use
3. Pest management and Pesticide use
4. Agricultural Production by Good Agriculture Practice (GAP)
5. Extension approach

Technology Package for Farmers



Recommendations, Manuals, Posters, Videos

Sinhala, Tamil & English

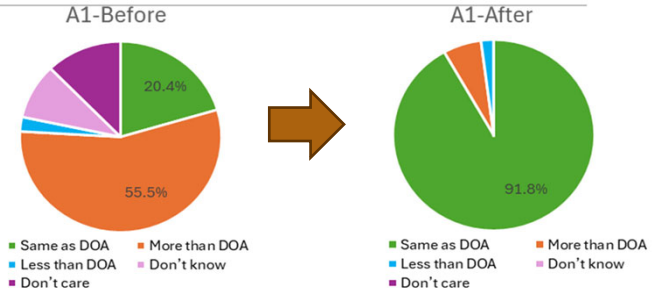
10

10

Outputs produced under WG4: Results of the pre- and post-training assessment of learning outcomes for farmers Trainers

Change of behavior of farmers on pesticide use

- ✓ Before the training, 55.5% of farmers overused pesticides.
- ✓ After the training, 91.8% of farmers used pesticides according to DOA recommendations.
- ✓ Pesticide overuse was reduced after the training.



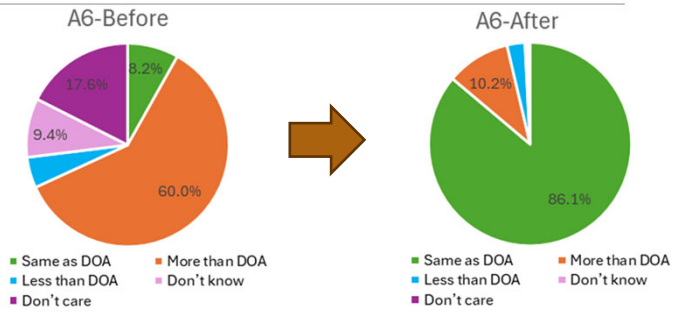
11

11

Outputs produced under WG4: Results of the pre- and post-training assessment of learning outcomes for farmers Trainers

Change of behavior of farmers on fertilizer use

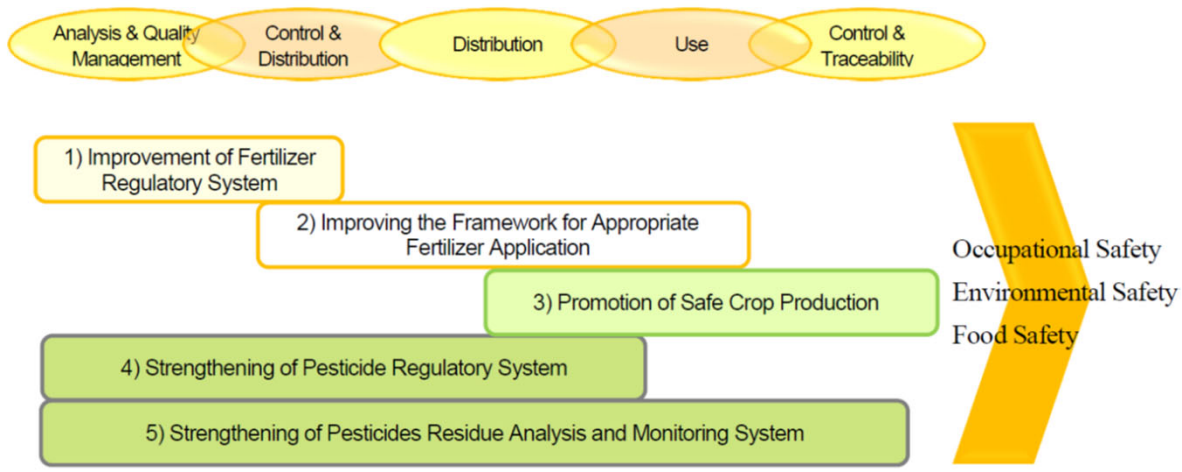
- ✓ Before the training, 60% of farmers overused fertilizer.'(More than DOA recommendation)
- ✓ After the training, 86.1% of farmers used fertilizer according to DOA recommendations.
- ✓ Fertilizer overuse was reduced after the training.



12

12

Overview of Roadmap



13

13

Summary

- Project implementation completed October 2023- January 2026
- All activities conducted on time
- Expected results obtained through implementing
  - Technology & extension activities/packages
  - Trained extension staff and farmers
  - Revised Comprehensive Action Plan
- Future Plan
  - To increase the number of farmers adopting safe and appropriate use of agrochemicals using the extension materials/ activities developed in the project

Details !

14

14

Thank you for your attention

15

Technology and Extension Packages

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizers in Sri Lanka (SAFE)

Experience Sharing Seminar

23rd January 2026

1

Contents

- Basic concept of Technology and Extension Packages
- Introduction of Technology Package
- Introduction of Extension Package
- Access to Technology and Extension Packages

2

2

Basic concept of Technology and Extension Packages

Technology Package

Materials on **set of technologies** for safe and appropriate use of pesticides and fertilizer **especially for famers**.



(manuals, pictorial cards, booklets, guidance, information sheets, formats, posters, videos)

Extension Package

Materials on **subject matter and its dissemination** on safe and appropriate use of pesticides and fertilizer **especially for trainers**.



(book)

3

3

Introduction of Technology Package (1/12)

Manual on pesticide recommendations for agriculture pest control

Summary

- 125-page manual on pesticide recommendations with pictures of pests & diseases in a user friendly format

What farmers can do

- To confirm pests & diseases by pictures
- To choose recommended pesticides

What extension officers can do

- To give instructions to farmers for confirmation of pests & diseases and application of pesticides



4

4

Introduction of Technology Package (2/12)

Pest & disease pictorial cards with QR codes

Summary

- Set of cards (10) with pictures, description and control measures of major pests & diseases, and a QR Code
- 5 crops (Beans, Brinjal, Cabbage, Potato, Tomato)

What farmers can do

- To identify pests & diseases by pictures and description
- To choose and apply pesticide appropriately
- To find detailed information through QR codes by smartphones

What extension officers can do

- To give instruction to farmers on identification of pests & diseases and application of pesticides



5

5

Introduction of Technology Package (3/12)

Guidance for color sticky traps

Summary

- 4-page booklet on how to use color sticky traps
- 3 crops (Brinjal, Cabbage, Tomato)

What farmers can do

- To understand the advantage of color sticky traps
- To install color sticky traps in field

What extension officers can do

- To give instruction to farmers on how to install color sticky traps



6

6

Introduction of Technology Package (4/12)

Guidance and information sheet for area specific nutrient management

Summary

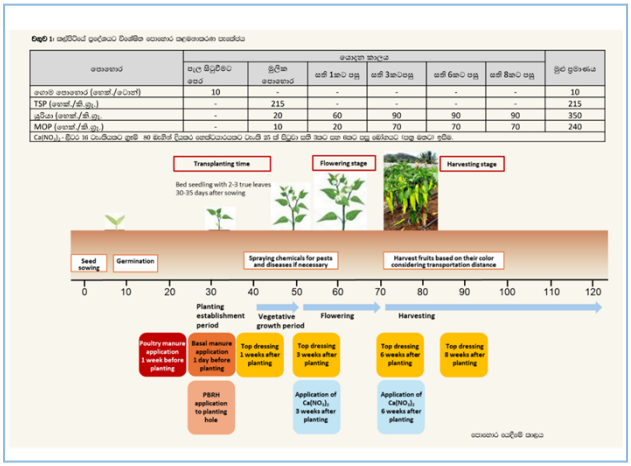
- 8-page booklet and a sheet on effective nutrient management for a crop in a specific area
- 3 crops:
  - Cabbage in Badulla and Kalpitiya
  - Tomato in Badulla
  - Capsicum in Badulla and Kalpitiya

What farmers can do

- To apply fertilizer effectively in the relevant area

What extension officers can do

- To give instruction to farmers on effective application of fertilizers in open field



7

7

Introduction of Technology Package (5/12)

Updated manual (KOPIA) and information sheet on media and nutrient management in protected agriculture

Summary

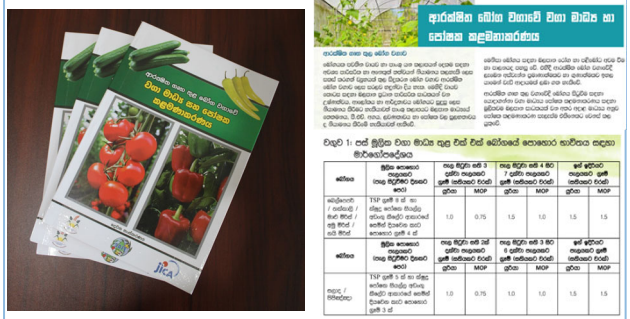
- 16-page booklet on how to manage media and nutrients in protected cultivation

What farmers can do

- To apply fertilizer effectively in protected agriculture

What extension officers can do

- To give instructions to farmers on effective application of fertilizer in protected agriculture



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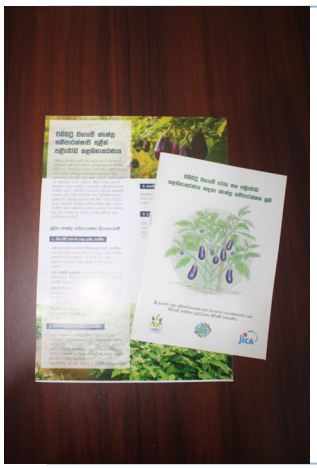
Introduction of Technology Package (6/12)

Guidance and information sheet for field hygiene

Summary
- 11-page booklet and sheet on appropriate field hygiene practices
- 2 crops (Brinjal and Guava)

What farmers can do
- To understand the advantage of field hygiene practice
- To practice appropriate field hygiene

What extension officers can do
- To give instructions to farmers on how to practice appropriate field hygiene





9

9

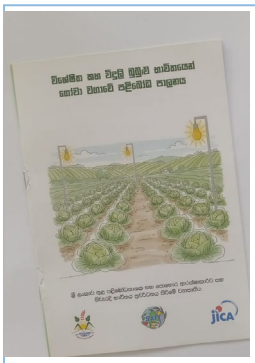
Introduction of Technology Package (7/12)

Guidance for LED yellow lighting to repel moths

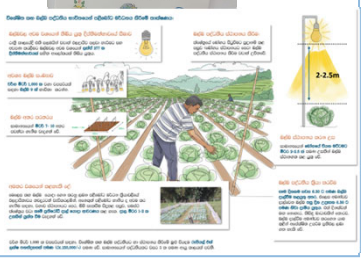
Summary
- 4-page booklet on how to use LED yellow lighting
- 2 crops (Brinjal and Cabbage)

What farmers can do
- To understand the advantage of LED yellow lighting
- To install LED yellow lighting system in the field

What extension officers can do
- To give instructions to farmers on how to install LED yellow lighting system







10

10

Introduction of Technology Package (8/12)

Recordkeeping formats

Summary

- Format for farmers who have never kept farming record before (beginners)
- Format for farmers who have kept record but not utilized well (intermediates)

What farmers can do

- To easily keep record of pesticide and fertilizer application
- To calculate simple (for beginner) or detailed (for intermediate) costs and profits

What extension officers can do

- To utilize them as training material



11

11

Introduction of Technology Package (9/12)

Information sheet on safe spraying of pesticides

Summary

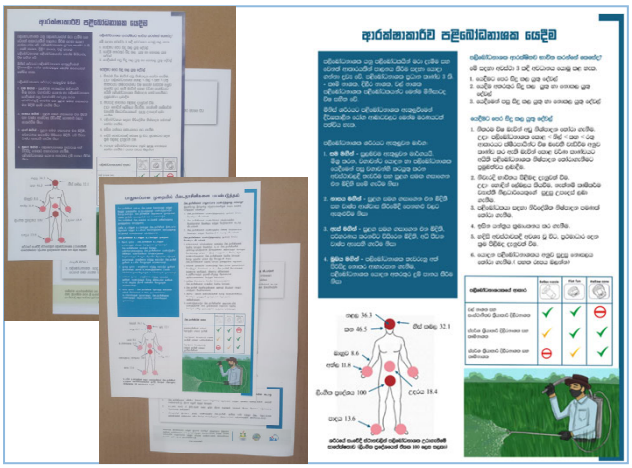
- Sheet on related information and guidelines in short form on safe spraying of pesticides

What farmers can do

- To understand the risk of inappropriate spraying of pesticides
- To apply pesticides safely

What extension officers can do

- To give instruction to farmers on how to spray pesticides safely



12

12

Introduction of Technology Package (10/12)

Booklets on important advice for pesticide / fertilizer use

Summary

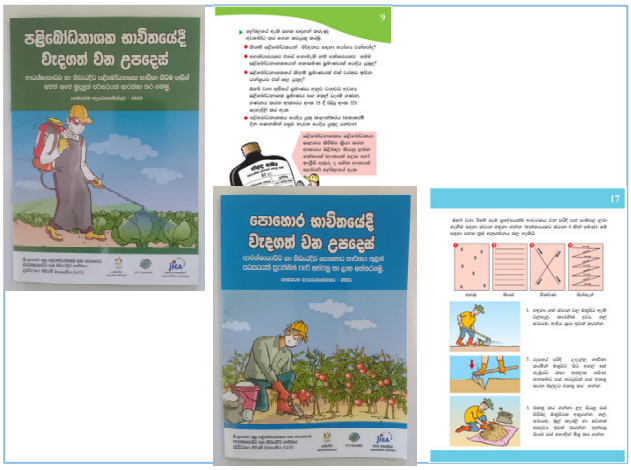
- 36-page and 41-page booklets on important advice for the use of pesticides and fertilizers, respectively, with simple descriptions and clear illustrations

What farmers can do

- To easily understand general information on use of pesticides and fertilizers

What extension officers can do

- To distribute to farmers for raising their awareness on use of pesticides and fertilizer



13

13

Introduction of Technology Package (11/12)

Posters on use of pesticides / fertilizers

Summary

- 3 posters
  - Safe use of pesticides
  - Personal protective equipment
  - Integrated plant nutrient management

What farmers can do

- To understand each topic visually

What extension officers can do

- To display it in their office as sensitization to visitors
- To utilize them as training material



14

14

Introduction of Technology Package (12/12)

Videos

Summary

- 3 technical topics - color stick trap, field hygiene, yellow lighting
- 3 types of videos - long, short, TikTok

What farmers can do

- To understand each technical topic visually

What extension officers can do

- To utilize them as materials in their training



15

15

Introduction of Extension Package (1/1)

Training text book

Summary

- 101-page book with subject matter and its dissemination on safe and appropriate use of pesticides and fertilizer
- 5 Chapters:
  - The Influence of Pesticides & Fertilizer
  - on the Environment and Humans
  - Soil Management and Fertilizer Use
  - Pest Management and Pesticide Use
  - Production Management by GAP
  - Extension Approach
- The left half for slide and the right half for text

What extension officers can do

- To plan and conduct training based on the contents of textbook



16

16

Access to Technology and Extension Package

Technology and Extension Packages are to be uploaded in DOA/SAFE webpage.
URL: https://safe.doa.gov.lk/



17

17

Summary

- All-inclusive Technology Package and Extension Package have been produced by the project
- They are easily accessible to any one

Feel free to use them for the promotion of safe and appropriate use of pesticides and fertilizer ensuring occupational safety and consumer safety

18

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Thank you

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Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

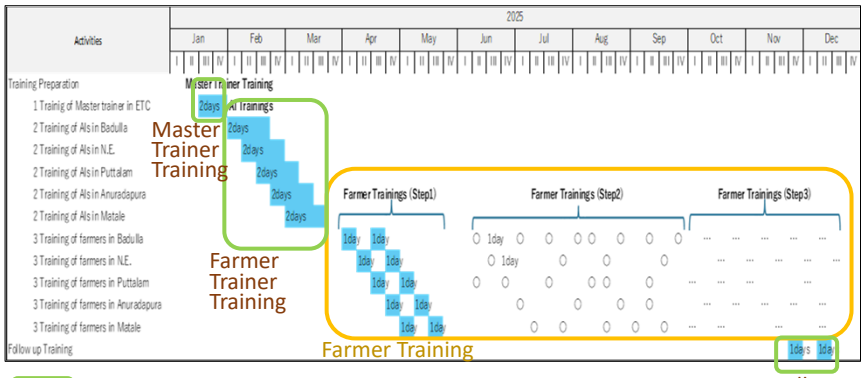
Training Evaluation Results

Experience Sharing Seminar

23 January 2026

1

Training program



Training of Trainers → Self Evaluation Before and After MT & FT Extension Training

Training of Farmers → Interview during Farmer Training Step 3, Visiting Instruction

2

Evaluation by Trainers

Before
Self evaluation
before training

After
Self evaluation
after training

- MT Training
- FT Extension Training

Evaluation Sheet for Trainer Training

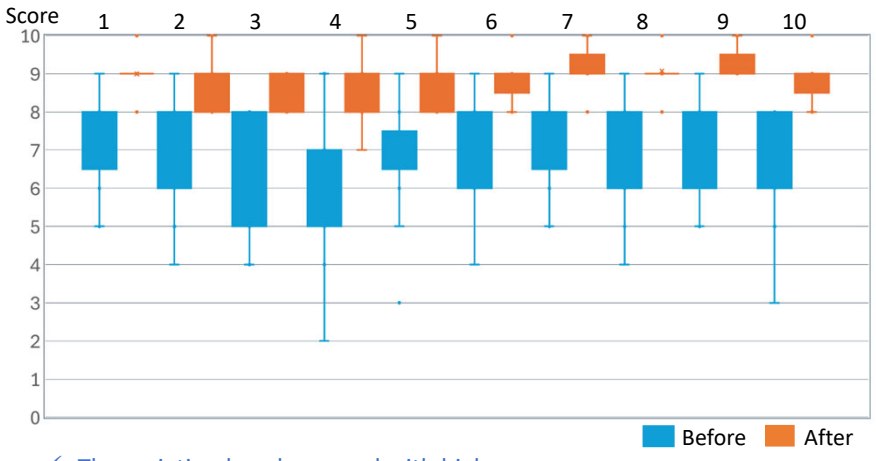
Name: . SMO, AI, TA, Date .

No.	Questions for Evaluation	Poor ⟷ Well
1	I know about the effects of pesticides on the environment and human health.	1 2 3 4 5 6 7 8 9 10
2	I know that over-application of fertilizers is having a negative impact on the environment and causing problems for health.	1 2 3 4 5 6 7 8 9 10
3	I know the efficacy of each fertilizer element and how to apply it.	1 2 3 4 5 6 7 8 9 10
4	I able to conduct soil diagnosis and calculate the amount of fertilizer application.	1 2 3 4 5 6 7 8 9 10
5	I know why plant diseases occur and what to do about them.	1 2 3 4 5 6 7 8 9 10
6	I know several options for pest control and can accurately advise farmers.	1 2 3 4 5 6 7 8 9 10
7	I know several methods of pest control other than pesticides and can advise farmers.	1 2 3 4 5 6 7 8 9 10
8	I can explain why GAP approach is effective in the promoting appropriate use of pesticides and fertilizers.	1 2 3 4 5 6 7 8 9 10
9	I can explain that record keeping is a fundamental practice for the appropriate use of pesticides and fertilizers.	1 2 3 4 5 6 7 8 9 10
10	I know several extension methods to farmers and are able to select, prepare and implement effective extension methods in line with farmers' needs.	1 2 3 4 5 6 7 8 9 10

3

Results of Evaluation

MT Training

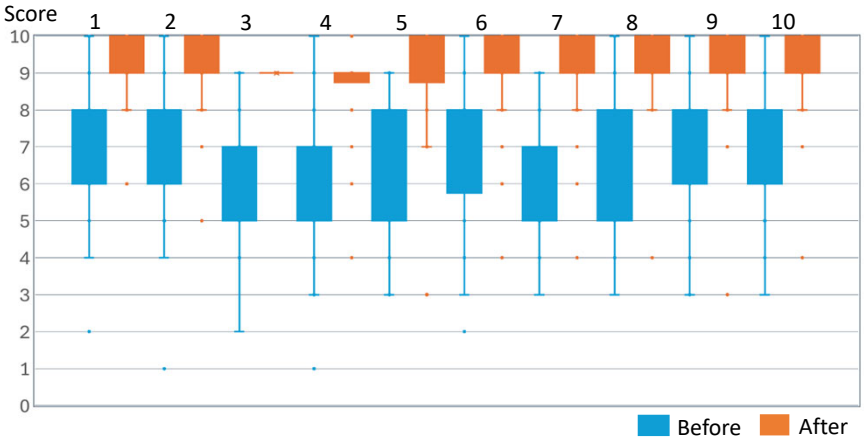


- ✓ The variation has decreased with high scores.
- ✓ Most of them marked More than 8 after training

4

Results of Evaluation

FT Extension Training



- ✓ The variation has decreased with high scores.
- ✓ Some FT is not yet at a level of confidence to conduct training

5

Evaluation by Farmers

Before
Interview via recall during visiting instruction

After
Interview during visiting instruction

Farmer Training
1.Introductory Lecture
2.Practice training
3.Visiting Instruction

Farmer Training Evaluation Sheet

District		Date	
AI Range			
Farmer			
Farmer Type	GAP farmer	If GAP farmer, GAP Type	
	Non-GAP farmer		
Interviewer			

Pesticide	
Q1.	Pesticide use – Quantity/Amount
Answer 1-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 1-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q2.	Pesticide storage
Answer 2-1	Before Training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Answer 2-2	After training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Q3.	Personal Protective Equipment (PPE) use
Answer 3-1	Before Training (1) Mouth cover (using cloth), (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hat, (7) Goggle, (8) Standard PPE set (9) No PPE *More than one answer allowed
Answer 3-2	After training (1) Mouth cover (using cloth), (2) Mask, (3) Apron, (4) Boots, (5) Gloves, (6) Hat, (7) Goggle, (8) Standard PPE set (9) No PPE *More than one answer allowed
Q4.	Container disposal method
Answer 4-1	Before Training (1) To collection center, (2) Burning, (3) Burying in the ground, (4) To river or pond, (5) In a disposal bag/container, (6) In farm field, (7) To collector *More than one answer allowed
Answer 4-2	After training (1) To collection center, (2) Burning, (3) Burying in the ground, (4) To river or pond, (5) In a disposal bag, (6) In farm field, (7) To collector *More than one answer allowed
Q5.	Understanding on the importance to follow the instructions on label of pesticide containers?
Answer 5-1	Before Training (1) Yes, really important, (2) Yes may be , (3) don't know
Answer 5-2	After training (1) Yes, really important, (2) Yes may be, (3) don't know

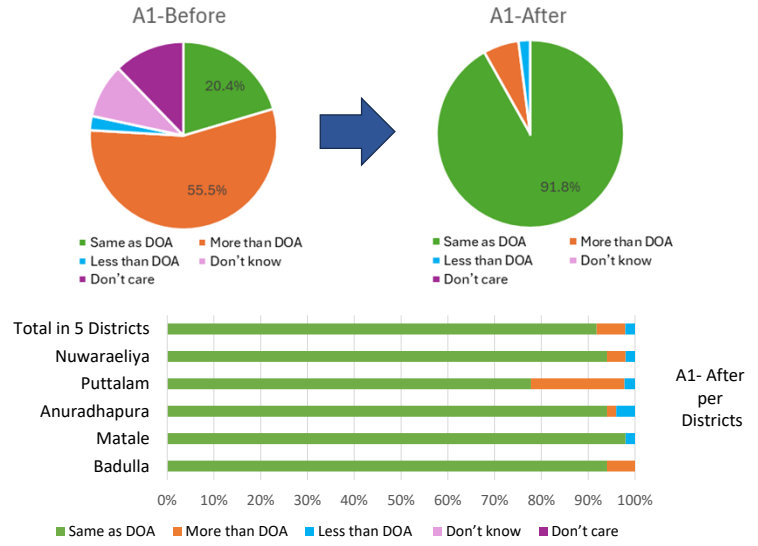
Fertilizer	
Q6.	Quantity of Fertilizer use
Answer 6-1	Before Training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Answer 6-2	After training (1) Same as DOA recommendation, (2) More than DOA recommendation, (3) Less than DOA recommendation, (4) Don't know, (5) Don't care
Q7.	Fertilizer storage
Answer 7-1	Before Training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Answer 7-2	After training (1) Inside house, (2) Outside store, (3) Farm store, (4) Temporary hut
Q8.	Understanding on the importance to follow the recommended amounts of fertilizer by DoA?
Answer 8-1	Before Training (1) Yes, really important, (2) Yes may be , (3) don't know
Answer 8-1	After training (1) Yes, really important, (2) Yes may be , (3) don't know
Others	
Q9.	Record Keeping
Answer 9-1	Before Training (1) Almost every time, (2) Sometimes, (3) None
Answer 9-2	After training (1) Almost every time, (2) Sometimes, (3) None
Q10.	Further Farmer Needs
Answer 10	(1) Methods of soil analysis and soil test based fertilization, (2) How to make and apply compost to enhance soil fertility, (3) New chemical fertilizer, (4) New organic fertilizer, (5) How to use pest resistant varieties, (6) How to use of pest resistant grafted seedlings, (7) Crop rotation methods, (8) Control soil humidity, (9) Crop protection in green house, (10) Soil sterilization methods, (11) Utilize natural enemy insect, (12) New pesticides, (13) Mixed planting methods, (14) GAP information, (15) New bio pesticides, (16) Pesticides spraying methods, (17) Others ( ) *More than one answer allowed
Q11.	Technical Materials Use
Answer 11	(1) Crop handbooks, (2) Pictorial cards, (3) Visualized pesticide recommendation, (4) Manuals provided by project (Manual Name:) (5) Others ( )
Q12.	Were the practical/practices on the safe and proper use of pesticides and fertilizers fruitful?
Answer 12	(1) Yes definitely, (2) Yes may be, (3) No (Reason:)

Thank you for your cooperation.

6

Results of Evaluation - Farmer Evaluation -
Pesticide Use

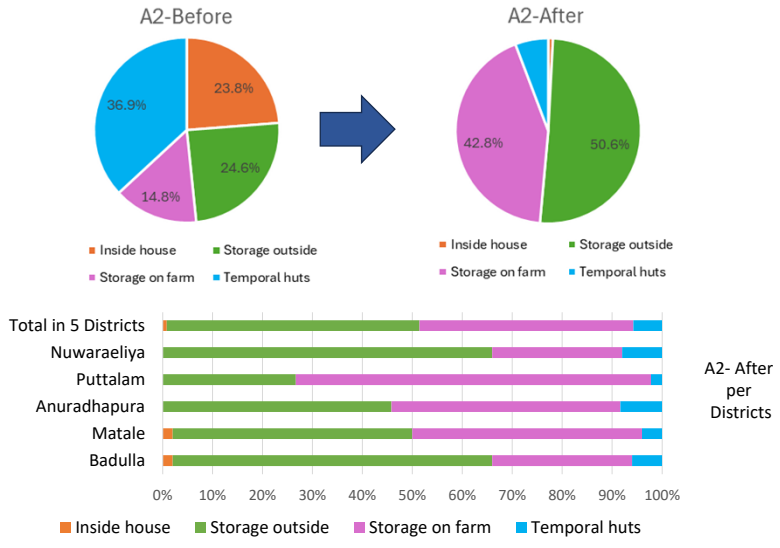
✓ Overuse has been improved.



7

Results of Evaluation - Farmer Evaluation -
Pesticide Storage

✓ Improved to store in Storage.

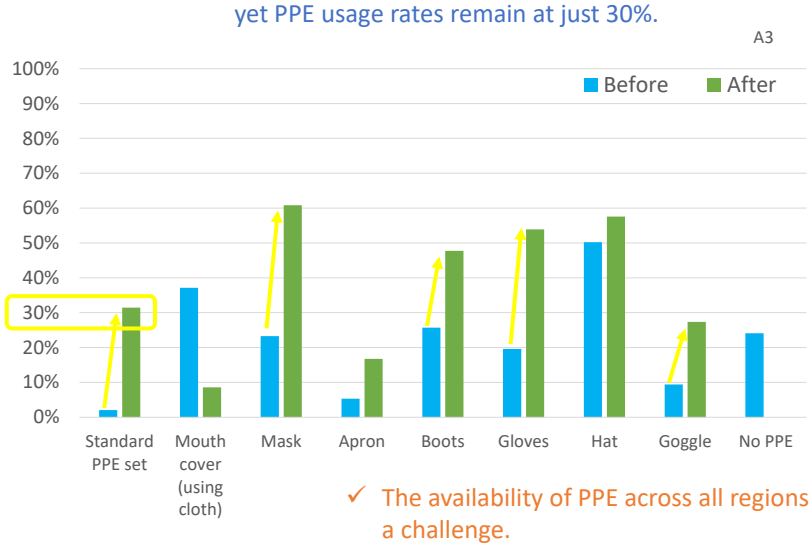


8

Results of Evaluation - Farmer Evaluation -

PPE Use

✓ Consideration for occupational safety has increased, yet PPE usage rates remain at just 30%.

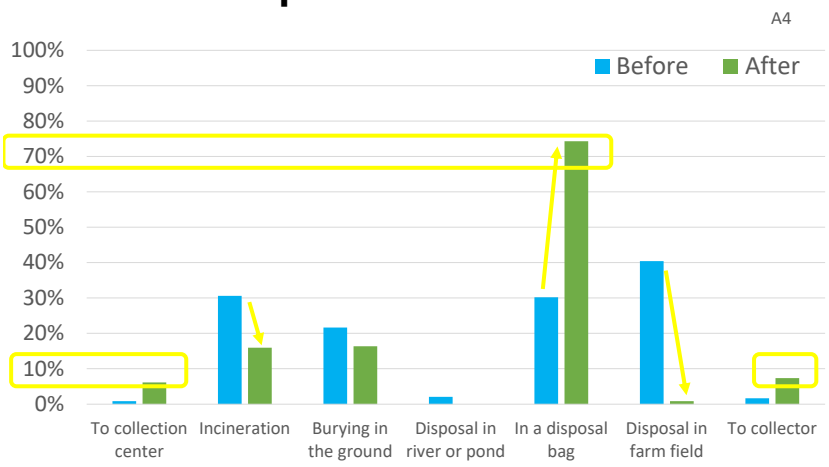


✓ The availability of PPE across all regions is a challenge.

9

Results of Evaluation - Farmer Evaluation -

Container disposal method



✓ While disposal on farm is decreasing.

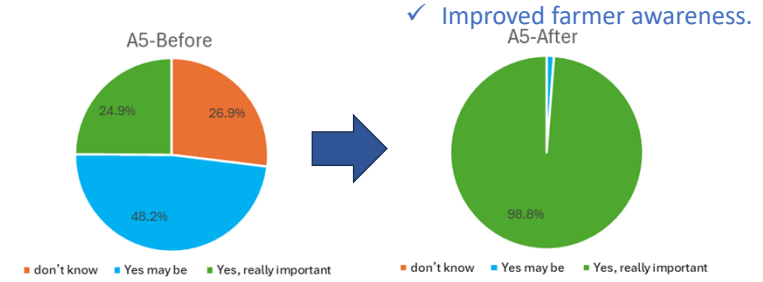
✓ It is necessary to improve the environment, including collection points and methods for further improvement.

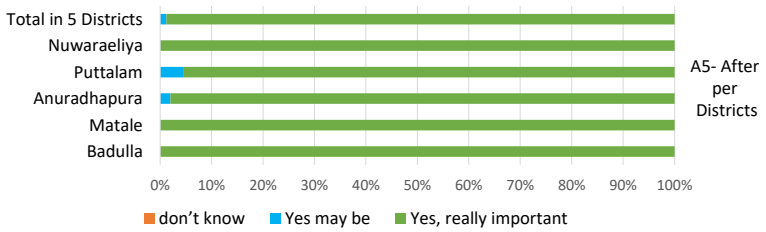
10

Results of Evaluation - Farmer Evaluation -

Importance of Pesticide Label confirmation

✓ Improved farmer awareness.



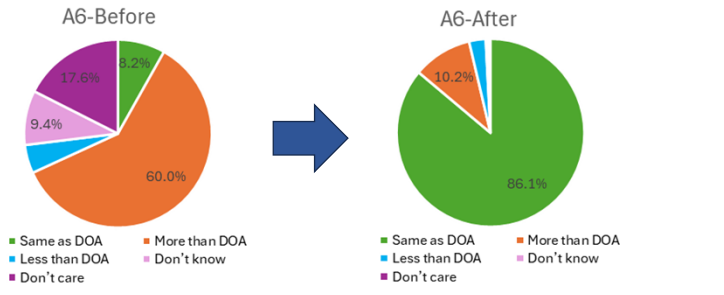


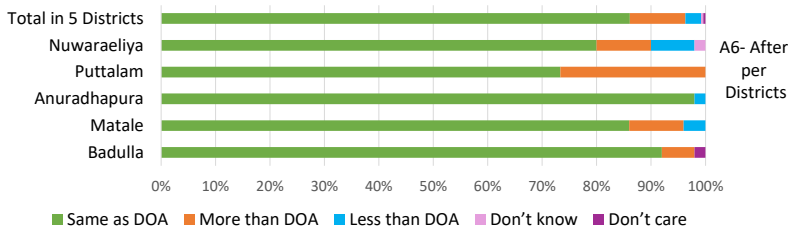
11

Results of Evaluation - Farmer Evaluation -

Fertilizer Use

✓ Overuse has been improved.



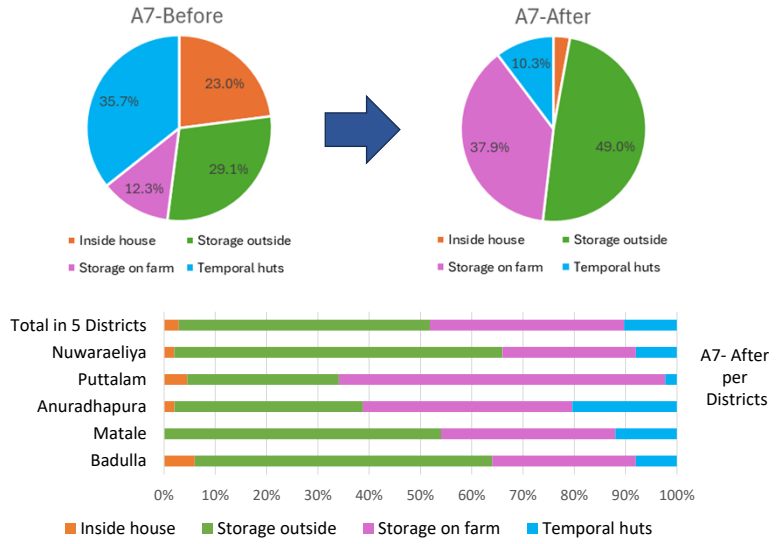


12

Results of Evaluation - Farmer Evaluation -

Fertilizer Storage

✓ Improved to store in Storage.

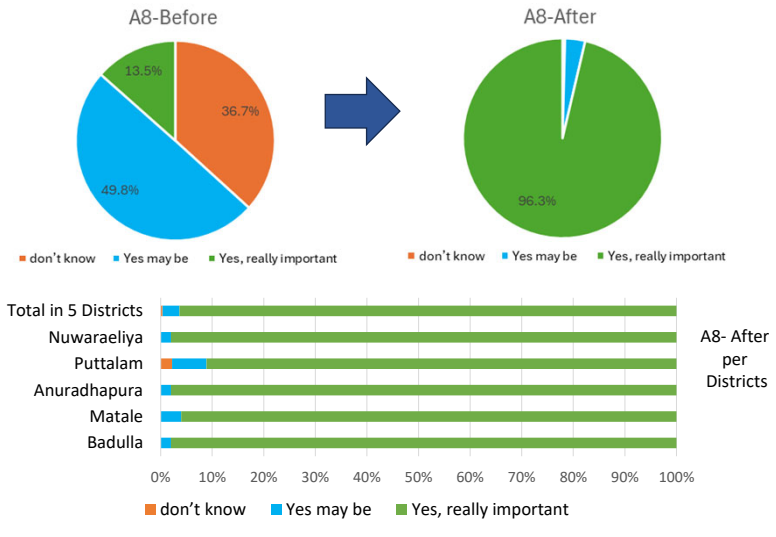


13

Results of Evaluation - Farmer Evaluation -

Importance of following Fertilizer Recommendation

✓ Improved farmer awareness.

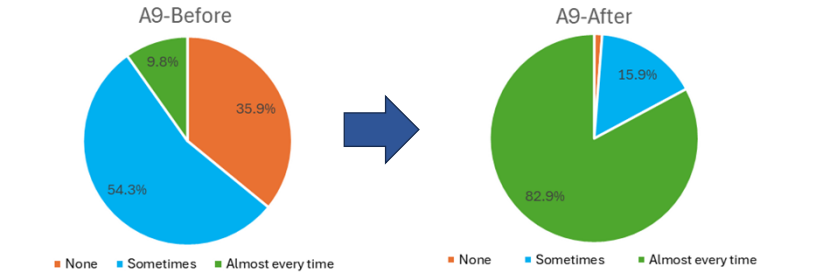


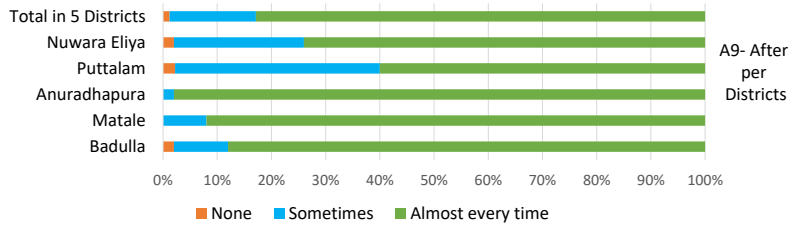
14

Results of Evaluation - Farmer Evaluation -

Record Keeping

✓ Improved the habit of record keeping.



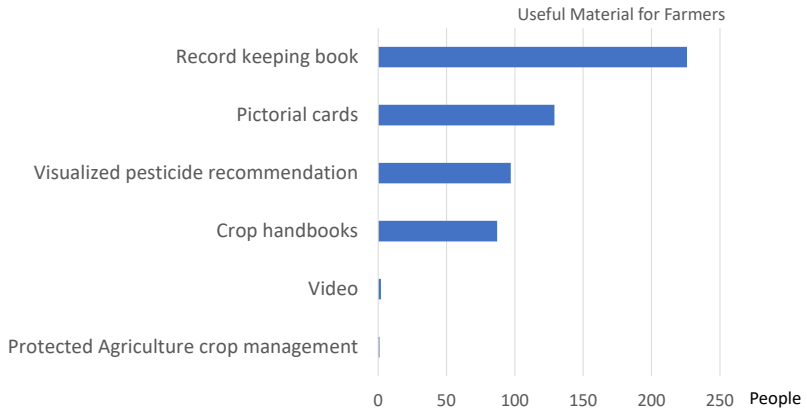


15

Results of Evaluation - Farmer Evaluation -

Useful Material for Farmers

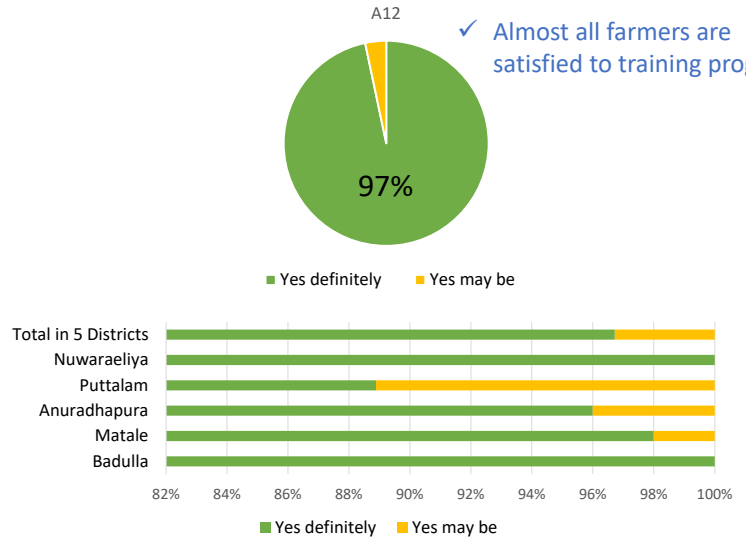
✓ The record-keeping book was well received by farmers.



16

Results of Evaluation - Farmer Evaluation -

Practice satisfaction



✓ Almost all farmers are satisfied to training program.

17

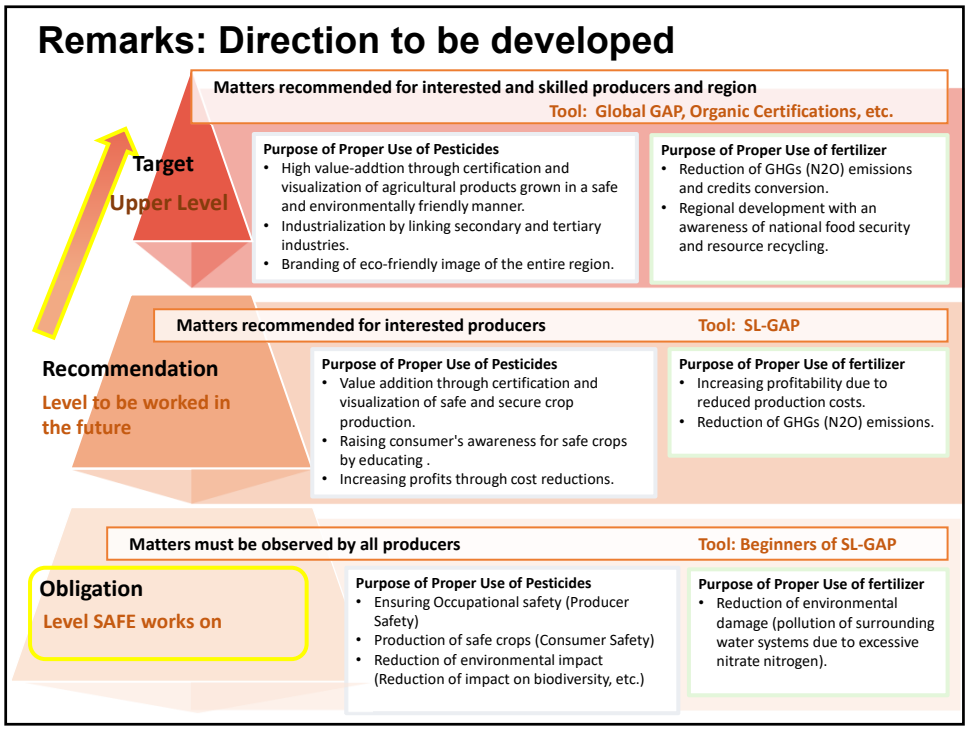
Summary of Evaluation Results

- Farmers' behaviour regarding the use and storage of pesticides and fertilizers has significantly improved.
- Over half of people have started wearing masks and gloves, but the use of PPE sets remains at just 30 %.

  ⇨ Improve PPE availability, Promote alternatives
- Container disposal has seen almost zero dumping in farm, but the use of disposal bags remains at just 70%.

  ⇨ Improve Disposal Environment
- Most farmers have developed the habit of record keeping.
- Most farmers are satisfied with the training program.

18


Remarks: Direction to be developed
Matters recommended for interested and skilled producers and region
Tool: Global GAP, Organic Certifications, etc.
Target
Upper Level
Purpose of Proper Use of Pesticides
• High value-addtion through certification and visualization of agricultural products grown in a safe and environmentally friendly manner.
• Industrialization by linking secondary and tertiary industries.
• Branding of eco-friendly image of the entire region.
Purpose of Proper Use of fertilizer
• Reduction of GHGs (N2O) emissions and credits conversion.
• Regional development with an awareness of national food security and resource recycling.
Matters recommended for interested producers
Tool: SL-GAP
Recommendation
Level to be worked in the future
Purpose of Proper Use of Pesticides
• Value addition through certification and visualization of safe and secure crop production.
• Raising consumer's awareness for safe crops by educating .
• Increasing profits through cost reductions.
Purpose of Proper Use of fertilizer
• Increasing profitability due to reduced production costs.
• Reduction of GHGs (N2O) emissions.
Matters must be observed by all producers
Tool: Beginners of SL-GAP
Obligation
Level SAFE works on
Purpose of Proper Use of Pesticides
• Ensuring Occupational safety (Producer Safety)
• Production of safe crops (Consumer Safety)
• Reduction of environmental impact (Reduction of impact on biodiversity, etc.)
Purpose of Proper Use of fertilizer
• Reduction of environmental damage (pollution of surrounding water systems due to excessive nitrate nitrogen).

Positive changes among famers after training in Anuradhapura

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23 January 2026

1

1. Introduction

Names of Master Trainers

- L.C.S. Samarawickrama
- R.D.P Bandara
- D.G.M. Nilantha Upul Kumara

Names of Farmer Trainers

- P.K.J.N.C Ratnayake
- A.M.U.B Abeysinghe
- H.M.K. Herath
- B.G.P.C Wijerathna
- E.J.A.M.K. Wijerathna
- H.M.M.K. Herath
- A.M.S.D. Adhikari
- J.M.A.M. Sewwwandi
- R.J.M.C Rajakaruna
- D.M.R.M Dassanayake

Technical training	No. of farmers Trained (1st Choice)	No. of farmers Trained (2nd choice)
Fertilizer application based on soil testing and improved nutrient management packages for selected crops	25	
Fertilizer application in protected agriculture		
Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards		
Physical control of pest attacks caused by moths -Yellow light application-		
A package of field sanitation practices	15	
Crop recordkeeping		50
Safe spraying of pesticides	10	

2

2

2. Positive changes among farmers (1st change)

Before Training

- Not practicing pruning in cultivated fields





After Training

- Practicing pruning in the field





3

3

2. Positive changes among farmers (2nd change)

Before Training

- not soil testing and lack of understanding about nutrient management




After Training

- Soil testing and nutrient management field applications





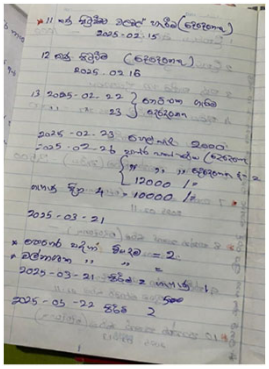
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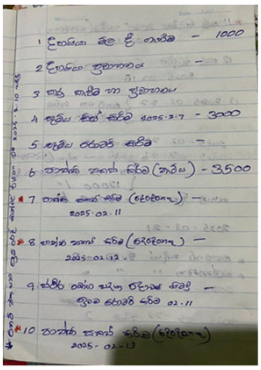
4

2. Positive changes among farmers (3rd change)

Before Training

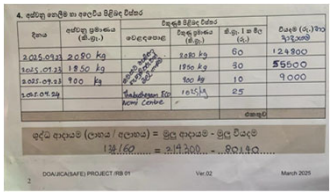
- Not regularly maintain crop records

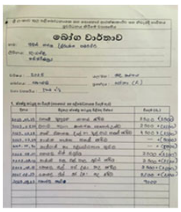


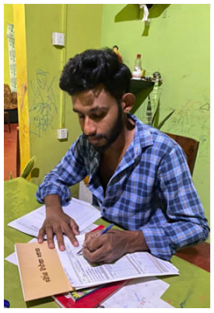


After Training

- Regularly Maintain crop record keeping







5

5

2. Positive changes among farmers (4th change)

Before Training

- Improper storage of pesticides and fertilizer





After Training

- Practicing proper storage for pesticides and fertilizer





6

6

2. Positive changes among farmers (5th change)

Before Training

- Applying pesticides without using any protective equipment




After Training

- Safely spraying of pesticides wearing protective cloths




7

7

2. Positive changes among farmers (6th change)

Before Training

- Not practicing field sanitation techniques




After Training

- Practicing field sanitation techniques




8

8

2. Positive changes among farmers (7th change)

Before Training

- Lack of attention on pre-harvest and post-harvest periods



After Training

- Awareness of timely harvesting and pre-harvest period





9

9

3. Suggestion from farmers

suggestion based on the implementation of Farmer Training

- ❖ The need for training experiences and knowledge sharing with farmers to continue the project at the agricultural sector level
- ❖ Providing pictorial cards for each crop and focusing on crops suitable for the area.
- ❖ Making pictorial cards easy and simple
- ❖ Preparing a system for the proper disposal of empty agrochemical packaging
- ❖ Applying agrochemicals using new technological methods

10

10

Thank you

Positive changes among farmers after the training - Puttlam

Project for the Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23 January 2026

1

1. Introduction

Names of Master Trainers
- W.A.B. Priyangika
- W.T.P.B.K. Jayasinghe

Names of Farmer Trainers
- R.M.D.N.K. Rathnayaka
- A.W. Rishada
- M. Chanam
- M.M.T.M. Bandara
- V. Sachala Dilshari
- D.R.P. Silva
- L.T. Gayashan
- W.T.B.P.K. Jayasinghe
- H.M.G.K. Herath
- D.H.M.P.G. Dissanayaka

Technical Training	No. of Farmers (1st Choise)	No. of Farmers (2nd Choise)
Fertilizer application based soil testing and improved nutrient management packages for selected crops	10	20
Fertilizer application in protected agriculture		
identification of pest and dieseases and slection of appropriate pesticides by using pictorial cards	30	
Physical control of pest attack caused by moth – application of yellow light		
Package of field sanitation practices		
Crop record keeping		50
Safe spraying of pesticides	10	30

2

2

2. Positive changes among farmers (1st change)

Before the training

- Non-use of protective equipment



After the training

- Pesticide application wearing protective equipment



3

3

2. Positive changes among farmers (2nd change)

Before the training

- Non-use of safe techniques when applying pesticides



After the training

- Pesticide application with safe techniques



4

4

2. Positive changes among farmers (3rd change)

Before the training

- Use of pesticides in excess of the recommendation for pest control



After the training

- Use of alternative pest control measures e.g.. sticky traps and pheromone traps



5

5

2. Positive changes among farmers (4th change)

Before the training

- Absence of proper place for pesticide storing



After the training

- Storing pesticides in a proper place



6

6

2. Positive changes among farmers (5th change)

Before the training

- Improper disposal of pesticide containers, discarding in the field



After the training

- Placing pesticide containers at one place



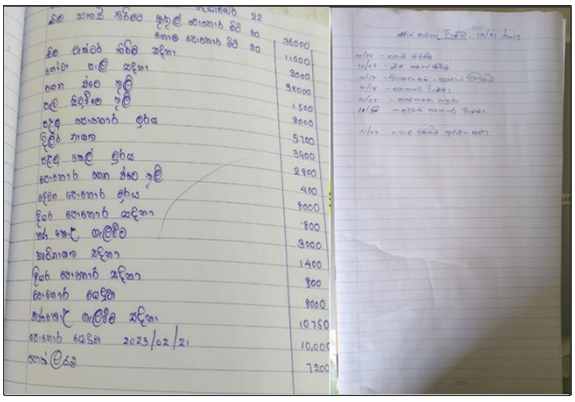
7

7

2. Positive changes among farmers (6th change)

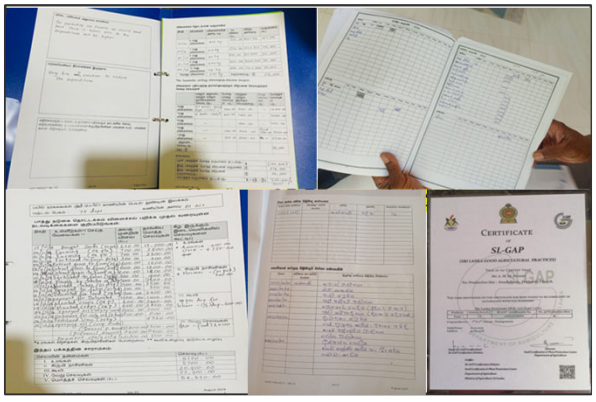
Before the training

- Not keeping of crops records / incorrect record keeping



After the training

- Keeping crop records
- Some farmers obtaining GAP



8

8

2. Positive changes among farmers (7th change)

Before the training

- Fertilizer application without soil testing



After the training

- Fertilizer application based on soil testing



9

9

2. Positive changes among farmers (8th change)

Before the training

- Incorrect identification of pests and diseases in vegetable cultivation



After the training

- Correct identification of pests and diseases using pictorial cards



10

10

3. Suggestions from field

- Provision of support to buy PPE
- Arranging a mechanism to dispose empty pesticide containers
- Preparation of pictorial cards for crops such as chili and red onion
- Organizing field visits among districts to exchange the experience
- Arranging a mechanism to expedite soil testing
- Making recommendations available for fertilizer mixtures
- Provision of funds for demonstrations

11

Thank You

12

Positive changes among famers after training in Matale

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23 January 2026

1

1. Introduction

Names of Master Trainers

- Mrs. Nayomani Weerasooriya
- Mr. Chamara Ekanayake
- Mr. Samantha Kumara

Names of Farmer Trainers

- Mr. Ajith Wimalasena
- Mr. Kasun Sirimanasinghe
- Mr. Sajitha Nuwangoda
- Mrs. Anuradha Hansamali
- Mr. Neel Wijebandara
- Mr. Kushan Dharmakeerthi
- Mr. Chaturanga Niyarepola
- Mr. Ranjith Amiyangoda
- Mr.Neeranga Welkotuwa
- Mr. Prakrama Tennakoon

Technical training	No. of farmers Trained (1st Selection)	No. of farmers Trained (2nd Selection)
Fertilizer application based on soil testing and improved nutrient management packages for selected crops	20	
Fertilizer application in protected agriculture		15
Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards	10	
Physical control of pest attacks caused by moths -Yellow light application-		
A package of field sanitation practices		20
Crop recordkeeping		50
Safe spraying of pesticides	20	

2

2

2. Positive changes among farmers (1st change)

Before Training

- Lack of interest in field sanitation





After Training

- Practicing field sanitation





3

3

2. Positive changes among farmers (2nd st change)

Before Training

- Unsafe application of pesticides and non-use of protective clothing




After Training

- Use of protective clothing during pesticide application for safety




4

4

2. Positive changes among farmers (3rd change)

Before Training

- Not using the correct amounts and the recommended fertilizers.





After Training

- Use recommended fertilizer after soil testing







5

5

2. Positive changes among farmers (4th change)

Before Training

- Cannot accurately identify crop diseases and pest damage in the field





After Training

- Accurately identifying diseases and pest damage using pictorial cards





6

6

2. Positive changes among farmers (5th change)

Before Training

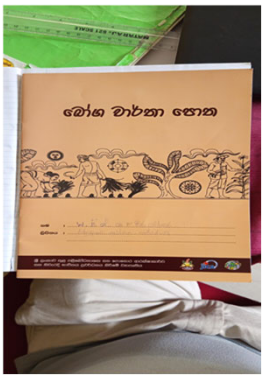
- Lack of awareness about recordkeeping

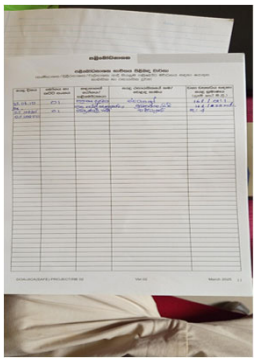




After Training

- Using a crop record book that allows easy recordkeeping





7

7

2. Positive changes among farmers (6th change)

Before Training

- No proper knowledge to select the suitable growing media for crops





After Training

- ආරක්ෂිත ගෘහ සඳහා නියමිත බෝග වගා මාධ්‍ය තෝරා වගා කිරීම Use recommended growing media for protected house cultivation





8

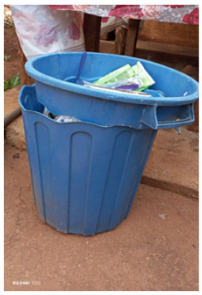
8

2. Positive changes among farmers (7th change)

Before Training

- Improper storage of pesticides and fertilizers.

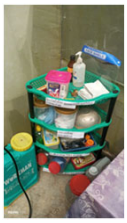




After Training

- Safely store pesticides and fertilizers in a storage room according to recommended practices.







9

9

Suggestion from farmers

- කෘෂි රසායන යෙදීමේදී භාවිතා කල හැකි ආරක්ෂිත ඇදුම් කට්ටල වෙළඳපළින් මිලදී ගත් හැකි වන ලෙස සුලභ කිරීම
- අමිශ්‍ර රසායනික පොහොර වෙලදපල තුල සුලභ කිරීම
- පළිබෝධනාශක හිස් ඇසුරුම් අපහරනය සදහා ක්‍රමවේද රාජ්‍ය අනුග්‍රහය සහිතව සිදු කිරීම
- Provide easy access to personal Protective Kit for agrochemical use.
- Ensure blended fertilizers are readily available.
- Use government-supported methods to dispose of empty pesticide containers.

10

10

Thank you

Positive changes among famers after training in - Nuwaraeliya

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23 January 2026

1

1. Introduction

Names of Master Trainers

- U.K.S.T Kumari
- T.I.B Ratnayake
- M.N Sagarika

Names of Farmer Trainers

- J.M.P.M. Jayatilleka
- H.M.N.I.K. Herath
- K.M.A.E. Kulathunga
- M.W.P.N.B. Miigasthenna
- N.M.M.C. Kumara
- P.W.M.P. Wijethunga
- M.V.A.N. Ariyasena
- N.M.K.P. Nawarathna
- J.A.N.H. Jayasooriya
- K.M.L. Kobbewala

Technical training	No. of farmers Trained (1st Choice)	No. of farmers Trained (2nd choice)
Fertilizer application based on soil testing and improved nutrient management packages for selected crops	15	35
Fertilizer application in protected agriculture	-	50
Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards	50	-
Physical control of pest attacks caused by moths -Yellow light application-	5	-
A package of field sanitation practices	20	-
Crop recordkeeping	10	5

2

2

1. Positive changes among farmers (1st change)

Before Training

- Lack of proper knowledge about pesticides entering the body



After Training

- Spraying pesticides using protective clothing





3

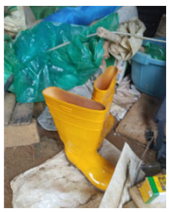
3

2. Positive changes among farmers (2nd change))

Before Training

- Failure to systematically maintain pesticide store and dispose of empty pesticide containers







After Training

- Systematically disposal and storage of pesticides

.









4

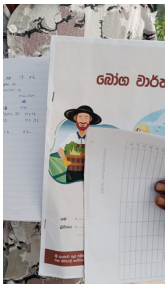
4

2. Positive changes among farmers (3rd change)

Before Training

- Not maintain crop records regularly



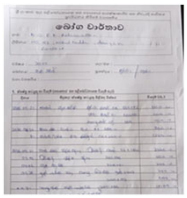


After Training

- Maintaining proper crop records









5

5

2. Positive changes among farmers (4th change)

Before Training

- Applying fertilizer not considering the needs of the crop.



After Training

- Applying the required amount of fertilizer based on the needs of the crop









6

6

2. Positive changes among farmers (5th change)

Before Training

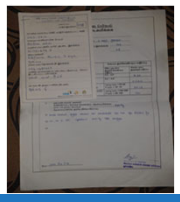
- Unnecessary use of chemical fertilizers



After Training

- Conduct a soil test and apply fertilizer accordingly





7

7

2. Positive changes among farmers (6th change)

Before Training

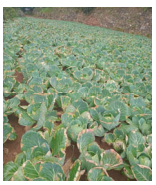
- Applying pesticides only after consulting with pesticide vendors without properly identifying diseases and pests in crops



After Training

- Identification of pests and diseases using pictorial cards and selection of appropriate pesticides based on the recommendations of the farmer trainers




8

8

3. Suggestion from farmers

Suggestion based on the implementation of Farmer Training)

- Arrange an observation tour for farmers in the district to see successful farming groups
- Provide resources to farmers for demonstrations
- Expedite the process of obtaining soil test reports
- Facilitate modern eco-friendly farming practices
- Provide pictorial cards appropriate to the crops in the area

9

Thank you

10

Positive changes among famers after training in - Badulla

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23 January 2026

1

1. Introduction

Names of Master Trainers
- R.M.G.S. Ratnayake
- R.M Dayananda
- H.M.P. Jayakelum#

Names of Farmer Trainers
- K.J.S Ranasinghe
- S.S Narangoda
- E.M.S Dilshan
- A.K.K Darmasiri
- R,M Wimalarathna
- Chinthaka Silogama#
- Sanka Wattegama#
- M.M.T. Mahakubura
- K.M Virajith Bandara#
- D.G.A.H. Wickramasundara

Technical training	No. of farmers Trained (1st Choice)	No. of farmers Trained (2nd choice)
Fertilizer application based on soil testing and improved nutrient management packages for selected crops	58	0
Fertilizer application in protected agriculture	0	38
Identification of pests & diseases and selection of appropriate pesticides by using pictorial cards	43	43
Physical control of pest attacks caused by moths -Yellow light application-	0	0
A package of field sanitation practices	0	38
Crop recordkeeping	0	48
Safe spraying of pesticides	48	48

2

2

2. Positive changes among farmers (1st change)

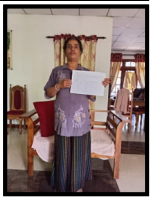
Before Training

- Lack of awareness about the importance of soil testing




After Training

- Soil testing and applying fertilizers accordingly


3

3

2. Positive changes among farmers (2nd change)

Before Training

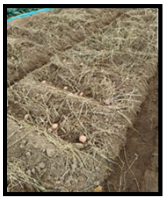
- Lack of attention to sanitation in cultivation fields





After Training

- Obtaining a quantitative and qualitative harvest by cultivating with proper hygiene





4

4

2. Positive changes among farmers (3rd change)

Before Training

- Irregular and unnecessary use of fertilizers
- Not using fertilizers at the proper intervals



After Training

- Proper use of fertilizers through testing the soil and obtaining soil test reports







5

5

2. Positive changes among farmers (4th change)

Before Training

- Unsafe use of pesticides





After Training

- Applying pesticides using protective clothing









6

6

2. Positive changes among farmers (5th change)

Before Training

- Inability to properly identify disease and pest damage



After Training

- Using picture cards to easily identify diseases and pests



7

7

2. Positive changes among farmers (6th change)

Before Training

- Unsafe disposal of empty pesticide containers



After Training

- Disposing of empty pesticide containers safely



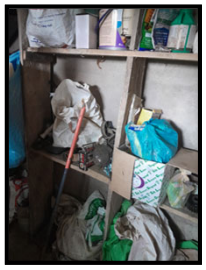
8

8

2. Positive changes among farmers (7th change)

Before Training

- Not storing agrochemicals safely


After Training

- Storing agrochemicals in the right place and using the right method







9

9

2. Positive changes among farmers (8th change)

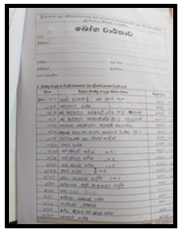
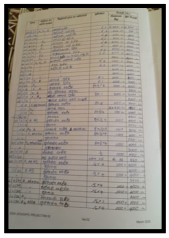
Before Training

- Lack of awareness about the importance of crop records




After Training

- Keeping crop records and calculating expenses and income



10

10

2. Positive changes among farmers (9th change)

Before Training

- Lack of awareness about post-harvest damage#





After Training

- Awareness of post-harvest damage reduction methods and their use in the field




11

11

3. Suggestion from Farmers

suggestion based on the implementation of Farmer Training

- ❖ It is necessary to focus on other practices, not just practicing one in the farmer field
- ❖ Nearby farmers express their willingness to join this project.
- ❖ Picture cards for common crops grown in Badulla district

12

12



13

Road Map for Safe and Appropriate Use of Agrochemicals

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka (SAFE)

Experience Sharing Seminar

23rd January 2026

1

Road Map

for Safe and Appropriate Use of Agrochemicals



Roadmap to achieve "Capacity to be" in short-mid-long term;

1) To **increase Occupational Safety** of farmers,
2) To **mitigate Health Problems** of rural population, **reducing Environment Impact** caused by agrochemical overuse/misuse,
3) To contribute to **improve Food Safety** and to **enhance Exports of vegetables and fruits** by controlling overuse of agrochemicals

Roadmap is for achieving the goal as above, with utilizing whatever existing resources, actors and projects.

Roadmap is composed of some mini-projects/components, with clear objective, actions, responsible actors and indicators, corresponding to the issues to solve.

2

Roadmap revision and approval procedure

Review and Revision of the Roadmap by WG5

Incorporate the learning from Training in Japan

↓

Incorporate the learning from project implementation

↓

Share Roadmap in Experience Sharing Seminar

↓

Approval as Road Map of DOA

in terms of Safe and Appropriate Use of Pesticides and Fertilizers

in Stakeholder meeting (after the seminar)

3

Components of the Roadmap

Goals of Roadmap

1) To increase occupational safety of farmers,
2) To mitigate health problem of rural population, reducing environment impact caused by agrochemical overuse/misuse,
3) To contribute to improve food safety and to enhance exports of vegetables and fruit by controlling overuse of agrochemicals

① Improvement of Fertilizer Regulatory System

② Improvement of the Framework for Appropriate Fertilizer Application

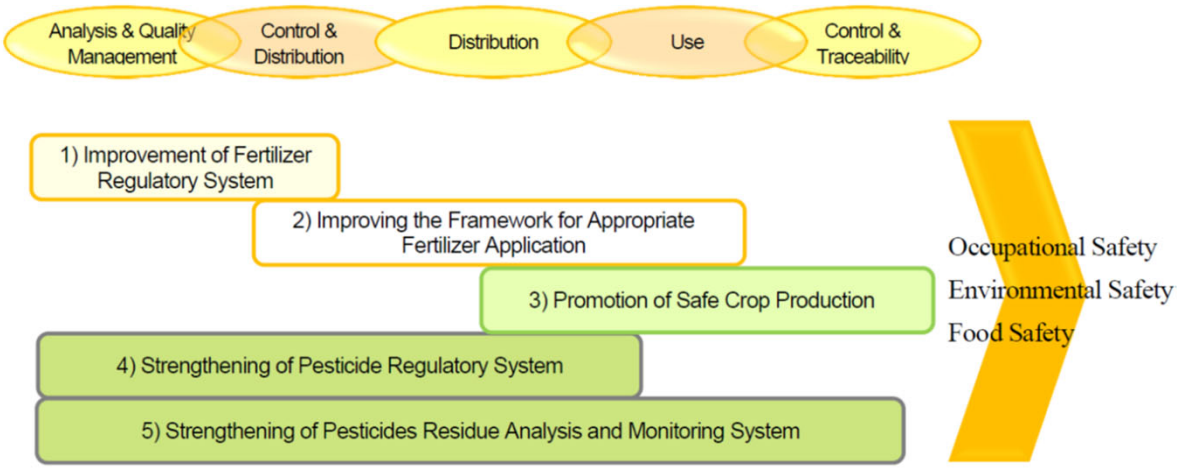
③ Promotion of Safe Crop Production

④ Strengthening of Pesticide Regulatory System

⑤ Strengthening of Pesticides Residue Analysis & Monitoring System

4

Overview of Roadmap



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Component 1	Component 2	Component 3	Component 4	Component 5

Improvement of Fertilizer Regulatory System

Capacity to be: Quality fertilizer is available in necessary quantities
Objective: Increasing availability of quality fertilizer timely to farmers
Overall responsible organization: NFS
Collaborating actors: DAD, SLSI, Private sector, ITI, HORDI, etc.
Implementation Period: 2025-2030

【Output1】 Elaborated database of fertilizer

【Output2】 Strengthened fertilizer analytical capacity for quality assurance

【Output3】 Improved fertilizer manufacturing and distribution system

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Component 1	Component 2	Component 3	Component 4	Component 5

Improvement of the Framework for Appropriate Fertilizer Application

Capacity to be: Farmers apply fertilizer upon soil condition, climatic condition referring to the recommendation

Objective: Promotion of appropriate fertilizer application

Overall responsible organization: DOA

Collaborating actors: Research Institutes & soil testing laboratory of DOA, NAICC, ETC, private sector, SLSI, ITI, PDOA, etc.

Implementation Period: 2026-2030

【Output1】 Recommendations for fertilizer application according to soil, crop, crop stage & climate condition

【Output2】 Strengthened Soil testing program

【Output3】 Trained extension workers on fertilizer application

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Component 1	Component 2	Component 3	Component 4	Component 5

Promotion of Safe Crop Production

Capacity to be: Safe and appropriate use of pesticides and fertilizers is widely practiced among farmers

Objective: Ensuring occupational safety of farmers, safe produce for consumers and sustainable environment

Overall responsible organization: ROP

Collaborating actors: ETC, PDOA, Mahaweli, farmers, NFS, ROP, HORDI, SCS, NAICC, etc.

Implementation Period: 2022-2030

【Output1】 Knowledge on technology and technology transfer packages on safe & appropriate use of pesticides and fertilizer

【Output2】 Improved technology and technology transfer packages for safe & appropriate use of pesticides and fertilizer

【Output3】 Validated technology and technology transfer package

【Output4】 Trained extension officers on technology and technology transfer packages

【Output5】 Trained farmers

8

Component 1	Component 2	Component 3	Component 4	Component 5

Strengthening of Pesticide Regulatory System

Capacity to be: Quality pesticides is available to farmers

Objective: Increasing availability of quality pesticides and ensuring safet y of farmers

Overall responsible organization: ROP

Collaborating actors: HORDI, Pesticide Importers, MOA, Custom, Import Controller, Pesticide Importers, Sellers, Dealers, Ministry of Finance, ITI, SLSI, NAICC, ETC, PDOA, MASL, SEPC, CEA, DAD, etc.

Implementation Period: 2026-2030

【Output1】 Improved system for quality analysis of pesticides
【Output2】 Efficient monitoring network from import to use
【Output3】 Registered and legalized pesticide storage & distribution system
【Output4】 Strengthened inspection & prosecution system
【Output5】 Comprehensive rules and guidelines for occupational safety and use
【Output6】 Efficient system of post-consumer waste management and disposal

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Component 1	Component 2	Component 3	Component 4	Component 5

Strengthening of Pesticides Residue Analysis & Monitoring System

Capacity to be: Facilitation of residue control in produce

Objective: Ensuring consumer safety

Overall responsible organization: ROP (in close collaboration with MOH)

Collaborating actors: MOH, MOA, Department of Commerce, Exporters, NPQS, HORDI, DOAgBiz, ETC, Research institutes of DOA, private laboratories, ITI, etc.

Implementation Period: 2025-2030

【Output1】 Declared MRLs for all pesticide crop combinations
【Output2】 Agreed MRLs for destination countries
【Output3】 Established pesticides residue analysis and monitoring system / program
【Output4】 Established rules & guidelines for complying MRL
【Output5】 System for ensuring safe levels of pesticides in food

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Thank you

Attachment-30
Details of lessons and outcomes incorporated into CAP

Details of lessons and outcomes incorporated into CAP

Component & section	Type of revision	Existing form	Revised form / new addition	Reference
1. Improvement of fertilizer management system				
Output 2	Wording	Strengthened fertilizer analysis capacity	Strengthened fertilizer analytical capacity for quality assurance	The cases observed in Japan
Activities	Word addition	onsite inspection of fertilizer (Random/ periodic)	Regular onsite inspection of fertilizer (Random/ periodic) quality, labelling, etc.	Regular inspection on quality and labelling of fertilizers by the national and prefectural governments (on-site inspection) according to training in Japan
Output 3	Word addition	Improved fertilizer distribution system	Improved fertilizer manufacturing and distribution system (especially P)	Concern and finding solutions for the decrease in P sources in the world according to training in Japan
Activities	New activity addition	-	Strengthen distribution of high-quality Organic fertilizers.	Many types of organic fertilizers are available on the market in Japan
Activities	New activity addition	-	Implementing regulations for fertilizer manufacturing	Fertilizer is manufactured and regulations are available in Japan
2. Promotion of appropriate fertilizer application				
Output 1	Word addition	Review and analysis of existing recommendations, standards of organic/inorganic/mixtures & bio-fertilizer etc.	Review and analysis of existing recommendations including amounts/ application methods/ time of application/ stage of application etc., standards of organic/inorganic/mixtures & bio-fertilizer etc.	The efficacy of bio-fertilizer has been confirmed in Japan.
	Wording	Improved recommendations for fertilizer application according to soil & climate condition	Recommendations for fertilizer application according to soil, crop, crop-stage & climate condition	Sri Lanka's climate is highly diverse, with varying soil qualities and topography. It has been found in the project that without recommendations tailored to each specific situation, farmers will not follow them.
Activities	New activity addition	-	Develop fertilizer recommendations for each type of organic fertilizer and available local organic resource	Research institute and extension workers collaboratively work to develop organic fertilizer use recommendation to minimize use of synthetic fertilizers in Japan.
	New activity addition		Recommend comprehensive nutrient management methods, such as utilizing green manure through the use of agricultural machinery and	Comprehensive nutrient management methods was developed and used in Japan.

Component & section	Type of revision	Existing form	Revised form / new addition	Reference
			the use of pelletized organic fertilizers.	
Output 2	Wording	Strengthened soil analysis capacity	Strengthened soil testing program	-
Activities	Word addition	Collaboration with private sector	Collaboration with provincials and private sector	According to experience in Training in Japan
Output 3	Wording	Trained extension workers & private sector on fertilizer application	Trained extension workers, private sector & farmers on fertilizer application	
	New activity addition		Establishment of farmer cooperatives for systematic implementation of appropriate fertilizer application	According to experience in Training in Japan
Activities	New activity addition	-	Develop technologies to produce fertilizer from wastes (industrial, household, and sewage sludge) and system to connect locally available organic fertilizer, soil conditioner, green manure, etc.	The use of Biomass in respective region was observed in training in Japan
3. Enhancing safe and appropriate use of pesticides and fertilizers				
Output 1				
Output 2				
Output 3				
Activities	Word addition	Implementation of extension service with utilizing the technology and extension package	Implementation of extension service with utilizing the user friendly technology and extension package.	Information material for Extension was user friendly in Japan Recordkeeping form for beginners has been developed through experience of project implementation
Output 4			Settle the goal to achieve safe crop production	The importance of goal is observed in Japan
4. Strengthening pesticide management system				
Output 1	-	-	-	-
Activities	Word addition	Improvement of accredited compliance laboratories.	Improvement of accredited compliance laboratories with adequate human resources and instrumentation. Recruitment of adequate	-

Component & section	Type of revision	Existing form	Revised form / new addition	Reference
			staff	
Output 2	-	-	-	-
Activities	New activity addition	-	Criteria development for identification and removal of inefficient/ highly hazardous/ chronic health impacts, pesticides	
Output 3	-	-	-	-
Activities	New activity addition	-	Implementation of systems for traceability of stock maintenance	The systems for traceability of stock maintenance was observed in Japan
Output 4	-	-	-	-
Activities	New activity addition	-	Create a carder revision to recruit a legal officer to each province Criteria development for disposing of confiscated pesticides Criteria development for border control of illegal pesticides collaborated with the police and forces	
Output 5	-	-	-	-
Activities	Word addition	Conducting campaign for awareness on improved regulatory system and at field level	Conducting campaign for awareness on improved regulatory system and importance of recordkeeping at field level	Learnt that record-keeping is extremely important for the appropriate use of pesticides in Japan
Output 6	-	-	-	-
Activities	New activity addition	-	Identification of responsible authorities for disposal of obsolete pesticides and containers and development of a criteria to disseminate the responsibilities	
5. Strengthening of pesticide residue analysis & monitoring system				
Output 1	-	-	-	-
Activities	New activity addition	-	Collaborative mechanism establishment for MRL declaration.	According to experience in Japan
Output 2	-	-	-	-
Activities	New activity addition	-	Harmonization of locally developed MRLs with CODEX MRLs	
Output 3	-	-	-	-
Activities	-	-	-	-
Output 4	-	-	-	-
Activities	-	-	-	-

Component & section	Type of revision	Existing form	Revised form / new addition	Reference
Output 5	-	-	-	-
Activities	New activity addition	-	Improved national level programs for monitoring pesticide residues in imported and exported food Development and maintenance of a of national residue database for crop produce and food commodities for decision making and forecasting using routine residue monitoring programs	-

Attachment-31
CAP (updated version)

Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka

Road Map

for

Safe and Appropriate Use of Agrochemicals (2021-2030)

February 2026

Department of Agriculture

This document was presented to key stakeholders, including directorate of the Department of Agriculture, at a meeting chaired by the Director General of Agriculture and held at the Royal Kandyan Hotel, Kandy, on 23 January 2026. The comments received at the meeting were duly incorporated. Subsequently, the document was circulated among the directorate of the Department of Agriculture and, in the absence of further comments, was formally adopted by the Department on 5th February 2026.

1.0 Introduction

Sri Lanka faces several urgent issues regarding pesticides and fertilizer namely patients with chronic kidney disease suspected to be caused by pesticides, refusal of import of agricultural products by other countries due to residual pesticides and pests, unavailability of fertilizers in a timely manner, very high chemical fertilizer subsidy accounting for about 80% of the MOA budget, insufficient knowledge of extension staff on the use of pesticides and fertilizer, The farmers do not have enough knowledge about the types of pests and the appropriate amount of pesticides and chemical fertilizers. In addition, private companies may sell more than the necessary amount at a high price, which leads to raising farming costs.

Accordingly the Government of Sri Lanka requested Technical Cooperation from JICA aiming at capacity development for comprehensive solutions in the area of safe and appropriate use of pesticides and fertilizers. The project for Promotion of pesticides and fertilizers was started in 2021 and the Comprehensive Action Plan was elaborated during the project.

2.0 Action Plan Elaboration Process

The elaboration comprised of several steps.

i. Status evaluation

The plan was developed with analyzing all outputs throughout the Planning Phase, namely, the findings from stakeholder meeting at national level, fact finding survey and stakeholder meetings at each pilot site, literature review, and hints gained through the series of online seminars.

During January and February 2021, various online discussions were held between Sri Lankan Team and Japanese Team, as well as several meetings by Sri Lankan Team with stakeholders at national levels, for identifying the capacity gaps and necessary actions to overcome to develop the plans, with strong commitment of Sri Lankan Team, being facilitated by the Japanese Team. (Please refer to Phase 1 Completion Report of the Project).

ii. Problem Tree Analysis

To be able to clarify the cause and effects of the issues surrounding pesticide and fertilizer, the issues identified through the above discussion and surveys were analyzed and mapped in the form of problem tree. The major problems arose are 1) health problem caused by soil and water pollution in rural areas, 2) refuse of exported ago-products due to pesticide residue, and 3) farmers health problem caused by inappropriate use of pesticide. 1) is the issue relating to both pesticide and fertilizer use, while 2) and 3) are induced by inappropriate use of pesticide. It was reconfirmed that to alleviate and solve those 3 problems it is necessary to challenge all aspects from policy, regulation to practice in field, as many of the causes are interrelated each other.

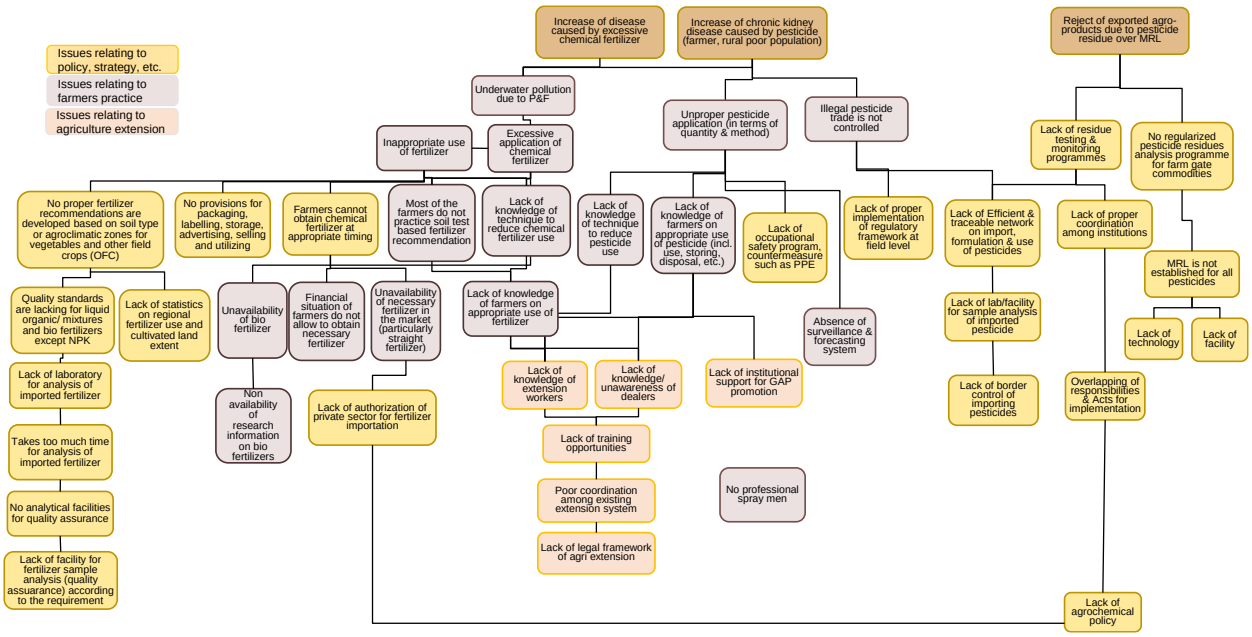


Figure 2.1: Problem tree analysis

As for the chemical fertilizer, all fertilizer distributed in the country is imported. It is pointed out that the sample analysis of imported fertilizer is not necessarily sufficient. As fertilizers are mixed by distributers without having proper recommendation, it makes difficult for farmers to apply necessary fertilizer according to their soil and climatic condition. Moreover, the sacks of mixed fertilizer after mixture tend not to have label of contents, farmers often apply fertilizer without knowing the appropriateness of them for their land yet believing whether fertilizer is "good". Inappropriate distribution of fertilizer at Agrarian Service Centers and Farmer Organizations due to lack of storage is also an issue, as there is a tendency that farmers apply fertilizer when they receive them, without paying attention to the appropriate timing of its application.

Considering these situations, it is necessary to analyze the imported fertilizer well and distribute the appropriate fertilizer for farmers to facilitate the availability of necessary fertilizer in markets.

The situation is similar in the case of pesticide. The pesticide is also all imported, and efficient traceable network on import, formulation and use of pesticides is lacking. Illegal pesticide and the pesticide with the label of foreign language are also in markets, which force farmers to rely on the information provided by dealers and knowledge from their experiences. As for the issue of pesticide residue, such issues were stressed; Maximum Residue Levels are not established for all pesticide, and there is no regularized pesticide residues analysis program for farm gate commodities, which impede appropriate control of residue of pesticide.

Commonly, it was found that lack of coordination and/or overlapping among stakeholders is also a serious issue which may create gap in responsibilities among the stakeholders.

iii. Creating the direction of the Comprehensive Action Plan

Comprehensive Action Plan is the roadmap to overcome the issues associated with pesticide and fertilizer. Thus, to lead the approach for solving the complex issues, the problem tree was further analyzed, categorizing the issues by group with relevant topics as shown below.

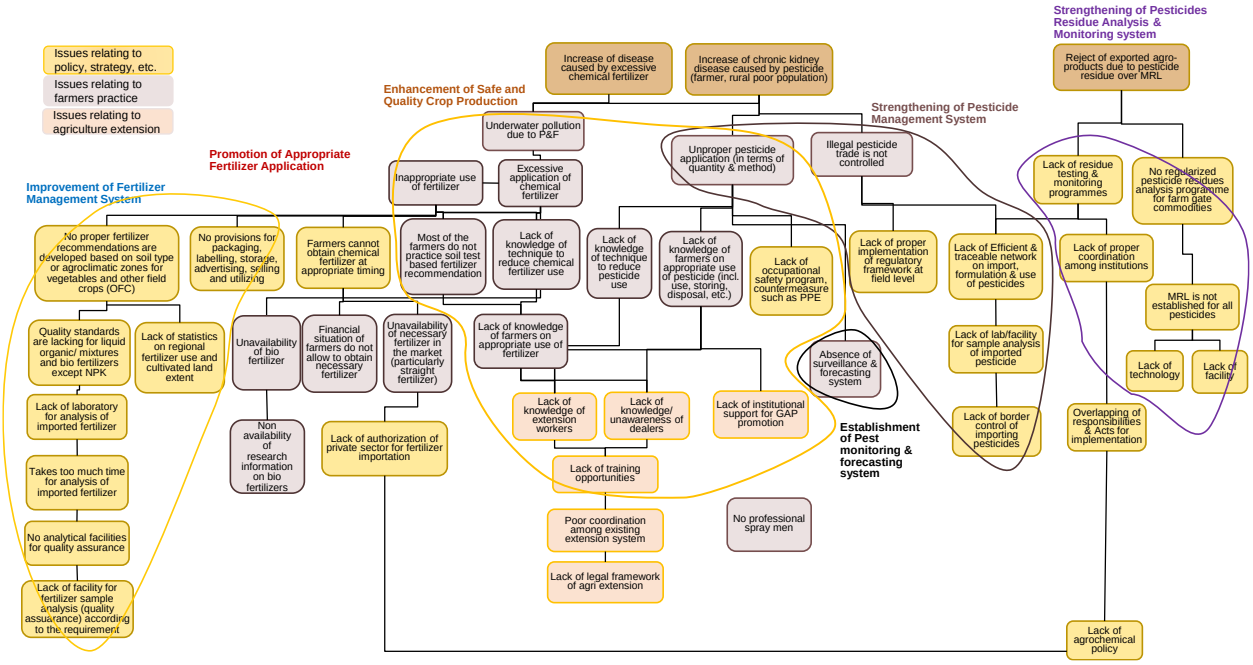


Figure 2.2: Categorization of the problem tree

The problem tree could be categorized by the following 5 categories namely; 1) Issues associated with insufficient fertilizer analysis and management; 2) Issues impeding appropriate fertilizer application; 3) Issues associated with inappropriate farmer practices; 4) Issues caused by insufficient pesticide analysis and management; 5) Issues related to deficiency of pesticide residue analysis and control. The issues could be also categorized by stages from import to use in farm and some are cross-cutting issues, but categorization may ease clarifying responsible organizations to tackle with each category of issue in the comprehensive action plan.

Comprehensive Action Plan

The definition and direction of the Comprehensive Action Plan (CAP) is as shown below.

- CAP is the **roadmap** for achieving the goal as above, with utilizing whatever existing resources, actors, and projects. It is expected for the responsible organizations to coordinate with collaborating actors to solve the issues associated with pesticide and fertilizer.
- CAP is composed of the 5 major components responding to the above 5 categories of issues with setting clear objective and capacity to be, the actions, responsible actors, and time-period.
- The components are positioned around 5 aspects of pesticides and fertilizer management namely 1. Analysis and Quality Management, 2. Control and Distribution, 3. Distribution, 4. Use and 5. Control and Traceability.
- The CAP provides the basis for achieving occupational safety, environmental safety and food safety finally promoting exports in addition to safe food for the consumers in the country.

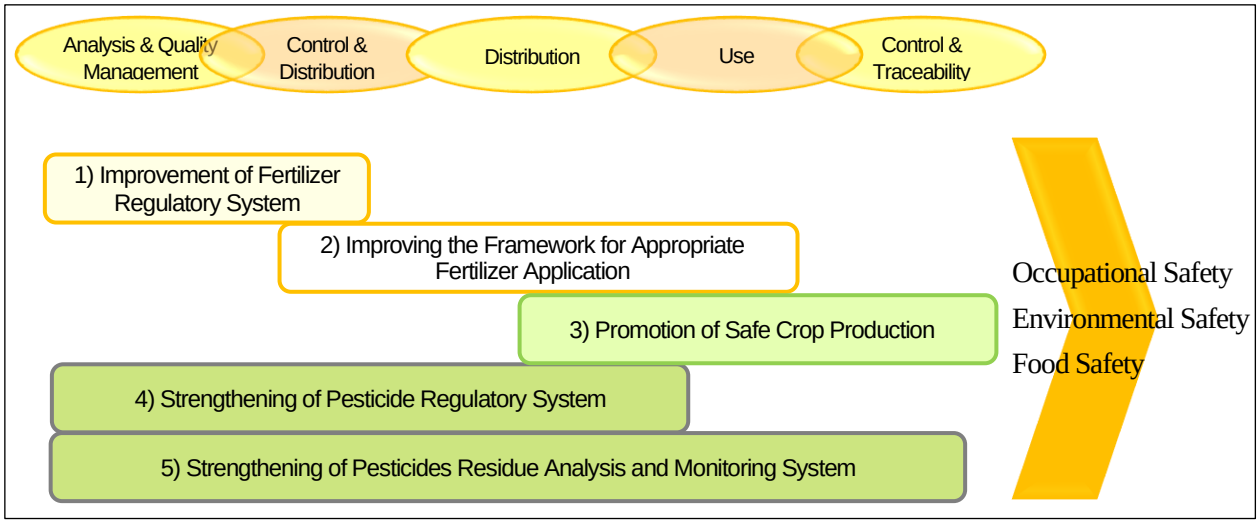


Figure 1: Overview of Comprehensive Action Plan

Component 1 - Improvement of Fertilizer Regulatory System

As for the chemical fertilizer, all fertilizer distributed in the country is imported. As fertilizers are mixed by distributers with general balance of N.P.K, it makes it difficult for farmers to apply necessary fertilizer according to their soil and climatic condition.

Moreover, the sacks of mixed fertilizer after mixture tend not to have label of contents, farmers often apply fertilizer without knowing the appropriateness of them for their land with believing that fertilizer is "good". Inappropriate distribution of fertilizer at ASC and Farmers Organization due to lack of storage is another issue.

Outline:

The roadmap toward improvement of fertilizer regulatory system is as shown below. Regarding imported and distributed chemical fertilizer, NFS has a list of importers and fertilizers. However, as it is not an accessible database, which could be utilized for better fertilizer application, it is not possible to understand if fertilizer needed is available in which markets. Thus, the Component 1 seeks the way to improve appropriate fertilizer analysis and improvement of fertilizer distribution.

Table 1: Outline of the Component 1

【Component 1 】Improvement of fertilizer regulatory system				
Capacity to be: Quality fertilizer is available in necessary quantities				
Objective: Increasing availability of quality fertilizer timely to farmers				
Implementation period: : 2026～2030				
Overall responsible organization: National Fertilizer Secretariat (NFS)				
Expected Output	Major Activities	Responsible Organization	Collaborating Actors	Target Year
【Output1】 Upgraded and digitalized national fertilizer information and monitoring system established	Collect and integrate national fertilizer demand data based on crop production plans and seasonal requirements, using relevant crop forecasting tools	NFS	DOA(CROPIX) / PDOA / DAD / TRI / CRI / RRI / SRI, DOEA Mahaweli/ Private Sector	2026 (system establishment), Annual updates thereafter
	Collect and update information on fertilizer availability, including market stocks, distribution channels, and sales statistics (imported and locally produced fertilizers)			
	Collect and consolidate data on fertilizer importation, including types, quantities, timelines, and suppliers			
	Develop and operationalize a centralized digital database and dashboard to regularly update, analyze, and visualize fertilizer demand–supply data			
	Establish standard operating procedures (SOPs) for periodic data updating, validation, and inter-agency data sharing			
【Output2】 Strengthened fertilizer quality assurance and analytical capacity at national and regional levels	Identify and adopt national strategies and standards for fertilizer quality assurance, aligned with international best practices	NFS	SLSI / DOA (HORDI)	2026–2028 (capacity strengthening), Continuous implementation thereafter
	Strengthen analytical capacity of public and private laboratories for fertilizer quality testing through accreditation, equipment upgrading, and technical guidance		SLSI, Private sector, ITI, DOA (HORDI)	
	Conduct regular on-site inspections of fertilizer products (random and periodic) to assess quality, composition, labeling compliance, and safety		PDOA/ District NFS/ Private sector	
	Provide specialized training programs for fertilizer analysts, inspectors, and regulatory		Local / Foreign/ SLSI / ITI /	

	officers		HORDI	
	Recruit and deploy adequate technical and research staff to laboratories and inspection units			
	Upgrade and modernize laboratory facilities, including analytical equipment, quality control systems, and safety infrastructure			
	Develop and implement streamlined procedures and coordination mechanisms to improve efficiency in fertilizer testing, certification, and regulatory enforcement		MOA, TRI / CRI / RRI / SRI, DOEA Mahaweli	
【Output3】 Improved fertilizer manufacturing, distribution, and sales system ensuring timely access to quality fertilizers	Establish and manage a fertilizer demand forecasting system at national and regional levels to maintain adequate buffer stocks (including provision for an additional cropping season)	NFS		2026–2028 (regulatory strengthening), Continuous improvement thereafter
	Streamline fertilizer distribution and sales systems through enhanced coordination among public institutions and private sector actors		Private Companies, DAD, Mahaweli	
	Strengthen regulations and guidelines for fertilizer mixture formulation, including nutrient composition and crop-specific suitability		Research Institutes of DOA, other respective research institutes, Plantation Sector, Private Sector	
	Implement and enforce regulations for fertilizer manufacturing, ensuring compliance with quality, safety, and environmental standards		PDOA/ DAD, Mahaweli	
	Implement and monitor regulations for fertilizer sales outlet management, including licensing, storage conditions, and record keeping		NFS and DOA	
	Promote and strengthen the production, quality control, and distribution of high-quality organic fertilizers		NFS and DOA	
	Develop and enforce standardized fertilizer labeling guidelines, including nutrient content, application instructions, and safety information		SLSI	
	Improve storage and distribution infrastructure at fertilizer sales centers, including Agrarian Service Centers (ASCs)			
	Review existing fertilizer regulations periodically and revise them as necessary to address emerging challenges and market dynamics		DAD/ Private Sector	
Resources necessary: (Government fund) - The concerning surveys, discussion on simplification of fertilizer analysis process. (Other resource secured) - N.A. Though the concept paper for improving fertilizer distribution system is prepared, the concrete actions haven't been decided yet. (Expectation to external fund) - Fertilizer expert, ICT technical expert for developing database and the cost for its development, training costs, etc.				

Note:

- Involvement of NSF was limited when preparing this component and it is necessary to discuss more deeply for proceeding with this component.

Component 2: Improvement of the Framework for Appropriate Fertilizer Application

It is common for farmers to apply fertilizer when they get it, without considering soil condition and the crop to grow. As fertilizer recommendation corresponding to crop, soil and climatic condition has not been sufficiently developed and it is necessary to upgrade, it is not possible for extension workers to train farmers the appropriate fertilizer application method. Furthermore, information on organic fertilizer including green manure use is limited.

Outline:

The roadmap to improve the framework for fertilizer application is as shown below. Considering that the appropriate fertilizer recommendation is not available at the moment, it is necessary to analyze the existing recommendation to find out the points to upgrade. It is also necessary to strengthen soil analysis capacity to prepare necessary fertilizer recommendation. Once the fertilizer recommendation is ready, it is essential to distribute the information to farmers through training and/or demonstration and preparing useful tool for easily knowing the appropriate balance of fertilizer for their farms. As the government is promoting bio-fertilizer for decreasing the excess use of chemical fertilizer, it is also useful to evaluate and set the recommendation for it

Table 2: Outline of the Component 2

【Component2 】Improvement of the framework for appropriate fertilizer application				
Capacity to be: Farmers apply fertilizer upon soil condition, climatic condition referring to the recommendation				
Objective: Promotion of appropriate fertilizer application				
Implementation period: 2026～2030				
Overall responsible organization: DOA				
Expected Output	Major Activities	Responsible Organization	Collaborating Actors	Target Year
【Output1】 Updated, crop- and site-specific fertilizer application recommendations established and operationalized	Review and analyze existing fertilizer recommendations, including application rates, methods, timing, crop stages, and standards for organic, inorganic, mixed, and bio-fertilizers	DOA	Research Institutes of DOA, Other respective crop research institutes	2028
	Update and replace blanket fertilizer recommendations with evidence-based, differentiated recommendations, including: • Soil type–specific fertilizer recommendations • Crop- and crop growth stage–specific fertilizer recommendations • Fertilizer recommendations for different types of organic fertilizers and locally available organic resources • Comprehensive nutrient management approaches, including green manure integration, use of appropriate agricultural machinery, and pelletized organic fertilizers • Fertilizer recommendations for hybrid varieties and open-pollinated varieties (OPVs)		Research Institutes of DOA, Other respective crop research institutes	2028
	Establish clear procedures and technical criteria for recommending new-generation fertilizers, including fertilizer mixtures, liquid fertilizers, bio-fertilizers, and hybrid fertilizers		Research Institutes of DOA, Other respective crop research institutes	2029
	Develop fertilizer application recommendations for fertigation systems and protected /		Research Institutes of	2029

	semi-protected agriculture systems, considering water efficiency and nutrient-use efficiency		DOA, Other respective crop research institutes	
【Output2】 Strengthened and accessible soil testing and soil fertility advisory system	Simplify soil analysis procedures through the introduction of rapid soil testing tools, mobile soil testing laboratories, and field-level diagnostic methods	DOA	Research Institutes/ Private sector	2026-2027
	Strengthen collaboration with provincial authorities and private sector laboratories to expand soil testing coverage and service delivery		Private sector, SLSI, ITI	2027
	Conduct training programs for soil analysts and technical staff to ensure accuracy, consistency, and reliability of soil test results		DOA/Research Institutes/ ETC	2027
	Improve soil testing laboratory capacity through recruitment of human resources, upgrading of equipment, and maintenance of facilities		MOA/ DOA	
	Train volunteer extension assistants and farmers on proper soil sampling techniques to improve data quality and farmer ownership of soil fertility management		Other relevant crop research institutes, Mahaweli,	2027
【Output3】 Extension workers and input dealers capacitated to promote appropriate fertilizer application among farmers	Design and elaborate a standardized training program on appropriate fertilizer application, aligned with updated recommendations and soil testing results	DOA	Research Institutes/ ETC	2026
	Conduct training programs for Agricultural Instructors, extension officers, and fertilizer dealers, including practical field demonstrations		Research Institutes/ ETC	2026
	Support and strengthening of farmer groups and cooperatives to enable systematic and collective implementation of appropriate fertilizer application practices		PDOA Mahaweli, Other relevant crop research institutes, DAD	2026
	Develop and promote technologies and systems for producing fertilizers and soil conditioners from waste (industrial, household, and sewage sludge), and establish linkages to locally available organic fertilizers, green manure sources, and soil conditioners		PDOA	2027

Resources necessary:
(Government fund) - Review of fertilizer recommendation, simplification of soil analysis, training for extension workers and dealers, etc.
(Other resource secured) - N.A.
(Expectation to external fund) - Technical training by external experts how to set the fertilizer recommendation, training costs, simple soil analysis laboratory equipment, simple tools for soil sampling, etc.

Component 3: Promotion of Safe Crop Production

Most of the issues regarding pesticide and fertilizer such as health problem due to environmental pollution, health problem of farmers caused by misuse of pesticide, and issues of pesticide residue, are associated with lack of knowledge and awareness of farmers on safe and appropriate use of them. Alternative techniques for decreasing the use of pesticide and fertilizer such as fertilizer application considering soil condition, IPM, utilization of resilient variety, grafting, etc. are not commonly used and the knowledge and experiences of farmers and extension workers are limited.

Outline:

The roadmap for promoting safe crop production is as shown below. Even if the appropriate fertilizer recommendation is ready, even if fertilizer and pesticide distribution system is improved, if farmers are not aware the advantages to follow those recommendation, it is difficult to expect farmers to apply those techniques with making extra efforts. Accordingly, the Component 3 tries to develop technical package facilitating the useful technologies for farmers to practice for safe crop production, and extension package which make easier for extension workers and farmers to apply those techniques, so as to secure occupational safety of farmers, to alleviate environmental impact and to provide safe crops in markets.

Table 3: Outline of the Component 3

【Component3 】 Promotion of safe crop production				
Capacity to be: Safe and appropriate use of pesticides and fertilizers is widely practiced among farmers				
Objective: Ensuring occupational safety of farmers, safe produce for consumers and sustainable environment				
Implementation period: 2026～2030				
Overall responsible organization: DOA				
Expected Output	Major Activities	Responsible Organization	Collaborating Actors	Target Year
【Output1】 **Validated technologies and technology transfer packages on safe and appropriate use of pesticides and fertilizers institutionalized within national extension and agricultural education systems** *(Technologies and packages developed under the SAFE Project, 2022–2025)*	Integrate validated SAFE technologies and technology transfer packages into existing national extension mechanisms, including Yaya Village programs, producer groups, and farmer organizations	ROP	DOA, Research institutions/ Extension	2026-2030
	Mainstream safe and appropriate pesticide and fertilizer use packages into Agri+SHEP project (Step 4) and other market-oriented extension approaches			
	Incorporate validated technologies and extension packages into in-service training programmes for extension officers			
	Integrate safe crop production contents into curricula of agricultural schools, training institutes, and Extension Training Centres (ETCs)			
	Conduct study tours and knowledge exchange programs in other countries to learn good practices on safe pesticide and fertilizer use			
	Review, harmonize, and update existing extension manuals, guidelines, and tools to reflect the validated SAFE technologies			
【Output 2】 Validated technology and technology transfer packages effectively	Implement validated technologies and extension packages through routine extension service delivery, using farmer-friendly and practical approaches	DOA (research institute & ETC)	PDOA / DOA / Mahaweli Authority/ Farmers	2026-2030
	Facilitate experience sharing and cross-learning among implementation sites to		ETC/ PDOA	
implemented,	promote horizontal diffusion of good practices			

refined, and scaled through field application	Refine and fine-tune technologies and extension packages based on field feedback, monitoring results, and farmer experiences		DOA-Research institutes/ ETC	
【Output3】 Extension officers capacitated to promote safe crop production nationwide	Design and implement a national training programme based on institutionalized and validated technology and technology transfer packages Set clear national and provincial extension targets for achieving safe crop production Conduct Training of Trainers (TOT) programmes to ensure consistent, quality dissemination of safe pesticide and fertilizer use practices	DOA (ETC)	DOA Research institute/ PDOA / Private sector/ Farmers	2026-2030
【Output 4】 Farmers trained and adopting safe and appropriate crop production practices	Conduct **farmer-level training, demonstrations, and field days** on safe pesticide and fertilizer use Promote adoption of safe crop production practices through **farmer groups, producer organizations, and community-based approaches** Conduct **farmer-level training, demonstrations, and field days** on safe pesticide and fertilizer use	DOA (ETC)	PDOA / DOA / Mahaweli	2026-2030
Resources necessary: (Government fund) - Identification of existing materials/tools/protocols, etc. human resources for development of technical and extension packages, training for extension workers and dealers. (Other resource secured) - N.A. (Expectation to external fund) - Technical experts for developing technical packages (fertilizer application, IPM, grafting, introduction of resident variety, etc.), experts for developing extension packages (ICT specialist, etc. in need), study tour in Japan and the third country, simple soil test kit and pesticide test kit for demonstration purpose, training costs, etc.				

Component 4: Strengthening of Pesticide Regulatory System

The pesticide is also all imported, and efficient traceable network on import, formulation and use of pesticides is lacking. Illegal pesticide and the pesticide with the label of foreign language are also in markets, which force farmers to rely on the information provided by dealers and knowledge from their experiences.

To distribute safe and appropriate pesticide for appropriate use by farmers, it is necessary to improve traceable network system on import, formulation and use of pesticides

Outline:

The roadmap to strengthen pesticide regulatory system is shown below. For promoting appropriate pesticide use, it is inevitable for the government to control inappropriate pesticide by establishing better system from analysis to distribution and monitoring. As for the measures in the field, the Component 4 aims to prepare guide for farmers for safe use of pesticide, including appropriate disposal of empty pesticide bottles to avoid polluting the environment which may cause health problems of the rural population.

Table 4: Outline of the Component 4

【Component 4 】Strengthening of pesticide regulatory system				
Capacity to be: Quality pesticides is available to farmers				
Objective: Increasing availability of quality pesticides and ensuring safety of farmers				
Implementation period: 2026～2030				
Overall responsible organization: ROP				
Expected Output	Major Activities	Responsible Organization	Collaborating Actors	Target Year
【Output1】 Strengthened pesticide quality analysis system at national level, including private and border-entry laboratories	Establish mechanisms to develop and operationalize pesticide quality analysis systems in private laboratories, in compliance with national standards	ROP	MOA, DOA/, SLAB, Private laboratories, Pesticide Importers	2027
	Upgrade and strengthen accredited compliance laboratories with adequate human resources, analytical instruments, and quality management systems		MOA, DOA, Ministry of Science & Technology, Custom, Import Controller, Pesticide Importers, Ministry of Finance	2030
	Establish a pesticide compliance laboratory at major entry points (customs) to conduct routine sample analysis of imported pesticides		Custom, MOA, NPQS, DOA, ITI, SLSI	2027
	Conduct technical training programs for laboratory analysts and technicians on pesticide quality testing, safety, and compliance		MOA, DOA, ITI, SLSI	
【Output2】 Efficient and integrated digitalized pesticide monitoring network from importation to field use	Establish a digitalized national monitoring network and centralized database covering pesticide importation, distribution, sales, and field-level use among regulators, private sector, and enforcement agencies.	ROP	DOA, Pesticide Importers, MOH PDOA, MASL	2028
	Develop criteria and procedures for identification, restriction, and removal of inefficient, highly hazardous, and chronic health–impact pesticides			
	Implement traceability systems for pesticide stock management across the supply chain, from importers to retailers		Customs, Import Controller, Pesticide Importers, Sellers, Dealers, Authorized Officers	2029
【Output3】 Updated and enforced pesticide registration and regulatory framework	Strengthen and operationalize pesticide registration and legalization systems in line with updated risk assessment and international conventions.	ROP	DOA, PDOA, MOA	2026
	Amend relevant Acts, regulations, and guidelines to address emerging pesticide risks and regulatory gaps			
	Conduct capacity development programs for regulatory officers to improve enforcement, risk assessment, and decision-making			2027
【Output4】 Strengthened	Amend legal provisions of the Act to enhance inspection authority and prosecution mechanisms	ROP	MOA	2029

inspection, enforcement, and prosecution system for pesticide regulation Strengthened inspection & prosecution system	Expand inspection and enforcement activities at provincial and field levels, including pesticide outlets and storage facilities		PDOA, ETC, MASL	2028
	Establish a rapid investigation unit to respond to pesticide-related violations, poisoning incidents, and illegal trade		DOA	2030
	Develop district-level criteria and procedures for safe disposal of confiscated and illegal pesticides		PDOA, ETC, MASL	
	Develop and implement border control criteria for detection and prevention of illegal pesticide imports, in collaboration with police and security forces		MOA, DOA, Security Forces, Police, Cyber Security	
【Output5】 Comprehensive rules, guidelines, and awareness mechanisms for occupational safety and pesticide use	Amend and update Acts and regulations to strengthen occupational safety requirements for pesticide handling and application	ROP	MOA/ DOA	2030
	Conduct training and awareness programmes for extension officers, dealers, and field-level stakeholders on updated regulatory requirements.		PDOA, ETC, MASL	2028
	Promote awareness and compliance among farmers and farmer organizations on safe pesticide use and occupational health measures		PDOA, ETC, MASL, Farmer Organizations	2028
【Output6】 Efficient system for post-consumer pesticide waste management and disposal established	Strengthen mechanisms for disposal of obsolete pesticides and empty containers, clearly defining stakeholder responsibilities	CEA	ROP, Pesticide Industries/ PDOA	2030
	Establish collection, disposal, and recycling systems for pesticide containers and obsolete stocks, including environmentally sound disposal options		ROP, Pesticide Industries, Ministry of Environment, Cement Companies (for incineration), Approved recyclable waste collectors etc.	2028
	Conduct national and local awareness campaigns on pesticide waste collection, safe disposal, and environmental protection		ROP, Pesticide Industries, DAD, PDOA, Mahaweli, Recyclers, Farmer Organizations, Ministry of Environment, CEA	2027
Resources necessary: (Government fund) - Establishment of platform, survey on pesticide dealers, legal actions such as amendment of laws, training for regulatory officers, campaign for awareness raising, coordination with concerning actors. (Other resource secured) - N.A. (Expectation to external fund) - Pesticide expert, and provision of necessary trainings, training cost, laboratory facility for HORDI, and for entry point (FTIR, scanner, etc.) **"Pesticide management plan" was published in December 2020, under the World Bank project "Agriculture modernization project". Although there is no concrete plan for its implementation, it is expected for the project to cover some of the activities under this component.*				

Component 5: Strengthening of Pesticides Residue Analysis and Monitoring System

As for the issue of pesticide residue, such issues were stressed; MRLs is not established for all pesticide; no regularized pesticide residues analysis program for farm gate commodities, which impedes appropriate control of

residue of pesticide. On the other hand, ROP has already declared more than 60 pesticides for setting PHIs according to the targeted MRL, and now is in the process of approval by MOH.

Outline:

The roadmap to strengthen pesticide residue analysis and monitoring system is shown below. The issue of pesticide residue is getting serious in the country for food safety, and for promoting export of agriculture products. MRL regulation is under the MOH. Recently, MOH has drafted a MRL regulation covering most of the crop plus pesticide combinations, which is expected to be on gazette soon according to the food act. On the other hand, ROP is responsible for declaring MRLs for registered pesticides for setting PHIs and leading farmers for the appropriate use with elaborating guideline and trainings. Thus, the Component 5 aims to strengthen the system for realizing it and closely coordinating with MOH and ROP.

Table 5: Outline of the Component 5

【Component 5 】Strengthening of pesticides residue analysis and monitoring system				
Capacity to be: Established system for residue control in produce				
Objective: Ensuring consumer safety				
Implementation period: 2026～2030				
Overall responsible organization: ROP (in close collaboration with MOH)				
Expected Output	Major Activities	Responsible Organization	Collaborating Actors	Target Year
【Output1】 Nationally declared and legally enforced Maximum Residue Limits (MRLs) for pesticide–crop combinations	Establish a formal collaborative mechanism among ROP, MOH, DOA, and MOA for coordinated declaration, revision, and enforcement of MRLs	ROP	MOA / DOA/ MOH / ETC/ HORDI	2027
	Review and analyze CODEX MRLs and MRL systems adopted by selected reference countries		DOA / ETC / MOA / MOH	
	Develop national MRL proposals for all priority pesticide–crop combinations, based on risk assessment and international benchmarks		DOA / MOA	2028
	Legalize and gazette declared MRLs under the Control of Pesticides Act		MOA	2029
	Legalize and gazette declared MRLs under the Food Act to ensure enforceability across the food chain		MOH	2030
【Output2】 Agreed and harmonized MRLs for export destination countries	Negotiate and agree on MRLs and related SPS requirements with importing countries for exported and imported agricultural commodities	DOA	ETC / NPQS, Department of Commerce / Exporters	2026
	Conduct supervised pesticide residue trials and develop a national database to support MRL setting and trade negotiations		ROP / HORDI / Exporters	2026
	Harmonize locally developed MRLs with CODEX and destination-country MRLs to reduce trade barriers		ROP / HORDI / ETC	2028
【Output3】 Established national pesticide residue analysis	Strengthen collaboration with research institutes, private laboratories, and pesticide industries for residue analysis and monitoring	DOA	ROP	2027
and monitoring system	Establish and operationalize a national pesticide residue testing and monitoring programme, covering major crops and production areas		ROP / Research Institutes of DOA	2027

	Conduct coordinated supervised residue trials to determine Pre-Harvest Intervals (PHIs) and support MRL setting		Other crop research institutes, Private laboratories, pesticide industries	2027
【Output4】 Established rules, guidelines, and compliance mechanisms for MRL implementation at field level	Develop guidelines to strengthen the regulatory framework for pesticide use at farm and production levels, aligned with MRL requirements	DOA	ETC, ROP, PDOA, Mahaweli, Other crop research institutes	2028
	Conduct training programmes for extension officers and field-level staff on MRL compliance and enforcement			2028
	Implement awareness campaigns for farmers and producer groups on MRLs, PHIs, and safe pesticide use			2029
	Conduct monitoring and verification of MRL compliance at production level, including farm inspections and sampling			2030
【Output5】 Operational system to ensure safe pesticide residue levels in food at import, market, and consumption stages	Establish Monitoring system to verify MRL compliance in imported food and domestic market samples	MOH	ROP	2028
	Develop and strengthen legal provisions under the Food Act to ensure enforcement of safe pesticide residue levels in food			2027
	Strengthen and expand national monitoring programmes for pesticide residues in imported and exported food commodities			2027
	Develop and maintain a national pesticide residue database for agricultural produce and food commodities to support decision-making, risk assessment, and forecasting		DOA	2028
Resources necessary: (Government fund) - Legal actions, survey on CODEX and MRL of other countries, operation cost for the laboratory, campaign cost, etc. (Other resource secured) - Food safety project, implemented by MOH with the support of FAO/WHO, "Support to Food safety and quality in Sri Lanka" (2021-) by UNIDO/FAO (Expectation to external fund) - External experts in food safety and pesticide management, simple equipment for residue analysis, training and monitoring cost, etc.				

Note:

- CODEX subcommittee is working collaboratively with ROP & MOH.
- HORDI lab is not yet recognized under Food Act at present.
- MOH with the support of FAO/WHO conducts food safety project, which include the issue of pesticide residue.

General Notes

- There are various stakeholders involved in pesticide and fertilizer management from national level to field level. Regardless of efforts of each stakeholder, lack of coordination among stakeholders is one of the issues which hinder the improvement to respond to the needs. Considering this point, the action plan was discussed, specifying responsible organization of leading each output, collaborating actors and overall responsible organization for each component.
- As it is mentioned in each component, it is also expected to collaborate with the on-going projects with external support, not only trying to use the government resources and/or waiting for new projects.

Chapter 4 Achievement of Project Objective

4.1 Project Design Matrix (PDM)

Attachment-32
Project Design Matrix
（updated version）

PDM for the Project for Promotion of Safe and Appropriate Use of Pesticides and Fertilizer in Sri Lanka, ver.2 (as of January 2024)

Implementation agency: ROP (Office of Register of Pesticide), DOA (Department of Agriculture)
Cooperating organizations: HORDI, ETC-Agribiz, SCS, ETC, NAICC, PDOA, NFS, MASL, private sector
Implementation period: (planning phase) April 2020- March 2021, (implementation phase) October 2023 - 2.5 years
Target Area: Nationwide and the target districts (Nuwara-eliya, Anuradhapura, Matale, Badulla, and Puttalam)
Target group:
(Direct beneficiaries) Implementation agency & cooperating organizations (Working group members, extension workers, farmers in the target districts (around 200 farmers)
(Ultimate beneficiaries) Other farmers in the target areas

Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Objective: Safe and quality crop production is widely practiced among farmers	・ ●% of the target farmers in the target districts learn and practice the technology packages for safe and quality crop production. ・ The technology & extension packages are shared with extension workers and farmers outside of the target districts.	・Interview to DOA ・Statistical data ・Series of the project reports	
Project Purpose: Capacity of the stakeholders and institutions is strengthened for promoting safe and quality crop production	・ Achievement of the action plan elaborated by each WG. ・ Validated technology & extension packages for safe crop production are approved by DOA. ・ Comprehensive action plan (updated version) is approved by DOA.	・Interview to DOA ・Interview to representative farmers ・Monitoring sheets and the project completion report	・The policy of the Sri Lankan government on food safety is not drastically changes. ・The comprehensive action plan (updated version) is implemented by the Sri Lankan government. ・Production and marketing environment do not deteriorate drastically.
Output 1 Comprehensive action plans and action plan for the implementation phase for promoting safe and appropriate use of pesticide and fertilizer are formulated.	・ Result of analysis of the issues and capacity of the stakeholders and institutions for promoting appropriate use of pesticide and fertilizer. ・ Comprehensive action plans elaborated. ・ Draft Action plan for the implementation phase	・Project implementation report of the planning phase	・The policy, system and budget of extension services do not drastically change.
Output2 Technology and extension packages (tentative) for promoting safe and quality crop production are developed and validated.	・Result of validation of the employed technology & extension packages for safe crop production. ・Final version of the technology & extension packages ・Status of application of the technology & extension packages and the evaluation results of the packages by the extension workers and farmers in the pilot	・Interview to DOA, target districts and farmers ・Monitoring sheets ・Results of the field survey in the planning phase	

	districts.		
Output3 Extension workers (including government and private sector) and farmers are trained for the use of technology and extension packages.	・The training program elaborated. ・Master trainer trained: more than 15 prs ・Number of the extension workers received the training: more than 50 prs (10 prs/district). ・Number of the farmers who received the training: more than 200 prs (20 prs /farmer group, 10 farmer groups). ・Evaluation result by the training participants	・Interview to DOA, and training participants in the target districts ・Monitoring sheets	
Output4 The experience and knowledge gained through the implementation phase are reflected to the Comprehensive Action Plans	・Record of the seminar for extension workers outside of the target districts. ・Record of the stakeholder meetings for promoting the Comprehensive Action Plan. ・Updated Comprehensive Action Plan	・Monitoring sheets	

Activities	Inputs	
1.1 To understand the current situation of environmental and health impact of inappropriate use of pesticide and fertilizer, feature of crop production, existing extension system, other donors' supports and so on through literature review and others. 1.2 To identify the stakeholders and issues related to safe and appropriate use of pesticide and fertilizer through group discussion at national level. 1.3 To survey current situation of the use and availability of pesticide and fertilizer, and awareness of farmers through fact finding survey at target districts. 1.4 To hold stakeholder meeting for identifying specific issues at target districts for finding clues for elaborating action plans. 1.5 To share the good practices of promoting safe crop production in Japan. 1.6 To analyze the results of all activities above and identify the capacity gap to fill. 1.7 To elaborate comprehensive action plans (draft) 1.8 To elaborate the action plan for the implementation phase (draft). 2.1 To establish Working Groups and elaborate WG action plans. 2.2 To prepare the list of existing training materials, manuals, tools etc. regarding safe and quality crop production. 2.3 To identify the appropriate technologies for safe and appropriate use of pesticide and fertilizer. 2.4 To develop the materials and tools for extending the technology. 2.5 To develop the tentative technology & extension packages.	<u>Sri Lankan side (DOA):</u> 1) Assignment of Counterpart personnel 2) Office spaces with fixtures and furniture for the Project (DOA) 3) Available data and information related to the project activities. 4) Operational expenses necessary, including business trip expenses within Sri Lanka, for the implementation of the Project. <u>Japanese side (JICA)</u> 1) Dispatch of experts of; Chief Advisor/Agriculture extension Agronomist/appropriate use of pesticide & fertilizer Promotion of Good Agriculture Practice Training material development 2) Counterpart Training; Training in Japan and the third country 3) Equipment: Office equipment and other necessary equipment for	・There are no conflicts, influence by COVID-19 and so on, which cause fatal effects on planned activities. ・There are no drastic climatic, pest and disease influences impeding crop production. ・Pesticide dealers do not object to the activities.

2.6 To select the test plot in the target district for testing the technology & extension packages. 2.7 To raise awareness of farmers on safe use of pesticide & fertilizer. 2.8 To organize the training in a third country on the safe & appropriate use of pesticide and fertilizer. 2.9 To finalize the technology & extension packages for safe crop production, reflecting the lessons learned through the field practice in the pilot districts. 2.10 To exchange experiences, good practice, outcome, and lessons among the pilot districts.	development and implementation of technology & extension packages, etc. 4) Others: Other costs necessary for project activities, including expenses for training / workshop / seminar, elaboration of materials & tools, transport fee, etc. which are not covered by Sri Lankan government.	
3.1 To elaborate the training program on the validated technology & extension packages for the extension workers and farmers. 3.2 To conduct trainings for the extension workers in the target districts (TOT) according to the program. 3.3 To conduct trainings for farmers in the test pilot according to the program.		<u>Pre-condition</u> ・Security issues, epidemic condition does not bring any profound impedance to the project activities ・There are no disasters, extreme climatic conditions and pests that cause fatal effects on farming activities.
4.1 To hold seminars for extension workers outside of the target districts. 4.2 To organize the training in Japan to exchange experiences for updating and implementing the comprehensive action plan. 4.3 To hold stakeholder meetings for promoting comprehensive action plans. 4.4 To reflect the lessons learned through the implementation phase to the comprehensive action plans		

Attachment-33
Comparison table of revision on PDM

As of 6 November, 2023

Comparison of PDM (ver.1) and PDM (ver.2)

1. Project Framework

PDM (ver.1) as of April 2023	PDM (ver.2) as of January 2024	Reason of change & Explanation
Implementation agency: DOA/ DOAgbiz, MOA	ROP (Office of Register of Pesticide), DOA (Department of Agriculture)	As the Project focuses on "Safety" rather than "marketing", it is better for ROP to be the coordinator.
Cooperating organizations: PDOA, NFS, ROP, HORDI, SCS, ETC, NAICC, MASL, Universities, private sector	HORDI, ETC-Agribiz, SCS, ETC, NAICC, PDOA, NFS, MASL, private sector	
Implementation period: (planning phase) April 2020- March 2021, (implementation phase) September 2023 - 2.5 years	(planning phase) April 2020- March 2021, (implementation phase) October 2023 - 2.5 years	As the field work started from October 2023.
Target area: Nationwide and the target districts (Nuwara-eliya, Anuradhapura, Matale, Badulla, and Puttalam)	No change	
Target group: DOAgbiz, other agriculture extension concerning institutions, and farmers for sales purpose with inappropriate use of pesticide & fertilizer in the target districts	<u>Direct beneficiaries</u> Implementation agency & cooperating organizations (Working group members, extension workers, farmers in the target districts) (around 200 farmers) <u>Ultimate beneficiaries</u> Other farmers in the target areas	Target group will not be changed. Just changed the expression, and organized the direct and ultimate beneficiaries, specifying the number of direct beneficiaries.

2. Overall Objective

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Overall Objective		
Safe and quality crop production is widely practiced among farmers	No change	
Objectively Verifiable Indicators		
・ ●% of the target farmers in the target districts learn and practice the technology packages for safe and quality	No change	

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
crop production. ・ The technology and extension packages are shared with extension workers and farmers outside of the target districts.		
Means of Verification ・Interview to DOA ・Statistical data ・Series of the project reports	No change	

3. Project Purpose

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Project Purpose		
Capacity of the stakeholders and institutions is strengthened for promoting safe and quality crop production	No change	
Objectively Verifiable Indicators		
・ The validated technology and extension packages are officially adopted in DOA's extension service. ・ ●% of extension workers can utilize the technology and extension packages in the target districts. ・ ●% of farmers in the pilot sites are trained by the extension workers trained (to be decided after selecting the pilot sites). ・ ●% the trained farmers adopt the technology package for safe and quality crop production.	・ Achievement of the action plan elaborated by each WG. ・ Validated technology & extension packages for safe crop production are approved by DOA. ・ Comprehensive action plan (updated version) is approved by DOA.	・In the original PDM, there were some indicators to measure the achievement of Output 2 & 3, rather the project purpose. So, eliminated those from here. ・Indicator 1 (achievement of the action plan by WG) was added, as it is one of the most important to know if the capacity of stakeholders & institution is strengthened. ・Indicator 3 (approval of comprehensive action plan) is also added, as it's important for sustainability.
Means of Verification ・Interview to DOA ・Interview to representative farmers ・Monitoring sheets and the project completion report	No change	

4. Output, Activities and Indicators

1) Output 1

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Output 1		
Comprehensive action plans and action plan for the implementation phase for promoting safe and appropriate use of pesticide and fertilizer are formulated.	No Change	
Objectively Verifiable Indicators		
・ Result of analysis of the issues and capacity of the stakeholders and institutions for promoting appropriate use of pesticide and fertilizer. ・ Comprehensive action plans elaborated. ・ Draft Action plan for the implementation phase	No Change	
Means of Verification ・ Project implementation report of the planning phase	No Change	
Activities		
1.1 To understand current situation of environmental and health impact of inappropriate use of pesticide and fertilizer, feature of crop production, existing extension system, other donors supports and so on through literature review and others. 1.2 To identify the stakeholders and issues related to safe and appropriate use of pesticide and fertilizer through group discussion at national level. 1.3 To survey current situation of the use and availability of pesticide and fertilizer and awareness of farmers through fact finding survey at target districts. 1.4 To hold stakeholder meeting for identifying specific issues at target districts for finding clue for elaborating action plans. 1.5 To share the good practices of promoting safe crop production in Japan. 1.6 To analyze the results of the all activities above and identify the capacity gap to fill. 1.7 To elaborate comprehensive action plans (draft)	No Change	

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
To elaborate the action plan for the implementation phase (draft).		

2) Output 2

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Output 2		
Technology and extension packages (tentative) for promoting safe and quality crop production are developed and validated.	No Change	
Objectively Verifiable Indicators		
・Result of validation of the employed technologies of the technology package(tentative). ・Result of validation of the employed extension methods of the extension package(tentative). ・Final version of the technology and extension packages ・Evaluation results of the extension workers and farmers in the pilot sites on the packages	・Result of validation of the employed technology & extension packages for safe crop production. ・Final version of the technology & extension packages ・Status of application of the technology & extension packages and the evaluation results of the packages by the extension workers and farmers in the pilot districts.	・While “technology package” is the contents, the definition of “extension package” was not clear. The team came to conclude to call it “technology & extension package”, which include technology content, together with extension materials & tools to deliver the message to farmers. ・Validity of the technology & extension package can be evaluated when it’s really applied in the field or not. Accordingly, the third indicator is added.
Means of Verification ・Interview to DOA, target districts and farmers ・Monitoring sheets	・Interview to DOA, target districts and farmers ・Monitoring sheets. ・Results of the field survey in the planning phase	The results of the field survey carried out in the planning phase will be used as the baseline for comparing with the result of the application of technology package.
Activities		
【Technology package for safe and quality crop production】 2.1 To prepare the list of existing training materials, manuals, tools etc. regarding safe and quality crop production. 2.2 To collect local technologies for safe and quality crop production implemented in Sri Lanka 2.3 To select the pilot sites in each target district for developing and verifying the technical package. 2.4 To examine the standard of appropriate use of pesticide	2.1 To establish Working Groups and elaborate WG action plans. 2.2 To prepare the list of existing training materials, manuals, tools etc. regarding safe and quality crop production. 2.3 To identify the appropriate technologies for safe and appropriate use of pesticide and fertilizer. 2.4 To develop the materials and tools for extending the technology.	・As all sorts of activities relating to safe & appropriate use of pesticide & fertilizer were mixed in the original PDM, re-organized and summarized according to the steps of the activities. ・It is supposed that the activities from 2.2 to 2.7 & 2.9 will be done by each Working Group. ・Under 2.3 (to identify the appropriate technologies for safe and appropriate use of pesticide and fertilizer), the detailed activities will be identified by each Working Group.

for safe and quality crop production and elaborate its manual (including set the standard of spray method, manual with local language, etc.) 2.5 To upgrade the guideline on occupational safety specifying the appropriate use of pesticide which is easy for farmers to follow. 2.6 To identify the alternative technology for pesticide management which match to the local condition, including utilization of indigenous knowledge. 2.7 To identify the useful technologies for promoting appropriate fertilizer application upon soil condition. (e.g. Introduction of simple soil test kit, recommendation/standard for fertilizer application, etc.) 2.8 To develop easy record keeping methods of pesticide purchase, mixture and application, fertilizer purchase and application, etc. 2.9 To elaborate the technology package for safe and quality crop production, compiling the above identified technology. 【Extension package for safe and quality crop production】 2.10 To survey on safe crop market needs and awareness of consumers and distributors. 2.11 To examine the effective approach to motivate farmers for safe and quality crop production (utilization of simple tools for visualize the effectiveness, study tours to learn from good practice (farmer to farmer), exchange of ideas with distributer and consumers, etc.) 2.12 To establish campaign methodology of appropriate pesticide application. (appropriate pesticide application recommendation upon diagnosis of pest and diseases/plant condition, proper disposal method of empty bottle etc.) 2.13 To establish campaign methodology of appropriate fertilizer application. (fertilizer application upon soil condition, utilization of bio/organic fertilizer, proper rotation, etc.)	2.5 To develop the tentative technology & extension packages. 2.6 To select the test plot in the target district for testing the technology & extension packages. 2.7 To raise awareness of farmers on safe use of pesticide & fertilizer. 2.8 To organize the training in the third country on safe & appropriate use of pesticide and fertilizer. 2.9 To finalize the technology & extension packages for safe crop production, reflecting the lessons learned through the field practice in the pilot districts. 2.10 To exchange experiences, good practice, outcome, and lessons among the pilot districts.	・As the activity on training in the third country was not listed in the original PDM, it was added as 2.8. ・Unified the word “pilot site” to “test plot”.

2.14 To develop and introduce extension tools for facilitating farmers to apply appropriate use of pesticide and fertilizer (apps, website, etc.). 2.15 To develop new channels for extending the technology package such as extension through ASC, private dealers, and retailers, etc. 2.16 To elaborate the extension package for safe and quality crop production, compiling the above identified extension methods. 【Finalization and verification of the packages】 2.17 To implement the extension service by utilizing the technology and extension packages in the pilot sites in the target districts. 2.18 To exchange experiences among the pilot sites. 2.19 To finalize the technology and extension packages, reflecting the lessons learned through the field practice in the pilot sites. *The examples in parenthesis described in Activities 2.1-2.19 above would be changed based on the local situation after starting implementation phase of the Project.*		

3) Output 3

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Output 3		
Extension workers (including government and private sector) and farmers are trained for the use of technology and extension packages.	No Change	
Objectively Verifiable Indicators		
・The training program elaborated. ・Record of TOT: more than ● times ・Number of the extension workers received the training: more than ● persons. ・Number of the farmers received the training: more than ● persons.	・The training program elaborated. ・Master trainer trained: more than 15 prs ・Number of the extension workers received the training: more than 50 prs (10 prs/district) ・Number of the farmers who received the training: more than 200 prs (20 prs /farmer group, 10 farmer	・Specified the target number to train under this project. ・Master trainer: 3 prs/district, 5 districts ・Extension workers: 10 prs/district, 5 districts ・Farmers: 20 prs/farmer group, 2 farmer groups/ district, 10 farmer groups/5 districts)

・Record of training for farmers in the pilot sites: more than ● times ・Evaluation result by the training participants *● *will be specified at elaboration of the training program*	groups) ・Evaluation result by the training participants	
Means of Verification ・Interview to DOA, and training participants in the target districts ・Monitoring sheets	No Change	
Activities		
3.1 To elaborate the training program on the validated technology and extension packages for the extension workers (including dealers) and farmers. 3.2 To conduct trainings for the extension workers (including dealers) in the target districts (TOT) according to the program. 3.3 To conduct trainings for farmers in the pilot sites according to the program.	3.1 To elaborate the training program on the validated technology & extension packages for the extension workers and farmers. 3.2 To conduct trainings for the extension workers in the target districts (TOT) according to the program. 3.3 To conduct trainings for farmers in the test plot according to the program.	・As it seemed unnecessary to specify “dealers” as training target, it’s deleted.

4) Output 4

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Output 4		
The experience and knowledge gained through the implementation phase are reflected to the Comprehensive Action Plans	No Change	
Objectively Verifiable Indicators		
・Record of the seminar for extension workers outside of the target districts. ・Record of the stakeholder meetings for promoting the Comprehensive Action Plans.	・Record of the seminar for extension workers outside of the target districts. ・Record of the stakeholder meetings for promoting the Comprehensive Action Plans. ・Updated Comprehensive Action Plans	Added “Updated Comprehensive Action Plan” as an indicator.
Means of Verification ・Monitoring sheets	No Change	
Activities		

4.1 To hold seminars for extension workers outside of the target districts. 4.2 To hold stakeholder meetings for promoting the comprehensive action plans. 4.3 To reflect the lessons learned through the implementation phase to the comprehensive action plans	4.1 To hold seminars for extension workers outside of the target districts. 4.2 To organize the training in Japan to exchange experiences for updating and implementing the comprehensive action plan. 4.3 To hold stakeholder meetings for promoting the comprehensive action plans. 4.4 To reflect the lessons learned through the implementation phase to the comprehensive action plans	As the activity on training in Japan was not listed in the original PDM, it was added as 4.2.

5. Inputs

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Sri Lankan side: 1) Assignment of Counterpart personnel 2) Office spaces with fixtures and furniture for the Project (DoA and/or MoA HQ) 3) Available data and information related to the Project activities 4) Operational expenses necessary, including business trip expenses within Sri Lanka, for the implementation of the Project	No change	
Japanese side: 1) Dispatch of experts of; Chief Advisor/Agriculture extension Agronomist Promotion of Good Agriculture Practice Training material development Farmers organization and promotion Training and human resource development Other short-term expertise necessary for developing the packages. 2) Counterpart Training Training in Japan and the third country.	1) Dispatch of experts of; Chief Advisor/Agriculture extension Agronomist/appropriate use of pesticide & fertilizer Promotion of Good Agriculture Practice Training material development 2) Counterpart Training; Training in Japan and the third country 3) Equipment: Office equipment and other necessary equipment for development and implementation of technology & extension packages, etc.	・The title of Japanese experts is changed to align with the reality. ・ The expression of 3) Equipment and 4) Others is changed to make the understanding clear.

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
3) Equipment: Office equipment and other necessary equipment. 4) Local expenses for the project activities, including expenses for training/ workshop/ seminar, which are not covered by Sri Lankan government, transport fee, etc.	4) Others Other costs necessary for project activities, including expenses for training / workshop / seminar, elaboration of materials & tools, transport fee, etc. which are not covered by Sri Lankan government.	

6. Precondition, Important assumption

PDM (ver.1)	PDM (ver.2)	Reason of change & Explanation
Precondition Security issues, epidemic condition does not bring any profound impedance to the project activities. There is no disaster, extreme climatic condition and pests that causes fatal effects on farming activities.	No Change	
Important assumption to achieve Outputs		
・ There are no conflicts, influence by COVID-19 and so on, which cause fatal effects on planned activities. ・ There are no drastic climatic, pest and disease influences impeding crop production. ・ Pesticide dealers do not object to the activities.	No Change	
Important assumption to achieve Project Purpose		
The policy, system and budget of extension services does not drastically change.	No Change	
Important assumption to achieve Overall Objective		
・ The policy of the Sri Lankan government on food safety is not drastically changes. ・ The comprehensive action plans are implemented by the Sri Lankan government. ・ Production and marketing environments do not deteriorate drastically in the pilot area	・ The policy of the Sri Lankan government on food safety is not drastically changes. ・ The comprehensive <u>action plans (updated version)</u> are implemented by the Sri Lankan government. ・ Production and marketing environments do not deteriorate drastically in the pilot area	Just added the word “updated version”, to specify it.

4.2 Achievement of the Projects' Outputs

Attachment-34
Examination material on achievement of output 2

Outputs 2: Verification of Response, Adoption, and Effectiveness of Technology & Extension Packages

Title of Technology & Extension Package	Priority Issue Addressed	Adoption Status	Status of Effectiveness Verification
Training Textbook for Trainers	Lack of training opportunities for extension officers on proper use of pesticides and fertilizers; Capacity development of GAP instructors; Farmer-oriented training	MT & FT trainings	Field verification not required as this is a training material
Pesticide Recommendation for Agricultural Pest Control	Insufficient knowledge on pest and disease identification, pesticide use, and IPM for proper pesticide selection	Farmer Training Practice 3	Field verification not required as this is a revision of existing materials
Pictorial Cards with QR Codes	Insufficient knowledge on pest and disease identification, pesticide use, IPM, and correct dilution	Farmer Training Practice 3	Verification not required as this is a revision of existing materials
Information Sheet for Field Hygiene in Brinjal and Guava	Insufficient knowledge on pest and disease identification, pesticide use, IPM; Limited dissemination of grafting technology effective against soil-borne diseases; Lack of new pest management technologies	Farmer Training Practice 5	Verified by WG3 (Guava published in AgTec Newsletter 11 – Aug 2025)
Information Sheet for Area Specific Nutrient Management	Inadequate fertilizer recommendations based on soil and agro-climatic conditions; Lack of crop trial-based fertilizer practices; Soil test-based fertilization not practiced	Farmer Training Practice 1	Verified by WG2
Information Sheet for Safe	Insufficient knowledge on pest and disease	Farmer Training	Verification not required

Spraying	identification, pesticide use, IPM; Occupational safety of pesticide users; Inappropriate use of PPE according to risk levels	Practice 7	(promotion of PPE use)
Information Sheet for Growing Media & Nutrient Management in Protected Agriculture	Lack of crop trial-based fertilizer practices	Farmer Training Practice 2	Verified by WG2
Guidance for Use of Sticky Traps in Brinjal, Cabbage, and Tomato	Insufficient knowledge on pest and disease identification, pesticide use, IPM	Farmer Training Practice 3	Verified by WG1
Guidance for Yellow Lighting to Repel Moths	Insufficient knowledge on pest and disease identification, pesticide use, IPM; Lack of new pest management technologies	Farmer Training Practice 4	Verified by WG3
Guidance for Area Specific Nutrient Management	Inadequate fertilizer recommendations based on soil and agro-climatic conditions; Lack of crop trial-based fertilizer practices; Soil test-based fertilization not practiced	Farmer Training Practice 1	Verified by WG2
Booklet for Pesticides	Insufficient knowledge on pest and disease identification, pesticide use, IPM	Under preparation	Verification not required (existing information)
Booklet for Fertilizers	Lack of crop trial-based fertilizer practices; Soil test-based fertilization not practiced	Under preparation	Verification not required (existing information)
Manual for Growing Media & Nutrient Management in Protected Agriculture	Lack of crop trial-based fertilizer practices	Farmer Training Practice 2	Verified by WG2
Recordkeeping Book – Beginner Farmer	No fertilizer application records maintained at farmer level	Farmer Training Practice 6	Verified by WG3
Recordkeeping Book – Advanced Farmer	No fertilizer application records maintained at farmer level	Farmer Training Practice 6	Verified by WG3

Poster – Pesticide Application	Occupational safety of pesticide users; Inappropriate PPE use according to risk level	Farmer Training Part 1	Verified by WG1 and WG2
Video – Field Sanitation (General/Technology/TikTok types)	Same as above	Farmer Training Practice 5	Verified by WG3
Video – Sticky Trap (General/Technology/TikTok types)	Same as above	Farmer Training Practice 3	Verified by WG1
Video – Yellow Bulb (General & Technology types)	Same as above	Farmer Training Practice 4	Verified by WG3
SHEP Crop Handbooks	Prepared by SHEP/SC and partially revised by SAFE	Under preparation	Under preparation

4.5 Evaluation of 6 criteria

Attachment-35
Material on
Six DAC Evaluation Criteria
（Impact）

Results of farmers' interviews on impact of the Project activities

The key comments resulting from interviews with approximately 50 farmer groups in each province, conducted under this project to introduce proper pesticide and fertilizer management practices to the target farmers, are summarized below.

Districts/AI range	Technologies	Comments from farmers
Badulla district Bogahakumbura Ai range	Fertilizer application based on results of the Soil Test	Farmers realized that they can rely on soil test result-based fertilizer applications. They explained to us there is significant difference between the crops with their normal fertilizer application and soil test results-based fertilizer application. They showed us the differences and say that the crops which received soil test results-based fertilizer application and soil mixed with paddy straws are much greener and healthy compared to normal fertilizer applications. Furthermore, now they believe they have lost significant of money by applying more fertilizer and now they can reduce their cost of production.
Badulla district Haldumulla AI range	Use of PPE and Safe Pesticide Spraying	I am suffering from Kidney-disease and getting treatment. Before joined with SAFE project we only used a jacket when spraying pesticide. I had a backpain after spraying and could not sleep well. After joined with the SAFE project we received the knowledge about the PPE and its benefits. Now we are using full PPE including boots and goggles which we never used before. I feel safe now and I can sleep well in the nights even in the days I spraying pesticide.
Badulla district Haldumulla AI range	Record keeping	Since I received the record keeping booklet, I have been recording the expenses of crop cultivation to calculate the profit. But after receiving the recording keeping books from the SAFE project we are now recording all the information of cultivation including type, mounts and dates of fertilizer application. it is more methodical, simpler and useful.
Badulla district Uduhawara AI range	Identification Pest and Diseases Using Pictorial Cards	This Pictorial Cards are incredibly useful, as it empowers us to recognize issues independently. The cards also provide recommendations for control measures, including which pesticides and fungicides to use. With this newfound knowledge, I expect that we will be able to reduce the quantity of pesticides and fungicides we apply, thereby lowering our costs. Furthermore, we anticipate achieving better quality harvests, which will lead to better prices.
Badulla distrcit Walimada AI range	Safe Pesticide Spraying	I have been farming for more than 30 years. We have been practicing inappropriate practices. After joining the SAFE project, we learned how important it is to do safe spraying for ourselves, our family members, customers and environment. Now we have been well aware of how to do spraying safely. What are the factors we have to consider before spraying, My sprayer is also more than 30 years old. Except for one- or two-time few parts that were replaced, I did not do regular maintenance. Now I understand the importance of my sprayer to ensure safe spraying.
Nuwara Eliya district Haguranketha 地区	Safe pesticide spraying	Farmers expressed their appreciation to the project for providing valuable knowledge on the safe use of pesticides. They emphasized that the training and practical demonstrations conducted under the SAFE project have been extremely beneficial. Many farmers are now practicing the SAFE spraying techniques; however, some are experiencing difficulties in purchasing Personal Protective Equipment (PPE).The FT agreed to assist these farmers in obtaining PPE from Kandy. A farmer cultivating beans and cabbage, stated that he is now highly conscious of safety measures when applying pesticides. He noted that, thanks to the project, he has significantly reduced the use of both pesticides and fertilizers, leading to a noticeable decrease in his production costs. Furthermore, he mentioned that he successfully managed his current cabbage crop with only one pesticide application.
Nuwara Eliya 県 Rikillagaskada AI range	Fertilizer application based on results of the Soil Test SAFE use of PPE Proper disposal of empty bottle	Ms. Bala Manike – Now we understand the importance of applying fertilizers according to the recommendations based on our soil test results, spraying pesticides safely using proper PPE, and disposing of empty pesticide containers responsibly. Previously, we did not follow these practices or realize how important they were for our safety and the environment. I started to practice remove all the debris of crops just after harvesting the crops. Because I learnt that those crop residues may provide houses to pest until the next crop starting. Ms. Danawathi Manike – She mentioned that using compost together with chemical fertilizers produced significantly positive results in her crops, leading to a better harvest. She noted that poultry litter, in particular, proved to be a highly effective fertilizer.

Results of farmers' interviews on impact of the Project activities

		Ms. Nilmini – "Previously, we applied pesticides and fertilizers based on the advice of the agrochemical seller (Mudalali). Now we understand that this is not the correct approach. We maintain good communication with the Agriculture Instructor and follow their recommendations instead. For an example, before joining this training program, I was not aware of the concept of the pre-harvest interval." Ms. Nayakasingham – "I didn't used to apply fertilizers according to the Department of Agriculture (DOA) recommendations. We believed that applying more fertilizer would result in a better harvest. But now I know that this approach is wrong — I need to test my soil and apply fertilizers according to the recommended rates."
Matale district Galewela AI range	Practice on Safe Spraying, Pest & Disease Identification, Record keeping	The farmers collectively expressed that before joining the project, their fields were not properly managed, with poor sanitation practices, damaged fruits left unattended, and little attention given to record-keeping and their own safety. Through the continuous guidance and support provided under the Step 1 to Step 3 programs, they have now adopted safe spraying practices, maintain records to better understand costs and profit levels, and recognize the importance of farmers' health and safety. They reported visible improvements in their plantations, appreciated the consistent instructions from AI officers, and highlighted that the project has positively influenced their attitudes and farming practices.
Matale district Pallepola AI range	Practice on Soil Testing & Fertilizer Application, Pest & Disease Identification, Record keeping	They shared that, prior to joining the Step 1 program, they had paid little attention to safety, record-keeping, and soil testing, often applying more fertilizer than recommended. Through continuous guidance from AI officers under the Step 1 to Step 3 programs, they have now adopted soil testing–based fertilizer application, maintain records to track costs and profits, and recognize the importance of farmers' health and safety. They also reported visible improvements in their plantations and found the pictorial cards highly useful for pest and disease identification. Overall, they acknowledged that the project has positively changed their attitudes and farming practices.
Matale district Palapathwala AI range	Safe Spraying, Record keeping	The farmers also highlighted that they have now adopted safe pesticide application methods and began using safety kits such as gloves, masks, and protective clothing while spraying. They mentioned that using these safety measures makes them feel much better and healthier compared to the past, when they were unaware of potential risks. They especially learned the proper methods for applying pesticides and disposing of empty pesticide containers. Through the continuous guidance and support provided under the Step 1 to Step 3 programs, they have adopted safe spraying practices and started maintaining records to better understand their costs and profit levels. They now recognize the importance of farmers' health and safety. They reported visible improvements in their plantations, appreciated the consistent guidance from the AI officers, and emphasized that the project positively influenced their attitudes and overall farming practices.
Matale district Laggala AI range	Practice on Field Sanitation, Crop record keeping	The farmers expressed that before joining the project, their fields were not properly managed, with poor sanitation practices, damaged fruits left unattended, and little attention given to record-keeping and their own safety. Through the continuous guidance and support provided under the Step 1 to Step 3 programs, they have now adopted proper field sanitation practices, maintain records to better understand costs and profit levels, and recognize the importance of farmers' health and safety.
Matale district Hunuketaela AI range	Practice on Pest and Diseases Identification by using pictorial cards	The four farmers from the districts acknowledged that, prior to joining the Step 1 program, they had not given much consideration to their own safety. However, after attending the Step 1 to Step 3 programs, they now understand that farmers' health is also important. They also stated that crop recording has helped them to better understand their costs and profit levels. They also now apply fertilizers based on recommendations and soil test results. In addition, the training enhanced their practical knowledge, with pictorial cards becoming a valuable tool for pest and disease identification. Overall, they noted that their attitudes have started to change as a result of this project. All farmers now maintain separate storage for pesticides and fertilizers. Farmers no longer rely on pesticide shops for advice; instead, they check

Results of farmers' interviews on impact of the Project activities

		pictorial cards for pest identification and pesticide selection. All five farmers are now using safety kits during pesticide application.
Puttalam district Kandakuliya AI range	Pest and Disease Identification and Selection of Appropriate Pesticide by using Pictorial Cards	The farmers mentioned that they benefitted a lot from all the training steps and are now very much concerned about use of pesticides. They have started to give reasonable attention to not only the pesticide selection but also other aspects relevant to pesticide use, especially safe use of pesticides. All farmers said that they use some PPEs when applying pesticides. With relevance to their practice, they mentioned that the pictorial cards are very attractive and simple, thus a farmer friendly tool and they are very useful in identifying diseases.