Democratic Socialist Republic of Sri Lanka
Ministry of Agriculture (MoA)
Agriculture Sector Modernization Project (ASMP)

Assessment of Current Pest Management Strategies Implemented by the MoA
&
Preparation of a Pest Management Action Plan

Final Report

VOLUME 3

ASMP interventions and its effectiveness towards the PM

&

Productivity of crops established by FPOs in Project Provinces

November 2019

Prepared by:
S & P Holdings (Pvt) Ltd.,
74/6, Stanley Place, Pepiliyana Road, Nugegoda, Sri Lanka

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1. Introduction

The project identified 20 Agro Technology Demonstration Park (ATDP) pilot programs and was established in five provincial areas and further clusters are identified in order to promote it in the same provincial areas. The clusters are also identified as Farm Producer Organizations (FPO) and promotes the concept of 'one- crop- one- village' for creating modern technology interventions for improved productivity and increased farm income for small farmers. Under the pilot ATDP programs, the FPOs established a range of selected crops such as fruits, vegetables and nuts as main items which were supported with intercropping/ mixed cropping systems in order to promote a consistent year round income. The programs are monitored by Project Management Unit (PMU) and Provincial Project Management Unit (PPMUs) in the provincial areas.

The selected farmers in diverse crop clusters were provided with improved seed and planting materials, machineries for land preparation/ seeding/ post-harvest processing, irrigation systems (drip/ sprinkler), materials for semi protected cultivation, and training/ exposure visits. The farmers among the clusters exhibited years of experience in crop cultivation practices such as soil/ land preparation, selection of planting materials, identifying irrigation intervals, benefits of weeding, hazards from pesticides, indigenous pest control methods, observation/ surveillance for pest populations, related to crops cultivated under provincial programs. Though the modern technology interventions are integrated in to the crop production systems, the farmers are yet to understand the benefits/ contributions of such technologies, (especially agronomic, biological and mechanical) towards increasing productivity, and farm income without causing harm to the environment and human life.

The farmers in the provinces prefer to use chemical inputs that ignore the other non-chemical crop production practices which negatively affects the small farm productivity, environment and human health due to reduced soil fertility, accumulation of toxic elements and increased pest/ disease infestations.

Identifying the hazardous status of the increased use of chemical inputs, the global initiatives intervened to promote programs which focus on crop management systems that include Integrated Pest Management (IPM), Integrated Nutrient Management (INM), and Soil Health Management (SHM), Integrated Water Management (IWM), which is focused to increase productivity and reduce the use of poisonous chemicals for pest control. However, these technologies/ systems which are mostly implemented in isolation of each other are creating issues/ challenges in promotion in small farm crop production in the provinces.

Accordingly, the study identifies the importance of creating a coordinated mechanism to promote the Plant Health Management (PHM) system, incorporating technologies for

Integrated Crop Management (ICM= IPM+INM+IWM) & SHM as a total crop production package for sustainable small farm development and increased small household income. In this regard, the ATDP programs seem like an ideal opportunity to improving the crop through stage-wise farming practices by adopting technological interventions focused on PHM for sustainable small farm agriculture. The PHM technology package is designed and proposed in the PM guide document submitted with the final report on' 'Assessment of Current Pest Management Strategies' Implemented by the MoA & 'Preparation of a Pest Management Action Plan' as required by the ASMP/MOA/WB project.

2. Pilot projects & technology interventions in ASMP provinces

All provincial projects are supported by Department of Agriculture (DOA) technical experts/ extension services at provincial and interprovincial administrative areas. The project has established close relationships with private sector processing/ trading/ export companies promoting market access for small producers.

ATDP Crops established	Province	ASMP Technology interventions
B-onion Seed Production	Central	25 farmers identified and 15 were supported to establish a Modified Atmospheric (MA) unit for vernalization treatment, poly covers/rain sheds and packaging/storage of seed. Variety promoted MI-BO-1.
Mango –New crop	Central, UVA & Northern	Matale, 103 farmers supported to establish 125 acres/Monaragala 40 acres ,40 farmers TJC mango. Drip irrigation system for all farmers provided by the project and Jaffna 100acs, of TJC Mango. Planting materials and technical training with exposure visit to TJC plantations. Intercropping with B-Onion, Melon, and Brinjal, Okra, Chilli, Long Bean, Purple Yam and Ground nut promoted for short term income until the Mango begins to produce fruits. Pruning equipment provided for each farmer.
Mango Existing	Central	35 Farmers identified and supported- improving 75 acres of TJC Mango (age of crop 6 years & above). Fruit quality management technology including bagging for controlling pest/disease infestation and facilities to manage post –harvest activities. Collecting trays pruning equipments were provided. Market access links established with modern retail chains, exporters, local traders.
Pineapple	Uva	75 farmers from 5 villages covering 37.5acres. Introducing Mauritius variety planting materials, sprinkler irrigation system. Villages are identified in Medagama Divisional Secretariat area.
Passion fruit	Uva	75 farmers from 06 villages covering 37.5acs.Introducing Horana gold variety planting materials, trellises, drip irrigation system, and technology training in Buttala area. Project extended grants to provide inputs such as steel pipes (posts), steel wire, drip irrigation and planting materials. The crop was established in October 2018 and first harvest implemented on May 2019 and thereafter

ATDP Crops established	Province	ASMP Technology interventions
		weekly harvesting will continue during 2020.
Guava	NCP	Project support extended for existing cultivations and new planting. 25 farmers with 0.5acs each new planting provided drip irrigation systems, planting materials and technical training. The existing plantations covering 35 farmers supported for post –harvest handling and marketing.
Papaya	NCP	Project support extended for FPO, comprised of 25 farmers identified from 4 villages in Elahara DS division. The total extent covered was 25 Acs. The seedlings and drip irrigation system are provided by the project.
Green chilli	NCP, Eastern Province & Northern Province	Extent covered in NCP was 60acs with 120 farmers under 3 FPOs, in Eastern province 50 acs covered under chilli with 100farmers under 01 FPO and Northern province Project intervention is experimental basis for 2.1acs with 08 farmers. The project has extended support by providing insect proof nets, polymulch and drip irrigation systems for chili growing FPOs in NCP Eastern Province & Northern Province. The FPO in East was a traditional chilli farming area where they are supported solely with sprinkler irrigation systems. Insect proof net and polymulch was not provided. The varieties cultivated are MICH-Hy1, MI-2, in NCP, KA-2, Imported varieties in Northern and PC-1 traditional varieties in the East.
Bitter gourd	NCP	Extent under Bitter Gourd technology demonstration fields was 35 acs. Two FPOs in Anuradhapura with 40 small farmers and in Polonnaruwa 30 small farmers promoted by the project to establish modern crop technology on B/G cultivation. The farmers provided with insect proof netting around the periphery of the farm and drip irrigation system. Thirunelnavely, and Matale Green are popular while other verities like Kalu Karawila, Maduri, Maya and Pali are cultivated in the province.
Ground Nut	Eastern & Northern	A total of 300 beneficiaries linked to establish 7 ground nut FPOPs in Batticaloa and Mullativu Districts. The project was promoted in 200 acs (100acs per district) covering 18 villages in two provinces for cultivating Ground Nut., Project extended technical support by providing sprinkler irrigation systems with water pump, land preparation machineries (20 inter-cultivators), post-harvest machinery & equipments such as, 01 seeder, 01 thresher/cleaner, 01 grading equipment,

ATDP Crops established	Province	ASMP Technology interventions
		01 decorticator and seed separator/cleaning machine, and including technology transfer training for farmers for Ground Nut production. The varieties cultivated are local types identified as Tissa and Tissa 01 selections approved by DOA and popular among farmers.
Green cucumber (gherkins)	Eastern Province	FPOs covered 500 small farmers with 0.25acs of land extent each, distributed among six GN areas; Mankerni, Uriyankadu, Vammiwattan, Palchenai, Kathirveli, and a Farm Colony in Vahare DS area. Sprinkler irrigation system for each farmer (0.25ac) provided by the project and linked export processing company supported with seed, fertilizer, pesticides and technology for growing, harvesting, and participatory training on crop management by field extension service of the company. The produce was purchased at a pre-determined price at farm gate/delivered to particular location. FPOs cultivated three crop cycles per year.

3. Observations on technical interventions

3.1 B-onion seed production program

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	No deep ploughing. Use only rotavator, prepare sunken beds for planting,	Soil borne organism/ nematodes/cyst stages of pests may not be exposed to sunlight/ predators on surface. Pest infestation could increase (nematodes) after planting.
Seed varieties	local seed-MIB-01,Galewela & imported varieties (Rampur red)	Lack of availability of quality certified seed has hindered the tolerance for Pest and Diseases (P&D). Yet to confirm the tolerance for P&D infestation. Irrespective of seed variety, routine pesticides application continued.
Nursery	Soil bed nursery. Sterilizing soil beds not practiced. Planting trays with sterilized pellets or soilless media not used. Traditionally transplanting aged (more than one month) seedling is practiced.	Less concerned over cultural methods for reducing: P&D infestations. Damage to roots during uprooting/transplanting affect the healthy vegetative growth. High probability of infestation-nematodes/ damping off due to poor soil health/ surface irrigation. Benefits of Planting aged seedling is yet to be identified
Weeding	Use pre-emergence weedicides, Stale bed methods not practiced. Hand weeding after six (06) weeks where necessary	Routine practice. Depends on pre-emergence weedicides as convenience risk averse method. Increase residual effects on consumer produce (Bulbs). Increase COP due to cost of chemical weedicides. Increased environmental hazards.
Irrigation	Flood irrigation. Sunken beds over soaked high moisture level. Sprinkler irrigation not adopted.	Use of excess water. High moisture levels promotes damping off/ diseases. Diseases may be carried through flowing water. Barrier for vigorous/healthy plant growth. Poor tolerance to

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Waste of water. Beds are continue to keep moist.	P&D due to high moisture.
Planting	Farmers in study area plant on delayed schedule till June. Recommended to plant before end of May. Time of planting differs according to climatic conditions and availability of seed in the area. Transplanting done in over soaked moist beds.	Delayed planting (June) could influence occurrence of P&D depending on the weather, especially rain during September. Farmer knowledge and skills need to be enhanced.
Nutrient	Few farms applied compost during LP. All farms apply Inorganic/chemical fertilizer. Practice excess application especially urea. Pelleted fertilizer identified as blue, purple and red are used for regulating growth and flowering.	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and informal sources but not purely based on recommendations. Therefore aspect related to PNM needs to be experimented and demonstrated to apply correct nutrient based on soil test results to maintain better plant protection.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Pest & Diseases (PD)	It was highlighted that the small farm lands are continuously cultivated with diverse crops on rotational basis. Leaf & bulb mites, Leaf eating caterpillar, leaf hoppers, anthracnose & purple blotch, identified by FPO. Farmers are vigilant for P&D. Control measures not based on monitoring/surveillance/ scouting.	The traditional/imported varieties were not identified for any resistance to P&D. Dependent on chemical pest control. 4-5days interval at first month and seven (07) day intervals thereafter. Poor awareness on potentials of P&D reduction by cultural/ biological/ mechanical practices for crop production. Lacks awareness on suitable crop mixtures and its influence for P&D infestation. There is no technology interventions for demonstrations/

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Direct use of chemical PC & routine application once in 4-7 days intervals.	experiments for training/knowledge development for monitoring based practices for P&D control.
Though the objective of the ASMP –The Central Provincial program was to promote technology advancement on B-onion seed production, the study identifies that FPOs are yet to demonstrate and adopt the appropriate PHM technology package for crop production practices to achieve maximum benefits of the project interventions. The ongoing programs support some aspects of the B-onion seed production process but it has not been designed/planned to blend technology package identifying the total production system/crop stage-wise technology approach. MA unit in the long run may be a challenge as cost of power is increasing. It is time to introduce solar energy for these FPOs to enable to use natural energy and surplus to generate monthly household income. It is important that the Scientific Officer of the PPMU takes on more responsibility in coordinating with extension/research/ FPOs and other relevant agencies, especially outsourcing the introduction of international technical experts and promoting advanced technologies and inputs to improve farmer skills/knowledge for cost effective B-onion farming and seed production. Though the farmer participation was observed in FBS training the numbers keep on declining over the past weeks.		

3.2 Mango producer clusters. Jaffna (Chavakachchari DS Division), Matale (Dambulla DS Division), Moneragala (Siyambalanduwa DS Division)

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
Land Preparation (LP)	Deep ploughing is practiced by a few farmers in the newly established mango cluster. Planting pits made as recommended. Organic manure 10kg/pit was added.	Soil borne organism/ nematodes/ cyst stages of pests may not be exposed to sunlight/ predators on surface. Pest infestation could increase (nematodes) after planting. Water logging/ excessive moisture may cause poor root development/plant

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
	Existing mango plantations is 6-7years old. Rotovating//Ploughing/ loosening the soil around the tree after flood irrigation is not observed.	growth, poor soil aeration, increased moisture levels, hardening of soil surface, affect the flowering/fruit falling, occurrence of soil borne diseases. Inadequate knowledge for maintaining soil pH; 5.5-7.0, soil nutrients, irrigation for healthy plant growth and fruit production. Lack of knowledge on benefits of soil mychoryzae.
Planting materials	TJC mango variety supplied through the project for new plantations. Existing plantations TJC plants has been supplied by DOA. Seedlings are supplied by DOA registered nurseries. All plants are grafted and between 8-12 months old at the time of planting in the fields.	The variety identified for its productivity/ appearance and market price as export potential. FPOs confirmed the plants supplied for planting are in good condition with respect to vigour and healthiness that helped to avoid any pest and disease occurrence during the planting stage. The root zone of the potted plants are well protected and the survival rate was almost 100% at field level. Guideline on crop stage-wise practices are not provided. Some farmers continue to follow their own way of caring for the plants leading to poor growth during the initial stages.
Planting	Planting carried out as per the instructions by DOA and companies linked for marketing. Planting pits are 2'x2'x2.' Observed Dense planting fields promoted by DOA. Project FPOs plantations are normal spacing. New plantations are intercropped with B-Onion (in Dambulla), Ground Nut (in Jaffna) and Vegetables	Though the plantations are established as ATDPs in a cluster village concept, the fields are scattered and there are other crop (annuals) in between. Close attention with technical inputs/ training is required to managing crop with regular pest/ disease monitoring mechanisms.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
	(in Dambulla).	
Weeding	In new plantations the weed control is practiced along with intercropping of annuals. Chemical weedicides are used for annual cropping that contribute towards the controlling of weeds in the area allocated for mango growing. The existing plantations it was not sufficiently attractive as there is no regular weed control implemented. Farmers use hoe or machine operated grass cutters for weeding. Mulching around plant base not performed.	Lack of proper weed control measures will cause increasing incidences of P&D. Intercropping green manure crops could reduce the cost of labour and nutrient requirement. Inadequate technical interventions for border cropping and wind breaks to reducing P&D infestations. Measure for mulching is not practiced. Protective measures are not applied when using pre emergence weedicides on a new mango plantation field. Mulching controls weed growth/saves moisture.
Irrigation	Practicing Flood irrigation with sunken beds where over soaked high moisture level was observed. Irrigation has been a difficult task during the prolong drought season in 2019, witnessed while this study was undertaken. Though the FPOs are aware of the benefits on P&D control, sprinkler irrigation is not adopted (especially new plantations up to the 3rd yr.). Drip irrigation is not adopted. Irrigation intervals are mostly 10-12days. Lack of monitoring for measuring soil moisture levels.	Use of excess water. Inadequate knowledge on frequency and rate of water required during the initial establishment to per year of growth. High moisture levels promotes diseases. Sooty moulds are common incidence. Diseases may be carried through flowing water and leaching nutrients become a barrier for vigorous/ healthy plant growth. Poor tolerance to P&D due to high humid/moisture conditions around the field. Poor irrigation efficiency – highly dependent on flood irrigation. Low pressure reticulation systems-employing drippers and under tree sprinklers is the most efficient irrigation combined

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
		with mulching that eliminates the weeds as well.
Nutrient	A few farmers used compost during planting. All farms apply inorganic/ chemical fertilizer as per the recommendations of DOA. Soil/ leaf test based specific application method not in use. FPOs use Gypsum as a practice but not aware of the importance and necessity for particular land/ soil. Trace elements as Foliar sprays are used for flower induce and fruit development and appearance. Some farmers use pelleted fertilizer (blue/ purple/ red).	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and not purely based on recommendations. Lack of proper nutrient management plan/ guide will lead to poor plant growth/ yield/ tolerance for P&D due to oversupply of nutrients. Therefore aspect related to PNM needs to be experimented and demonstrated to apply correct nutrient management based on soil conditions and planting densities.
Pruning	The FPOs were trained for pruning of new plantations and existing plantations. FPOs are yet to show experience on pruning of young plant and making the tree canopy and frame. Follow-up action by PPMU/ DOA is not adequate to encouraging the farmers on proper pruning/training of plants/maintaining field hygiene. Existing trees producing fruits and effective pruning/ cleaning is not observed.	Pruning allows penetration of sunlight and helps controlling P&D. Lack of Farmer skills on pruning trees is a probability for high infestation of P&D. Farmers in some FPOs are reluctant to remove flowers during initial growing stage, hindering the healthy plant growth and attracting P&D. Ground level/ Lower branches of existing trees bare fruits and touch the ground resulting in P&D infestation/ unhygienic status. Lack skills on identifying and removing the infested leaves/ branches/ flowers/ small fruits.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
	Pruning of ground level/lower branches are not effectively practiced in new/existing plantations Lack of proper technology transfer and advisory services observed in Mullativu dense Mango plantation.	Yet to receive sufficient technical support. Low fruit production. High shading due to inadequate pruning, high humidity within the plantation physiological disorders on fruits, anthracnose, sooty moulds infestation.
Bagging fruits	Bagging fruits with paper bags- waxed or non-waxed. Some uses news paper bags. The current method is bagging individual fruit at 1 month after flowering. FPOs noted bagging is labour intensive and costly. Bagging is mainly for control of aphids/ thrips/ scale insect/fruit fly and obtain good appearance of fruit. Bags are not sealed properly at the neck of stalk and was open allowing the ants to carry insects inside the bags.	Bags are not properly attached to the fruits. Inadequate awareness on technical aspects of bagging lead to poor fruit appearance. FPOs not aware of judging the correct stage/ size of fruit. Some used imported bags but of poor quality. Insects-ants/ mealy bugs are infested. Bagging has not effectively demonstrated to show its importance. FPOs require technical skills to identifying the correct bagging stage for fruit, type of bags to be used, Bagging may be avoided by good orchard hygiene and management. Fruit flies cannot attack green fruits unless it is damaged.
Pest & Diseases (PD)	During early growing stages FPOs identify leaf rollers/cutters, leaf miners, mealy bugs, scale insects, plant hoppers, fruit borers flower thrips, flower cutters that cause damage. Though farmers indicate that there are many insects during the flowering period, they are unable to correctly determine harmful and	Lack of awareness on PNM lead to low fruit production. Flower eating caterpillars, thrips Infestation of leaf rollers/presence of sooty moulds, anthracnose, powdery mildew, will cause fall of flowers, flower buds, and low quality fruits. FPOs not familiar with symptoms of physiological disorders. Application of chemicals will eradicate the beneficial insects,

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
	beneficial (pollinators) insects. Sooty moulds, anthracnose, mango scab observed during the visit. Die-back of branches noticed due to lack of aftercare measures for pruning. FPOs not aware of the reasons for drop off of small fruits. Routine PC application (weekly basis) observed in Matale. Jaffna & Monaragala did not have similar applications but implements PC spraying for intercrop under Mango. Poor hygienic management of plants, surroundings, and crop field There is sufficient awareness and user experiences about pheromone traps. But had not acquired the confidences about the method. Lack of Technical knowhow and rate of traps per unit area was also a bottleneck.	reducing the pollinator population. Farmers need more awareness and technical knowledge on combined PM practices to maintain better PH to increase tolerance level for P&D. Dependent on chemical pest control. Poor awareness on potentials of P&D reduction by cultural/biological/ mechanical practices for crop production. Unintentional PC use in some district-due to lack of sufficient knowledge. More attention and training is required to influence the farmers to adopt PHM practices Lack of experiments/demonstration on effectiveness of use of different PM methods for controlling P&D.
New Mango plantations in Matale, UVA and North are in vegetative stage; canopy structure is in development. However, the effects of technology interventions were not adequately demonstrated especially for stage wise crop production activities which would contribute towards healthy/vigorous plant growth. Subsequently, leading to environmentally friendly, cost effective, crop production for sustainable small farmer income. The observations identified that close supervision and technical inputs by experienced experts (preferably international experts) will be advisable to promote and demonstrate technical interventions to enable the Mango plantations to achieve expected production with quality and quantity. Implementation of Crop- stage-wise PHM practices will enable to reduce the P&D infestation and use of		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/ challenges related to PM
chemical PC. The project depends more on the technical support from DOA/AIs at field level. It was observed the technical capacities of these officers are not up dated to tackle the needs of Mango FPOs. The Level of technical knowledge is still basic as revealed during the discussion. Also the involvement of an Agriculture Scientist is imperative in order to provide the latest/innovative technology to achieve the project objective and demonstrate the technical interventions.		

3.3 Passion fruit cluster – UVA province -- Buttala, Wellawaya, Bibile, Kodayana, Siyambalanduwa

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing is practiced by a few farmers. Bund/humps on the land was not flattened or removed. Planting pits made as recommended. 10-15kg of compost added to every pit. FPOs had only dug pits for planting. Water logging conditions around the base observed in some lands. Soil fertility analysis has been done but not used effectively to determine the pH level, nutrient requirements.	Experience of soil management techniques by small farm PF cluster cultivations in non ASMP program (eg. Berandina - NCP) are not exposed. Soil borne organism/ nematodes/ cyst stages of pests may not be exposed to sunlight/ predators on surface. Pest infestation could increase (nematodes) after planting. Water logging/ excessive moisture may cause poor root development/plant growth and cause collar rot. Existing Rat burrows damage young plants. Poor soil aeration, increased moisture levels, hardening of soil surface, affect the initial plant growth. Inadequate knowledge for maintaining soil pH; 5.5-7.0, soil nutrients, irrigation for healthy plant growth and fruit production.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Planting materials	Horana gold variety supplied through the project for new plantations. Research scientists are involved in making observations to determine technical interventions for improvements in this regard.	The variety identified for its productivity/ appearance and market price. FPOs confirmed that plants thrive well in Horabokka village compared to Mahasenpura. The scientific reason could be the variation in climatic conditions based on AEZ IL & DL respectively. Experiments/ research activities need to coordinate with farmer participation
Planting & training	Planting pits are made 2'x2'x2.' Spacing as recommended by DOA (7.5' between rows and 12'between plants). Plant is trained to aim at a height of 6', along trellises. Laterals are trained to hang vertically.	Lack of capacity of farmers on identifying P&D infestation during early growing period. More attention with technical inputs/training is required to managing crop with regular pest/disease monitoring mechanisms. The crop records introduced by the project is not fully utilized due to inadequate capacities to assess/ evaluate the crop stage wise information/ data/ statistics and implement the action as needed. Traps/ baits/ biological measures are not recognized.
Weeding	The existing plantations were not satisfactory as there is no regular weed control implemented. Weed growth observed around the plant. Annual crops for intercropping was not identified or introduced.	Lack of proper weed control measures will cause increasing incidences of P&D. Intercropping green manure crops could reduce the cost of labour and nutrient requirement. Seasonal vegetables (e.g. Turmeric, Ginger, Chilli, pea, Green leafy vegetables, mustard etc) may be grown as intercrop right from the first year to reduce weed infestation.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		Legume varieties are not recommended as it harbors the aphids that carries virus infestation in PF. Inadequate technical interventions for border cropping and wind breaks to reducing P&D infestations. Measure for mulching is not practiced. Protective measures are not applied when using pre-emergence weedicides.
Irrigation	Drip irrigation is adopted. Irrigation intervals are mostly 2days. Lack of monitoring water/ moisture levels. Drippers are not properly arranged/placed. Farmers are not aware of plant water requirement. FPOs are not aware/ familiar to monitor/ adopt any climate change situation (drought, cloud, heat, rain, wind, sunshine, humidity) Water resources are becoming scarce and available volumes are reducing with time.	Watering is not equally distributed. Some drippers are away from the plant base Pressure may not be sufficient to move the required amount of water towards the end. Absence of mulching around the plant base causes surface drying. Prone to P&D due to hindered plant growth. Lack knowhow to mitigating climate change factors the productivity may reduce due to stress, infestation of P&D. There is no readiness for water scarcity- due consideration is not given on efficient use of water and rain water harvesting methods. Cost of electricity increasing with time will pinch the farm income- Use of solar energy is not identified as a cost effective long term energy solution.
Nutrient	Few farmers used compost during planting. All farms apply inorganic/ chemical fertilizer as per	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and not purely

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	general recommendations of DOA. Soil/ leaf test based specific application method not in use. Trace elements foliar sprays are used for flower induce and fruit development and appearance.	based on recommendations. Therefore, aspect related to PHM needs to be experimented and demonstrated to apply correct nutrient management based on soil conditions and planting densities. Foliar sprays (albert solution) used to boost the plant growth. (Effectiveness is not assessed/ demonstrated).
Pruning	The FPOs were trained for pruning. Aware of unproductive canopy development if the harvested branches are not removed. FPOs are yet to increase the skills. Inadequate awareness on timing for pruning	Lack of proper pruning reduces yield and increases P&D infestation. Lack of Follow up training/ demonstration for FPO at newly harvested fields. Lack of Farmer skills on pruning trees. Farmers in some FPOs are reluctant to remove small fruits in the bunch.
Pollination	Artificial pollination is required especially for yellow PF/ Horana Gold. Pollination through beetle (Xylocopa megaxylocopa frontalis) common in PF fields. Use of chemical pest control measures have reduced these beneficial beetle.	Lack of awareness and adoption of a proper PHM system caused the reduction of the beetle population leading to adopt manual pollination. Based on the time of pollination and cost of labour there is possibility of withdrawing of the PF cultivation in the long run. Need to experiment and demonstrate cost effective speedy pollination mechanisms to sustain the industry. Increasing population of honeybees in the vicinity will reduce the fruit yield due to loss of pollen for pollination.
Pest & Diseases (PD)	Scale insects, thrips and aphids are the common pests reported.	Lack of awareness on PHM practices hindered control of beetle infestation. Light trap/ sticky traps are not used.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Farmers had used insecticides, under AIs instructions. Vine eating beetle active during night and difficult to control with chemical spraying. Fruit fly attack was observed by FPOs Root rot and collar rot is common in nurseries. Abnormal swelling of stems. Anthracnose infestation in young leaves, shots, flowers and fruits. Flowers/ fruit falling. Mottle virus on fruits, mosaic virus on leaves and woody virus on fruits. Dry bark of branches noticed due to lack of aftercare measures for pruning. FPOs not aware of the reasons for drop off of small fruits	Chemical control measures not effective for scale insects (White & Pink). No training/ demonstration to adopt monitoring/ combined methods. Chemical control is effective only at the early stage of development of scale insects. FPOs are not aware of covering stems and applying grease to reduce infestation. Intercropping leguminous crops/ Gliricidia with PF attract aphids. Inadequate awareness among FPOs on the time of fruit fly attack. It only attacks mature and ripening fruit. Chances are less for infestation but market value of ripe fruit is less. Lack of proper drainage and hygienic conditions cause root rot and collar rot. Farmers have not noticed early symptoms of stem cracks before swelling. Adoption of timely pruning/ avoiding forced training or bending of vines will mitigate the disorder. Protective measures are not implemented. Wind barriers, hygienic field management, monitoring and surveillance not observed. Instead FPOs depend heavily on Chemical control measures which are less effective. Leaf mosaic virus is a potential cause for reducing fruit yield. Adoption of Crop stage wise PHM practices is a better solution for controlling the vectors and virus infestation in PF. FPOs not familiar with symptoms of physiological disorders.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		Application of chemicals will eradicate the beneficial insects reducing the pollinator population. Farmers need more awareness and technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D. Poor awareness on potentials of P&D reduction by cultural/ biological/ mechanical practices have influenced FPOs to depend on chemical control measures.
Overall, the Passion fruit FPOs are currently doing well as new cultivation which is 8-9 months old and the yield keeps increasing at every pick. In the long term the crop is prone to pest and disease incidences such as vector transmitted diseases, collar rot (fusarium), stem cutting beetle, fruit fly and Anthracnose. According to farmers the crop cycle was determined for over four years, long gestation period and high potential for yield drops due to pests and diseases, climate changes, intermittent weather patterns etc. The FPOs though guided to maintain crop records for crop production/ management activities, have not demonstrated any involvement on pest monitoring or scouting to determine the method for pest management/control. The farmers are yet to identify the proper control measures and currently depend on chemical pesticides. Technical interventions by the project has not sufficiently introduced/demonstrated other practices such as agronomical/ mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/ infestation, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues in Passion fruit cultivation under FPOs in the ATDP pilot programs.		

3.4 Guava cluster-Anuradhapura District Ippalogama, and Thanthirimale

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing is not practiced. Existing guava plantations are 4-5years old.	No measures applied to controlling Soil borne organism/ nematodes/cyst stages of pests by exposing to sunlight/

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Rotovating// Ploughing/ loosening the soil around the tree after flood irrigation is not observed. Planting pits made as recommended. 2'x2'x2'Organic manure 10kg/pit was added. New planting also followed the same practice.	predators on surface. Pest infestation could increase (nematodes) after planting. Water logging/ excessive moisture may cause poor root development/ plant growth. Poor soil aeration, increased moisture levels, hardening of soil surface, effects of flowering/ fruit falling, occurrence of soil borne diseases. Inadequate knowledge for maintaining soil pH; 5.5-7.0, soil nutrients, irrigation for healthy plant growth and fruit production. Lack of knowledge on benefits of soil mychoryzae.
Planting materials	Horana white and Bangkok giant, popular varieties generally known as apple guava (apple pera). Planting materials were supplied through existing plantations in the area. Farmers are not aware of varietal characteristics of plants supplied. The plants are raised in the farmers own nursery plots by using seeds obtained from ripened fruits bought from existing guava growers. The farmers were not aware of any P&D infestation and proper technical input was not disseminated through the project interventions.	The variety identified for its productivity/ appearance and market price. The seedling raised in a traditional manner and no information about varietal characteristics / productivity/ resistance for P&D. Farmers continue to care for the plants in their own way leading to poor growth during the initial stages. There is sustainability issues if expected results are not achieved by farmers.
Planting	Planting carried out as per the instructions by DOA. Observed dense planting fields promoted by DOA. New plantations are intercropped with B-Onion,	The technology interventions do not adequately address the importance of planting rows to receive maximum sun light. Excess moisture conditions reduced plant growth.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Ground Nut, and Vegetables.	Poor plant health and vigour lead to more P&D incidences.
Weeding	Mulching around plant base not performed. In new plantations the weed control is practiced along with intercropping of annuals. Chemical weedicides are used for annual cropping that contribute for the controlling of weeds in the Guava area also. The existing plantations was not satisfactory as there is no regular weed control implemented. Farmers use hoe or machine operated grass cutters for weeding.	Lack of proper mulching caused more weed growth. Intercropping green manure crops could reduce the cost of labour and nutrient requirement. Protective measures are not applied when using pre-emergence weedicides. Farmers continue the traditional or own practices and depend on chemical inputs as technical interventions. Identification of diverse methods for managing weeds has not been introduced.
Irrigation	Flood irrigation. Sunken beds over soaked high moisture level. Though the FPOs are aware of the benefits on P&D, control sprinkler irrigation is not adopted (Project support is expected for new plantations). Drip irrigation is not adopted. Lack of monitoring for measuring soil moisture levels. Excessive use of irrigation water although water is very scarce resource especially during Yala seasons. Observed Water logging conditions in some fields.	Use of excess water. Inadequate knowledge on frequency and rate of water required from initial establishment to per year of growth. High moisture levels promotes diseases. Sooty moulds are common incidence. Diseases carried through flowing water and leaching nutrients become a barrier for vigorous/ healthy plant growth. Poor tolerance to P&D due to high humid/moisture conditions around the field. Poor irrigation efficiency – highly dependent on flood irrigation.
Nutrient	Few farmers used compost during planting. All farms apply inorganic/chemical fertilizer as per	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and not purely

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	the recommendations of DOA. Soil/leaf test based specific application method not practiced. Trace elements as Foliar sprays are used for flower induce and fruit development and appearance. Some farmers use pelleted fertilizer (blue/ purple/ red).	based on recommendations. Lack of proper nutrient management together with irrigation plan/guide lead to poor plant growth/ yield/infestation of P&D. Therefore aspect related to PNM needs to be experimented and demonstrated to apply correct nutrient management based on soil conditions and planting densities. Project interventions are not sufficiently addressed by the PNM for new/ existing crops.
Pruning	The FPOs were trained for pruning of new plantations and existing plantations. FPOs are yet to show experience (under supervision/ close guidance by Extension Officers - AIs) on pruning of the young plant and making the tree canopy and frame. Crowded branches. Pruning of lower branches (close to soil surface) are not effectively practiced in new/ existing plantations. Thinning out of fruits not effectively practiced. Follow-up action by PPMU/ DOA is not adequate to encouraging the farmers on proper pruning/training of plants/ maintaining field hygiene. Effective pruning/ cleaning is not implemented in existing trees producing fruits.	DOA recommendations are not effectively practiced. Pruning allows penetration of sunlight and helps to control P&D. Lack of Farmers attitudes and skills on importance of practicing pruning trees is a probability for P&D infestation. Farmers in some FPOs are reluctant to remove flowers during initial growing stage, hindered the healthy plant growth and attract P&D. Lower branches of existing trees bare fruits and touch the ground resulting in P&D infestation/ unhygienic status. Lack skills on identifying and removing the infested leaves/ branches/ flowers/ small fruits. Farmers keep more than two fruits per bunch causing P&D infestation and poor quality /appearance of fruits when maturing. Yet to receive sufficient technical support. Low fruit production. High shading due to inadequate pruning, high humidity within

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		the plantation causes physiological disorders to fruits, anthracnose sooty moulds infestation.
Bagging fruits	Bagging fruits with paper bags and poly bags. Some uses news paper bags. Current method is used to bagging individual fruit at 1.5 to 2 months after flowering. FPOs noted bagging is labour intensive and costly. Bagging is mainly for control of aphids/ thrips/ scale insect/ fruit fly and to obtain a good appearance of fruit. Bags are not sealed properly at the neck of fruit Ants carrying insects observed inside the bags. Bags are torn and open when soaked due to irrigation water/ rain/ dew. Potential for Fruit contamination with toxic chemicals of print ink on news paper bags.	Bags are not properly attached to the fruits. Inadequate awareness on technical aspects of bagging lead to poor fruit appearance. FPOs need more technology interventions for judging the correct stage/size of fruit for bagging Poor quality of bags causes infestation of P&D leading to poor status fruits at maturity. Also the possible contamination of inks/paints in newspaper bags may lead to toxic/residue issues. Infested with insects-ants/mealy bugs. Bagging has not effectively demonstrated for its importance. FPOs require technical skills to identifying the correct bagging stage for fruit, type of bags to be used, Bagging may have be avoided by implementing good orchard hygiene and management and introducing other cultural practices.
Pest & Diseases (PD)	Dieback (Fusarium oxysporum or Macrophomina phaseoli) is the most severely damaging disease in guava cultivations. It appears especially in 2 to 3 years of plant growth. Enlarged and cracked Scab/ brown spots cause secondary infection by fungus. FPOs indicated anthracnose infestation on trees and fruits	Increasing soil moisture levels increases die back of plants. Lack of awareness on PNM and poor pruning/training practices increase incidences of scab/ anthracnose disease. Lack of technical knowhow and rate of traps per unit area is a bottleneck. Leaf eating caterpillars are active at night. Day time spraying is not effective.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	effecting the fruit yield. Fruit fly infestation observed by farmers mainly during fruit maturing stage. Baits/ traps are not used by many farmers. Mealy bugs, thrips, leaf eating beetles, leaf rollers/cutters, scale insects, plant hoppers, causing damages are controlled by chemical spraying. FPOs skills are yet to improve on identification of Nematodes infestation. FPOs are not familiar to recognize nutrients/ physiological disorders and their symptoms.	Technical interventions should be sufficiently promoted and the adoption of crop stage wise PHM practices for minimizing the P&D incidences.
It is obvious that the principle objective of the ASMP is to convert project benefited crop fields into highly productive agricultural systems through technological advancement and use it as technology demonstration units promoting high tech Guava production under small farm lands. The project supported guava cultivations has not demonstrated/provided exposure on high tech interventions for farming communities in the provinces. Though the project expected the AI to implement technology transfer activities, his/her role in this regard is not adequately received for the project due to other commitments related to provincial/ area development work. Coordination and involvement of Agricultural Scientist's too is not adequate in promoting crop stage wise PHM practices for improved production/quality under ATDPs upgrading these technologies and monitoring of these components is an essential part for the technology demonstration by ATDPs.		

3.5 Pineapple cluster – Introducing Mauritius PA –FPOs in Medagama, Moneragala

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Adopted deep ploughing using disk plough implemented. Most of the lands selected were with some slope and necessary measures (terracing/ earth bunds) implemented for soil conservation. Organic manure/ compost added during land preparation.	Farmers expected better soil drainage and fertility for healthy plant growth. Continued monitoring and follow up interventions necessary for increased skills on soil management for better plant growth.
Planting materials	Mauritius pineapple introduced. Farmers are experienced in cultivating Kew for many years but Mauritius new to them though the training/technical aspects are provided. The suckers delivered are in different sizes/ growth stages. Suckers are sourced from different Pineapple fields in major growing areas. FPOs have no idea about the healthiness and disease free conditions of suckers delivered.	UVA is popular for its smooth cayenne or Kew plantations. Lack of proper technical advice and follow up training could challenge the future sustainability of the Mauritius cultivation. Lack of uniform growing could affect the crop yield. Technology interventions with experiments/ demonstration required to promote uniform plant growth to achieve expected yield for link markets. Suckers are treated with chemical for controlling pest infestation-mite/ thrips/ mealy bugs. FPOs have no idea about the healthiness of suckers and reliability of the source of supply. Healthy plant nurseries are not identified or there is no plan for producing suckers for future expansion. Lack of proper information about the age of plantations from which suckers are obtained (suckers obtained from plantations that are more than 5years old are susceptible for increased

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		infestation of P&D.
Weeding	Stale bed methods not practiced. Manual weeding at monthly intervals. Mutual labour exchange is actively operated within PA FPOs. Plantation is maintained weed free.	Weed control is satisfactorily done. Demonstrated efficient cluster participation. Continued technical interventions to introduce intercropping/ mulching methods through participatory research/ experiments for sustainable PA cultivation in the area.
Irrigation	Sprinkler irrigation has been introduced and purchasing of necessary implements was under progress at the time of this study There is no measure adopted to identify the time or intervals for irrigation. Depletion of water reserves in streams reported during Yala season causing limited water availability for lift irrigation.	Use of excess water causing depletion of reserves for drought period. Non- availability of rain water harvesting mechanisms. Lack of knowledge on effects of climate change or drought on plant growth. Lack of skills on identifying symptoms of water stress and virus infections.
Planting	Contour planting with double row method. Spacing as recommended by DOA. Timely planting was done as agreed by FPOs. DOA recommended planting by April/May. Time of planting differs according to climatic conditions and availability of planting materials in the area. Transplanting done in over soaked moist beds.	Delayed planting (June) could influence occurrence of P&D depending on the weather. Farmer knowledge and skills need to be enhanced. Excess soil moisture could influence soil borne diseases, nematode infestation, varied plant growth.
Nutrient	All farms had applied compost during LP. All farmers used inorganic/chemical fertilizer. Practice of excess application especially urea was identified. Pelleted fertilizer identified as blue, purple and red is	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and informal sources but not purely based on recommendations. FPOs not aware of plant stage-wise nutrient management

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	used for regulating growth and flowering. Plant growth was not uniform or even size or number of leaves.	methods. Aspect related to PNM needs to be experimented and demonstrated to apply correct nutrient levels based on soil test results to maintain vigorous plant growth and protection from P&D.
Pest & Diseases (PD)	Majority of plantations were hygienically maintained. Suckers are treated before planting with insecticides and fungicides to prevent any incidence of P&D. Few farmers used chemical pesticides especially fungicides to prevent/control spread of collar rot. Observed the random presence of Mealy bugs during the visits. FPOs are well alerted for use of chemical control measures if P&D occur. Pest repellant plant "Madu" (Cycus spp), Derris Spp, available within the plantations.	Poor awareness on pest surveillance and scouting. Lack of uniform plant growth create a platform for increased P&D. The traditional practices/border crops are available but not identified/promoted for repelling the pest. High moisture levels, use of high doses of fertilizer, deep planting of suckers increase cause of root rot/collar rot. Poor awareness on potentials of P&D reduction by cultural/biological/ mechanical practices for crop production. FPOS are not aware of replanting cycles that need to adopt with planting new suckers every 2 -3 years. Lacks awareness on suitable crop mixtures/border cultivations and its influence on P&D infestation. Lack of traps and baits for observation and monitoring insect population in the field. There is no technology interventions for demonstrations/ experiments for training/ knowledge development for monitoring based practices for P&D control.
The particular variety of PA introduced in the area was new to the farmers. The study observed that there is inadequate coordination or		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
involvement of research and expertise to monitor/ follow-up/ demonstrate and share scientific knowledge with FPOs to the farmers to manage the plantation by different crop growth stages to avoid any draw back/crop losses. Though the plantations are well maintained, the growing status of plants within rows are not uniform due to difference sized suckers planted in the field. The PNM methods and recommendations are essential in this regard in order to achieve set targets for markets as agreed. Introducing crop stage wise pest monitoring practices could prevent the occurrence of any P&D infestation and reduce the use of chemical pesticides. Identifying the potential intercrops with pest repellant plants and food crops would enhance the environment sustainability and house hold earning.		

3.6 Papaya cluster – Production of green papaya- FPO in Elahara- NCP

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing followed with tiller and rotavator for making fine tilth of soil. Planting pits made as recommended. 10-15kg of compost added to every pit. Soil fertility analysis was done but not used effectively to determine the pH level, nutrient requirements. The lands identified are chena lands.	Lack of awareness of soil management (soil pH; 5.5-7.0, soil nutrients, etc.) techniques, soil borne organism/ nematodes/ cyst stages of pests may cause poor plant growth. Inadequate knowledge for maintaining irrigation for healthy plant growth and fruit production. Mulching is not practiced, Increased moisture depletion from the soil affects the plant growth.
Planting materials	Seedlings of Red lady variety supplied through the project for new plantations. FPOs identified the varietal characteristics as high yielding, short duration for first harvest and	The benefits of Red Lady as a green fruit i unknown. Farmers are not aware of the type of the seedlings supplied, which can only be detected at harvesting. Poor quality/adulterated seeds could tarnish the true type characteristics.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	resistance for virus infestation.	There is no demonstrated technology transfer activity or experiments to identify more productive varieties with resistance for P&D.
Planting	Planting pits are made 2'x2'x2.' Spacing as recommended by DOA (7' between two rows and 5' between plants). More than 1000 plant/ac.	Lack of capacity of farmers on identifying P&D infestation during the early growing period. More attention with technical inputs/ training is required to managing crop with regular pest/ disease monitoring mechanisms. The crop records introduced by the project is not fully utilized due to inadequate capacities for assessing/evaluating the crop stage wise information/ data/ statistics and implementing the action as needed. Traps/ baits/ biological measures are yet to be recognized by the FPO members.
Weeding	Manual weeding is practiced. The existing plantations are kept weed free around plants. Annual crops for intercropping was not identified or introduced to reduce the weed growth within the plantation.	Inadequate knowledge of farmers on identification of different types of weeds and relationship for hosting different lifecycle stages of pests. Intercropping green manure crops could reduce the cost of labour and nutrient requirement. Seasonal vegetables (e.g. Turmeric, Ginger, Chilli, pea, Green leafy vegetables, mustard etc) may be grown as intercrop right from the first year to reduce weed infestation. Legume varieties are not recommended as it harbors the aphids that carries virus infestation.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		Inadequate technical interventions for border cropping and wind breaks to reduce P&D infestations. Measure for mulching is not practiced.
Irrigation	Flood irrigation is still in use by some members of the FPO. Few farmers installed drip irrigation systems. Irrigation intervals are maintained as DOA recommendation. Daily irrigation provided up to one month after planting due to dry weather conditions. Farmers are not aware of plant water requirement. Crop fields are formerly chena areas mostly cultivated under rain-fed. Most farmers in the study area reported they are yet to receive the facilities relevant to irrigation and scarcity of water had badly affected some farmers due to prolonged drought conditions.	Flood irrigation and use of excess water and water logging could affect the plant growth/influence P&D infestation. Lack of awareness on maintaining pressure for equal distribution of water for entire plantation. Absence of mulching (straw/plastic) around the plant base causes surface drying/soil erosion around the plant base/weed growth. Inter cultivation and earthening up not observed. Lack of knowhow to mitigate climate change factors the productivity may reduce due to stress, infestation of P&D. There is no readiness for water scarcity- due consideration is not given on efficient use of water and rain water harvesting methods. Use of solar energy is not identified as cost effective long term energy solution. Sapling had been kept aside the home garden due to drought conditions and lack of water for irrigation.
Nutrient	Farmers used compost before crop establishment. All farms apply inorganic/chemical fertilizer as per general recommendations of DOA. Soil/leaf test based specific application method not	Effectiveness of general fertilizer recommendations are yet to be studied/assessed. FPOs blankly apply plant growth regulators/granulated fertilizer which may influence P&D or physiological disorders.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	in use. Trace elements Foliar sprays are used for flower induce and fruit development. Pelleted/granulated fertilizer also used.	Nutrient management depends on fellow farmer experience and agro- input supplier networks. Lack of field level experimentation and demonstration to identify correct nutrient management practices based on soil conditions and planting densities. Crop stage wise growth characteristics related to nutrient application was not monitored/assessed.
Pest & Diseases (PD)	Mealy bug, scale insects white flies, thrips and aphids are the common pests reported. Anthracnose, leaf curl virus, ring spot, are important diseases identified by the farmers. Farmers had used insecticides, under AIs instructions. Farmers used water flushing/ spraying to dislodging aphids/ thrips/ white flies. Fruit fly attack was observed when the fruit is mature and starting to ripen. Poor awareness on anthracnose infestation in young leaves, shots, flowers and fruits. Flowers/fruit falling. Mottle virus on fruits, mosaic virus on leaves and woody virus on fruits. Die back of branches noticed due to lack of aftercare measures for pruning.	Lack of awareness on varieties that are resistant for nematodes/ P&D. Poor water management leading to water logging/ high moisture content influences the foot rot disease/falling of trees. Light trap/sticky traps/pheromone traps are not used. No pre-treatment or P&D prevention method adopted for seedlings/transplants No Proper practice of de-trashing/cleaning of crop at 150 and 210 days after planting. Lack of awareness on vacuum removal of aphids/white flies/thrips. Lack of awareness on the importance of deterring the insects by installing reflective mulch (poly mulch). No training/demonstration to adopt monitoring/ for identifying correct maturity stage which could control post –harvest storage diseases especially Anthracnose, Stem end rot, Aspergillus rot, Rhizopus rot, Fruit rot, Phomopsis observed in Papaya when ripening.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	FPOs not aware of the reasons for drop off of small fruits.	Intercropping leguminous crops/ Gliricidia attract aphids. Inadequate awareness among FPOs on the time of fruit fly attack. Ploughing and turning soil to expose pupae on surface light/heat, during moist weather conditions are not practiced. Protective measures such as border crops/ Wind barriers, hygienic field management, monitoring and surveillance are not adequately implemented. Parasitic activities are reduced due to spraying chemical pesticides. Leaf mosaic virus is a potential cause for reducing fruit yield. Adoption of Crop stage wise PHM practices is a better solution for controlling the vectors and virus infestation. Traditional setting up of evening bonfire as measure of repelling insects was not observed. FPOs not familiar with symptoms of physiological disorders. Application of chemicals will eradicate the beneficial insects. Farmers need more awareness and technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D. Poor awareness on potentials of P&D reduction by cultural/ biological/ mechanical practices have influenced FPOs to depend on chemical control measures.
Green Papaya producers FPO holds 01arec per farmer supported by ASMP to install Sprinkler irrigation systems for 50 farmers implemented in two stages (1st stage 25 farmers/ 2nd stage 25 farmers) in Elahara area. The study team visiting two GN divisions in Kiri-oya and Atharagalla in Elahara DS area met with farmers cultivating Papaya in Chena lands abandoned for a few years. Though the farmers managed to provide water		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
by lift irrigation, there is a high risk of depletion of water due to drought conditions in the area. The technical interventions have not recognized the situation for mitigating the challenge at least by introducing the rain water harvesting method for storing water for irrigation purpose. Nutrient management is an important area related to fruit production and productivity. The current practices are based on general recommendations and no area, soil or variety specific recommendations are available. This could create challenges for healthy plant growth and plant tolerance levels for P&D, where farmers are compelled to practice adhoc nutrient/ growth regulators/ mineral/ chemical compounds by their own or informal sources. This may cause detrimental effects on plant health and growth leading to loss of crop. Overall, the FPOs are guided to maintain crop records for crop production/ management activities but they have not demonstrated any involvement on pest monitoring or scouting to determine the method for pest management/control. The farmers are yet to identify the proper control measures and currently depend on chemical pesticides. Technical interventions by the project has not sufficiently introduced/demonstrated agronomical/mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/infestations, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues in the Papaya cultivation in the province. It was also observed and learnt that this area is highly remote, water is very scare during the dry season, prone to frequent wild elephant attacks, and soil is very shallow as the water table rises above the surface and remains stagnated for one or two weeks during Maha season. Although the new road network under Moragahakanda has made it accessible to a great extent, other problems still remain and are mostly affected by the success of crops such as papaya. So, it is proposed to consider this matter prior to implementing the second stage of this project.		

3.7 Chilli clusters – NCP (Anuradhapura and Polonnaruwa), Eastern (Kaluthaweli) and North (Jaffna)

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	No deep ploughing under FPOs in ASMP program. Use only rotavator, prepare beds for planting. Farmer group in Galkiriyagama (MASL) chilli seed producers implemented deep ploughing and reported the advantage for healthy plant growth.	Soil borne organism/ nematodes/cyst stages of pests may not be exposed to sunlight/ predators on surface. Pest infestation could increase (nematodes/ whiteflies) after planting. Lack of adoption of proper land preparation lead to poor drainage/ water logging/ excess moisture level at root zone which caused poor plant growth/ P&D infestation. Soil solarization (that could reduce the soil borne insect/ pests) methods not introduced.
Seed varieties	Local seed-MI-2, KA-2, and MICH-2 popular among FPOs in NCP & North. PC1 (Panjabi origin) and its selections are popular among major chilli growers in East. /MIPC1-is a selection identified by researchers @ NCP. Farmers use own seed produced by them. New introduction MICH-1 -though yield is high (30mt/ha) yet to capture the market due to its brittleness and wrinkled appearance. Imported varieties-Raj hot, Super indum, Spartacus cultivated varieties but susceptible to P&D.	Lack of availability of quality certified seed has caused increased P&D infestation. Use of own seed from previous cultivations deteriorated the resistant for P&D. Inadequate seed producer farms under DOA. Lack of knowledge of farmers on field procedures adopted for seed production. Lack of technical interventions for promoting seed and planting material production within the FPOs in the provinces. DOA has implemented cluster farm seed production programs under protected culture and open field cultivation systems leading to poor seed quality with potential for transmitting seed borne diseases.
Nursery	Soil bed nursery.	Less concerned for use of plug-trays/ nursery trays for raising

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Sterilizing soil beds not practiced by all farms. Planting trays with sterilized pellets or soilless media not used. Traditionally transplanting method adopted and it is proven that the yield has decreased by 20%. One month old seedlings are used in some fields.	seedlings. ASMP interventions to introduce such technology is not included. Damage to roots during uprooting/transplanting affect the healthy vegetative growth. High probability of infestation-nematodes/ damping off due to poor soil health/surface irrigation. Benefits of Planting aged seedling is yet to be identified.
Weeding	Hand weeding was adopted for nurseries. Stale bed methods that will reduce the incidence of weed during early growing period was not practiced. Manual weeding was adopted up to 6-8 weeks after planting and weed growth was suppressed due to high grown canopy covering the ground. FPOs in NCP and North have used poly-mulch on the planting beds suppressing the weed infestation.	The project interventions have not sufficiently introduced innovative/cost effective weed control approaches such as stale bed technique. Project interventions identified poly-mulch as an effective weed control method. But the cost factor remains a question for farmers. Insufficient technical interventions in laying polymulch have caused more space between soil surface and polymulch that increased the soil temperature, deteriorated plant health and caused vigorous growth.
Irrigation	Flood irrigation. Sunken beds used by some farmers in the project provinces. Sprinkler irrigation systems adopted by FPOs in East. NCP & Northern farmers are provided with drip systems Waste of water. Beds are continuously kept moist.	Less efficient flood irrigation and hand watering with traditional water buckets are still used in the North. Use of excess water/ high moisture levels promotes damping off/ diseases. Diseases may be carried through flowing water. Lack of efficient water management under drip/ sprinkler/ flood system created a barrier for vigorous/ healthy plant growth/ poor tolerance for P&D due to high moisture.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Planting	FPO Farmers in study area carried out schedule planting as agreed by all members. Year round cultivation is observed in East and NCP. (Includes planting in February and August though it is dry) FPOs in EAST planting on open soil beds. FPOs in NCP and NORTH planting on soil beds covered with polymulch and installed insect proof nets on periphery. Recommended plant spacing is used. Time of planting differ according climatic conditions & availability of seed in the area. Transplanting done in over soaked moist beds. Planting two plants per hill is recommended practice but FPOs in East & North adopt 4-5 plants per hill method as they are used to do for many generations.	Delayed planting (June) could influence occurrence of P&D depending on the weather. Lack of proper monitoring mechanism, high moisture levels during planting, high number of seedlings per hill, could increase P&D occurrence. Planting uprooted seedling causes yield reduction up to 20% (indicated by research information). ASMP interventions are yet to introduce alternate technologies in this regard. Farmers believe that planting a higher number per hill will avoid weed infestation and also reduce the cost of labour. Further, it was noted that harvesting frequency is increased and performed every other day by having a higher number of plants. The farmer adopted practice was not proven scientifically and could lead to more infestation as observed in farmers' fields and if large volumes are expected, marketing will become a challenge for FPOs.
Nutrient	Though the compost is added the farmers heavily depend on inorganic/chemical fertilizer. Excess application of urea to boost vegetative growth. Pelleted/foliar fertilizer identified as blue, purple and red (in laymen terms it was noted as plant vitamin) is used for regulating growth, induce flowering and enhance pod appearance.	Excess urea may influence P&D occurrence. Nutrient management is depend on farmer experience and informal sources but not purely based on recommendations. Insufficient technical interventions to train/ identify/ use on different crop growth stages. No demonstrations/ experiments/ R&D by national level institute to increase farmer skills PNM for vigorous healthy

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Information and advice received through relevant company representative/area sale outlet.	plant growth. Poor nutrient management could lead to increased environmental and health hazards by especially polluting the water resources.
Pest & Diseases (PD)	The varietal characteristics indicated for their resistant on identified P&D. Irrespective of seed variety and resistant to P&D, routine pesticides application continued. Occurrence of Damping off reported in nursery stage and mostly controlled by seed treatment before sowing. Disease becomes a problem when soil moisture levels are increased. Thrips, aphids, white flies are common pests identified by FPOs. Chilli leaf curl was the most reported disease. Vector control measures implemented by using chemicals. Incidence of anthracnose also reported by farmers. Pod borer was the important pest that farmers are very keen on or controlling with chemicals. Most Mealy bug, scale insects white flies, thrips and aphids are the common pests reported. Anthracnose, leaf curl virus, ring spot, are important diseases identified by the farmers.	Lack of awareness on varieties that are resistant for nematodes/P&D. Poor water management leading to water logging/high moisture content influences the foot rot disease/falling of trees. Lack of awareness on the importance of deterring the insects by installing reflective mulch (poly mulch), Light trap/sticky traps/pheromone traps, biological measures, caused increased use of chemicals. No pre-treatment or P&D prevention method adopted for seedlings/transplants. Intercropping pest repellant crops marigold, wild sunflower, sesbania, border crop like maize, castor trap leguminous crops/Gliricidia those repels/act as barrier crops for vector insects. Wind barriers, hygienic filed management, monitoring and surveillance are not adequately implemented. Parasitic activities are reduced due to spraying chemical pesticides. Traditional setting up of evening bonfire as a measure of repelling insects was not observed.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Farmers had used insecticides, under AIs instructions. Farmers used water flushing/spraying to dislodge aphids/ thrips/ white flies. The fruit fly attack was observed when the fruit is mature and starting to ripen. Poor awareness of anthracnose infestation in young leaves, shots, flowers and fruits. Flowers/fruit falling. Mottle virus on fruits, mosaic virus on leaves and woody virus on fruits. Die back of branches noticed due to lack of aftercare measures for pruning. FPOs not aware of the reasons for drop off of small fruits.	FPOs not familiar with symptoms of physiological disorders. Farmers need more awareness and technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D. . Poor awareness on potentials of P&D reduction by cultural/biological/ mechanical practices have influenced FPOs to depend on chemical control measures.
Identifying the importance of controlling vector infestation by introducing modern semi protected nettings and drip irrigation with mulching practices were yet to convince the farmers under chilli FPO. The demonstrated effect was not recognized by farmers due to insufficient training/expertise for promotion and adoption of technology. It was considered important for establishing FPO based plant nurseries for supplying quality assured planting materials as the basic feature of the technology interventions. Further the members of FPOs are using the traditional art of crop management that has no difference to small farms outside the project interventions. The key officers responsible in this regard are Agricultural Scientists who are more involved in day to day coordination activities instead of making time for identifying challenges/issues on introducing modern techniques for diverse stages of crops which are not adequately addressed at FPO level. Lack of proper mechanism for coordinating with research stations and establishing relationships with respective AIs and obtaining technical expert services other than DOA (or private agribusinesses) has hindered the introduction/ promotion/ adoption of innovative technology approaches for identified crops in the project provinces.		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Nutrient management is an important area related to chilli production and productivity. The current practices are based on general recommendations and not on area or soil specific recommendations. This could create challenges for healthy plant growth and plant tolerance levels for P&D. Overall, the FPOs are guided to maintain crop records for crop production/ management activities but they have not demonstrated any involvement on pest monitoring or scouting in order to determine the method for pest management/control. The farmers are yet to identify the proper control measures and currently depend on chemical pesticides. Technical interventions by the project has not sufficiently introduced/ demonstrated agronomical/ mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/infestation, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues in Chilli cultivations in the provinces.		

3.8 Bitter Gourd clusters – NCP (Anuradhapura & Polonnaruwa)

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing was not recognized as an important practice under FPOs in the ASMP program. Only a few farmers did deep ploughing and reported the practice which helped them to have a better plant growth during the early stages. Bitter gourd and other vegetable growing farmers in Galkiriyagama (MASL) implemented deep ploughing and	Organism/ nematodes/cyst stages of pests living/hibernating below surface may not be exposed to sunlight/ predators on surface. Pest infestation could increase (nematodes/ whiteflies) affecting the early vegetative growth. Lack of adoption of proper land preparation lead to poor drainage/water logging/excess moisture level at root zone

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	reported benefits for healthy plant growth.	caused by poor plant growth/ P&D infestation. Soil solarization techniques (that could reduce the soil borne insect/ pests) are not introduced or sufficiently promoted. Soil management is not adequately done especially when cultivating in clay soils.
Seed varieties	DOA recommended Thirunelvely and Matale Green are the popular varieties cultivated. Imported hybrid varieties such as Pali, Maduri and Maya are also cultivated by farmers in the province. Imported varieties released subjected to clearance from plant protection/NPQS.	Farmers lack confidence on the quality of seed available in the open market. Varietal trails for screening and experimentation of characteristics on seed available is not adequate. Use of own seed from previous cultivations deteriorated the resistant for P&D. Lack of technical interventions for promoting seed and planting material production within the FPOs in the provinces. Incidence of crop losses on imported hybrid seed varieties especially Pali variety. Cause of loss is yet to be determined by DOA experts).
Nursery	The project proposed to promote potted plants prepared in the nursery. Experiments initiated with Ruhuna university to introduce potted plants using coil dust pellets. Innovative approach yet to be promoted through the project.	Less concerned for use of plug-trays/ nursery trays for raising seedlings. FPOs are not aware of potted plant raising system. Project interventions have not adequately demonstrated/ experimented with the technology exposure to FPOs. Climate change risk and prolonged drought during planting time could be managed by using the nursery method where delayed field establishment is made possible.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Weeding	Stale bed methods that will reduce the incidence of weed during early growing period was not practiced. Weeding by hoe was practiced up to 6-8 weeks after planting and weed growth was suppressed due to crop canopy covering the ground. Farmers who were given an introduction to poly mulch reported success in suppressing the weed infestation. Line planting with optimum plant density was implemented to minimize the effect of weed Some farms boundaries & crop fields are infested with weeds.	The project interventions have not sufficiently introduced innovative/cost effective weed control approaches such as stale bed technique/ shallow tillage before planting. Project interventions identified poly-mulch as an effective weed control method. But the cost factor remains a question for farmers. Private sector interventions have already supported the farmers with poly mulch. Dumping weeds/ non removal of left over weeds within the crop field and surrounding attract more P&D including the spread of weed seed.
Irrigation	Flood irrigation was common in the province. Project interventions have provided drip irrigation and insect proof net to cover the planting area up 7ft high. Raised planting beds used with drains in between to facilitate the drainage. Some farmers used flood irrigation, though they have installed the drip systems. Farmers preferred to keep high moisture levels around plants.	Less efficient flood irrigation and hand watering with traditional water buckets are still used in the North. Use of excess water/ high moisture levels promotes damping off/ diseases. Diseases may be carried through flowing water. Lack of efficient water management under drip/flood system created a barrier for vigorous/ healthy plant growth/poor tolerance for P&D due to poor drainage/high moisture.
Planting	FPO Farmers in study area carried out scheduled planting as agreed by all members. Year round cultivation is observed in East and NCP. Land used for chena cultivation was used for growing B/G.	Farming areas under FPOs are not in one locality but dispersed in the village areas, which lead to many challenges for managing/guiding and introducing the technologies. Some farms which delayed planting made heavy infestation of P&D though netting was installed.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Recommended plant spacing is used. Time of planting differs according to climatic conditions and availability of seed in the area. Planting seed done in over soaked moist beds. Planting two seeds per hill was common practice implemented by FPOs.	ASMP interventions are yet to introduce alternate technologies such as border crops around boundary, intercrops that could reduce the incidence of sap sucking pests. The farmer adopted cultivation practices are highly conventional and ASMP interventions are yet to make a breakthrough in demonstrating crop stage wise technologies leading to better PHM.in farmers' fields.
Nutrient	Inadequate supply of organic manure which causes a majority of farmers to heavily depend on inorganic/chemical fertilizer. DOA general recommended fertilizer was used. Soil analysis based fertilizer recommendations are not available for FPOs. Excess application of urea to boost vegetative growth. Pelleted/foliar fertilizer identified as blue, purple and red (in laymen terms it is known as plant vitamin) is used for regulating growth, induce flowering and enhance pod appearance. Information and advice received through relevant company representatives/ area sales outlets.	Excess urea may influence P&D occurrence. Nutrient management depends on farmer experience and informal sources but not purely based on recommendations. Insufficient technical interventions to train/ identify/ use on different crop growth stages. No demonstrations/ experiments/ R&D by national level institutes to increase farmer skills PNM for vigorous healthy plant growth. Poor nutrient management could lead to increased environmental and health hazards by especially polluting the water resources.
Pest & Diseases (PD)	The varietal characteristics indicated their resistance to identified P&D. Irrespective of seed variety and resistance to P&D, routine pesticides application continued.	Lack of awareness on varieties that are resistant to nematodes/ P&D. Poor water management leading to water logging/ high moisture content, influences the foot rot disease/ falling of

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Wilt observed that early vegetative growth and disease becomes a problem when soil moisture levels are increased. Thrips, aphids, white flies, Melon flies are common pests identified by FPOs. FPOs are vigilant about P&D. Vector control was only by using chemicals. Fungicides are used without any monitoring or observations for symptoms.	trees. The objective of using insect proof netting was not fully achieved and FPOs lost confidence as the transfer of technology was not properly handled. Inadequate technology interventions/ promotions/ demonstration on the importance of deterring the insects by installing reflective mulch (poly mulch), Light trap/ sticky traps/ pheromone traps, biological measures, caused increased use of chemicals. Heavy use of insecticides- 7 brands used 4-7 days intervals. Lack of confidence on traps/ cultural practices on melon fly control. Technology package for B/G not adequately identified. Traditional practices such as soil raking, border crops, wind barriers, intercropping marigold, wild sunflower, sesbania, border crop like maize, castor trap crops/ Gliricidia those repels/ act as barriers for vector insects, fruit flies, disease causing organisms.. Poor field sanitation and hygienic field management, monitoring and surveillance are not adequately practiced/ implemented. Potential for emerging powdery mildew disease due to poor ventilation/ air movement within the canopy. Predators/ Parasitic activities are reduced due to spraying

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		chemical pesticides. FPOs not familiar with symptoms of physiological disorders. Farmers need more awareness and technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D. Poor awareness on potentials of P&D reduction by cultural/ biological/ mechanical practices have influenced FPOs to depend on chemical control measures.
Identifying the importance of controlling P&D infestation, the project intervened to introduce modern semi-protected nettings and drip irrigation for FPOs growing B/G. The demonstrated effect was not recognized by farmers due to insufficient training/expertise and exposure for promotion and adoption of such technology. Considering the natural and conventional farming in the provincial area, B/G is also cultivated using traditional practices have been followed for years. Providing a new technological aspect half way into the crop cultivation flow chain could create a negative mindset among the FPOs where such interventions without a holistic approach may lead to failures. It was considered important for establishing FPO based plant nurseries for supplying quality assured planting materials as the basic feature of the technology interventions. Further the members of FPOs are using the traditional art of crop management that has no difference to small farms outside the project interventions. The key officers responsible in this regard are Agricultural Scientists, who are more involved in day to day coordination activities in which time is utilized for identifying challenges/ issues and introducing modern techniques for diverse stages of crops which are not adequately addressed at FPO level. Lack of proper mechanism for coordinating with research stations and establishing relationships with respective AIs and obtaining technical expert services other than DOA (or private agribusinesses) has hindered the introduction/ promotion/ adoption of innovative technology approaches for identified crops in the project provinces. Nutrient management is an important area related to short term crops, especially vegetables such as B/G production and productivity. The current practices are based on general recommendations and there are no area or soil specific recommendations available. This could create		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
challenges for healthy plant growth and plant tolerance levels for P&D. Overall, the FPOs are guided to maintain crop records for crop production/ management activities but they have not demonstrated any involvement on pest monitoring or scouting in order to determining the method for pest management/ control. The farmers are yet to identify the proper control measures and currently depend on chemical pesticides. Technical interventions by the project has not sufficiently introduced/ demonstrated agronomical/ mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/ infestation, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues in B/G cultivation in the provinces.		

3.9 Ground Nut Clusters – Eastern and Northern Provinces (Batticaloa & Mullativu Districts)

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing was rarely practiced by farmers in Ground Nut FPOs in the ASMP program. Common practices in both districts are; first ploughing by tine tiller and second by rotavator. Farmers in Kathirveli in Batticaloa reported that using tine tiller was sufficient as the soils are sandy. Ridge and furrow preparation is a recommended practice but farmers follow the traditional practice of level field/basin block with a bund initially followed by the ridges.	Organism/ nematodes/ cyst stages of pests living/hibernating below surface may not be fully exposed to sunlight/ predators on surface. Deep ploughing will cut the rodent burrows which will help to control the rat menace in the crop fields, Pest infestation could increase (nematodes/ whiteflies), affecting the early vegetative growth. Lack of adoption of proper land preparation led to poor drainage/ waterlogging/ excess moisture level at root zone which caused poor plant growth/ P&D infestation. Even in the sandy soils, continues shallow ploughing/tillering could build up the hard pan below surface causing poor

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		drainage. Therefore it is advisable to identify the effectiveness through R&D. Soil solarization techniques (that could reduce the soil borne insect/pests) are not introduced or sufficiently promoted. Bunds/humps in the cultivation areas not flattened/levelled for effective removal of rodent burrows. The technical interventions are yet to demonstrate the advantages/ disadvantages of different land preparation practice implemented by farmers against the recommended practices to determine the better option with any improvements through experiments/ R&D.
Seed varieties	A variety called Tissa is used by all farmers in the provinces. Farmers in the Northern Province (Mullativu) have many years of experience in a selection known as Tissa 01, of which the cover of pods show an irregular net pattern compared to the Tissa variety that has a regular net pattern.	Lack of technical interventions to promote a quality seed production cluster within the FPOs in project provinces. Farmers lack confidence in the quality/ viability of seed available in the open market. Seed cost (increasing COP) increases as they have to use a high seed rate than the recommended seed rate. Varietal trails for screening and experimentation of characteristics on seed available is not adequate. Use of own seed from previous cultivations deteriorated the resistance for P&D. Focused on single market i.e. snack /roasted consumer market. Insufficient technical interventions to introducing different seed varieties to capture the diverse market segments locally

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
		and internationally, which challenges the future sustainability of small farm Ground nut production. Inadequate R&D development to identify high yielding provincial wise promising varieties with resistance for P&D and suitable for provincial climate/ soil and preferred by diverse consumer segments.
Weeding	Tiller/ rotavator application during land preparation partially destroys under-surface weeds/plant of perennial weeds. A majority of farmers practice mechanical weeding at 15-20 days and only if necessary again in 30-45 days after seeding. Only a few farmers were able to use the rotavator for weeding/earthing up based on the availability and time. Farmers are well aware of Earthen up at 6th week is more important as the hyphae has to be covered with soil. Thereafter no soil disturbing/weeding required as the soil is covered with crop canopy. Chemical weeding practices though reported, the FPOs couldn't elaborate the type of chemicals used. Alachlor identified a weedicide applied after sowing seeds but before germination. Also it is recommended to use post emergence weedicides for grass weedicides and broad leaves.	Lack of deep ploughing causes weed growth during early vegetative growth. Shallow ploughing could influence the emergence of weeds hibernating underground. The project interventions have not sufficiently introduced innovative/ cost effective weed control approaches such as stale bed technique/ shallow tillage before planting. Dumping weeds/ non removal of left over weeds within the crop field and surrounding areas attracts more P&D including spread of rodents, and weeds.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Irrigation	Sprinkler irrigation is used by all farmers in Provincial FPOs. According to farmers they perform irrigation at every 6-8 days intervals. FPOs identify the advantage of the sprinkler method against the flood irrigation method in respect of cost of labour, time taken for irrigation, and more importantly the reduced incidence of pests especially the aphid/ thrips/ caterpillars. Farmers were able to maintain a better moisture level by using sunken beds and making ridge and furrows by earthning up the soil during the 6th week.	Use of excess water/ high moisture levels promotes diseases that may be carried through flowing water. Lack of testing for water quality/ suitability for crop irrigation and farmer ignorance of the effects on crops due to the level of salinity, pH, microbial contaminations, etc., could be detrimental for healthy plant growth. Lack of skills/knowledge on managing/ maintaining the sprinkler system makes a barrier for vigorous/ healthy plant growth/ poor tolerance for P&D due to irregular/ unequal distribution of water basins.
Planting	FPO Farmers in study area carried out schedule planting as agreed by all members. Year round cultivation is observed in Northern District of Mullativu (Planting in January, May and August with crop rotation). FPOs in Eastern province plant in Jan/Feb and after harvesting an alternate crop like Maize, is cultivated or a Rice crop during the Maha season. Planting seed on flat surface of the basin structure. Time of planting differs according to climatic conditions and availability of seed in the area. Direct seeding is practiced manually and the project	Some farms delayed planting which led to loss of crop due to the heavy infestation of P&D. ASMP interventions are yet to introduce alternate technologies such as border crops around the boundary, intercrops that could reduce the incidence of sap sucking pests. The farmer adopted cultivation practices are yet to study and identify scientific importance and sustainability- specifically related to plant health and vigorous growth yield and highly conventional and ASMP interventions are yet to make a breakthrough in demonstrating new technologies and farmer experience on crop rotation and its advantage/ disadvantages on to better PHM in farmers' fields.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	introduction of a tractor mounted seeder was used by a few farmers in the FPO in the East. Single Seeds are dibbled in to the soil according to or randomly	Row planting by machines facilitated machine weeding by using of inter-cultivators. Random planting allowed only hand weeding, increasing the COP.
Nutrient	Though the DOA recommendations available, farmers practice differently- based on their many year of experience on Ground Nut production. Farmers use cow dung at the rate of around 2-4tons/ac During planting TSP was added to the soil. Urea is applied during the vegetative stage. Farmers as a practice apply gypsum during planting and flowering stages. 15 days before harvesting plant nutrient Micronutrient identified as “discovery” applied to boost pod colour and appearance.	Soil analysis based fertilizer recommendations are not available for FPOs. Nutrient management depends on farmer experience and informal sources but not purely based on recommendations. Insufficient technical interventions to train/identify/use nutrients on different crop growth stages. No demonstrations/ experiments/ R&D by national level institutes to increase farmer skills PNM for vigorous healthy plant growth. Poor nutrient management could lead to increased environmental and health hazards by especially polluting the water resources.
Pests & Diseases (PD)	Thrips, Aphids, White fly, Leaf caterpillar (also known by farmers as the “Jewel beetle”) and root termites are reported by farmers in Mullativu and Batticaloa. Farmers in Jaffna area reported colour rot/ die back of young plants and rodent attacks. FPOs Vigilant to P&D, but irrespective of potential resistance to P&D, routine pesticide application was implemented.	Lack of awareness on varieties that are resistant for nematodes/P&D. Poor land preparation practices and water management practices increased incidences of weeds, P&D. The use of chemicals destroy the beneficial insects. Inadequate technology interventions/ promotion/ demonstration on the importance of vigilance/ monitoring pest movements/ populations/ diagnosis of disease symptoms

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Nematode incidences reported by farmers.	influenced the FPOs to use chemical control measures. The project intervention for the technology package on Ground Nut was not adequately identified as the use of traditional practices such as land preparation, border crops, wind barriers, intercropping plants repels/ act as barrier for vector insects, disease causing organisms. Field sanitation/ management, monitoring and surveillance are not adequately practiced/ implemented. Predators/ Parasitic activities are reduced due to spraying chemical pesticides. FPOs not familiar with symptoms of physiological disorders. Farmers need more awareness and technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D.
Ground Nut cultivation in study areas existed for generations where farmers, under identified FPOs continued to grow using own experiences gained during their farming life. The project interventions have provided farm equipments and processing equipments to enable farmers to implement land preparation practices and post-harvest processing of ground nut efficiently and in a cost effective manner by using mechanized methods. It was observed these machineries/mechanized systems already existed and used by farmers in the provinces. The project support for its selected FPOs will facilitate and enable more farmers to make use of mechanized methods for cultivation and processing. However, the FPOs in the provinces are yet to familiarize the use of machinery/ equipment at field level where technology transfer/training procedures are not adequately addressed. The study identified that the technical aspect related operation/adjustments/maintenance of machineries are not fully acquired by FPOs. This made them discourage the use of particular machines and revert to the same old traditional practices and revert to square one. Lack of		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
properly organized and continued training/ experiments/ demonstrations with farmer participation have constrained to achieve the benefits by adoption of efficient technologies introduced by the project. There is a dearth of technical expertise to demonstrate and train farmers on use/operate/maintain machineries at field level. The demonstrated effect was not recognized by farmers due to insufficient training/expertise exposure for promotion and adoption of such technology. Providing a technological solution half way into the crop cultivation cycle could create a negative mindset among the FPOs where such interventions without a holistic approach may lead to failures. Mechanization is only a part of the crop production system. In order to obtain the maximum benefits to the FPOs, it is necessary to intervene in a holistic manner by introducing technologies/inputs addressing crop stage-wise activities which is missing at present. Considering the nature conventional farming in the provincial area Ground Nut is cultivated using traditional practices with traditional marketing linked to local small/ medium industrial sector, where adoption quality/ standard/ food safety systems are not a priority. Farm level activities especially harvesting/ post-harvest operations observed are highly prone to contamination of microbial toxins and fungal infestations. It was considered important for establishing FPO based seed production clusters for supplying quality assured planting materials (certified free of diseases/pests) and also farmer participatory approach to identify and introduce new seed varieties focused to capture diverse market segments to sustain the ATDP investments in the long term. The currently used seed type, Tissa shows mutation or variations where farmers started to select their own choice such as Tissa 01. It is important for ASMP interventions to look for the possibilities of introducing new varieties/types for increased resistant for P&D and higher yield. Further the members of FPOs are using the traditional art of crop management that is no different to small farms outside the project interventions. The key officers responsible in this regard are Agricultural Scientists, who are more involved in day to day coordination activities where time taken for identifying challenges/ issues in introducing modern techniques for diverse stages of crops are not adequately addressed at FPO level. Lack of proper mechanism for coordinating with research stations and establishing relationships with respective AIs and inability in obtaining technical expert services from any other than DOA has hindered the introduction/ promotion/ adoption of innovative technology		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
approaches/demonstrations in the project provinces. Nutrient management is an important area related to short term crops production and productivity. The current practices are based on general recommendations or farmer experience where no area or soil specific recommendations are available. This could create challenges for healthy plant growth and plant tolerance levels for P&D. Overall, the FPOs are guided to maintain crop records for crop production/ management activities but they have not demonstrated any involvement on pest monitoring or scouting in order to determine the method for pest management/control. The farmers are yet to identify the proper control measures and currently depend on chemical pesticides. Technical interventions by the project has not sufficiently introduced/demonstrated agronomical/mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/infestation, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues for cultivation of Ground Nut in the provinces.		

3.10 Green Cucumber Clusters – Eastern Province

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Land Preparation (LP)	Deep ploughing was not recognized as an important practice as cultivating lands are sandy soils. Based on the advice of a link company, the farmers used only tine tiller (as 1st ploughing) and rotavator (as 2nd ploughing) for land preparation. No seed beds prepared and planting was carried out in individually dug planting pits mixed with compost (2Kg/pit).	Organism/ nematodes/ cyststages of pests living/ hibernating/ resting stages of insects/ weeds below surface may not be fully exposed to sunlight. Cultivation in sandy soils consume a high volume of water. Technical interventions in this regard are not adequately implemented for introducing of soil management methods especially in sandy soils. Soil solarization techniques (that could reduce the soil borne

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Farmers were aware that adding compost during planting increases the soil moisture holding capacity.	insect/ pests) are not introduced or sufficiently promoted.
Seed varieties	Seed was supplied by the company on cost recovery basis. The varieties identified “Chandranee” /imported and distributed by the company. According to farmers, the seed introduced at the beginning performed well and after two crop cycles a new variety was introduced which performed poorly. FPOs reported that pest and disease incidence was high in the third crop due to lack of resistance in second lot of seed introduced by the company.	FPOs to bare the high cost of seed. Farmers have no option of buying seed from open market. Quality variation due to changing seed has affected the farm income/ weakening/ destroying the confidence between farmer/company. FPOs are not aware of the varietal characteristics of seed available/ introduced could lead to poor performance. Incidence of crop losses on imported hybrid seed varieties due to P&D and potential invasion of alien P&D.
Nursery	Raising seedlings in nurseries are not implemented as a practice. Experiments are ongoing for bitter gourd as reported. Innovative approach yet to be promoted through the project. Loss of high cost seed due to direct planting and thinning out could be mitigated.	Less concerned for use of plug-trays/ nursery trays for raising seedlings. FPOs are not aware of the possibility for potted plant raising system. Project interventions have not recognized or adequately demonstrated/ experimented the technology exposure to FPOs. Climate change risk and prolonged drought during planting time could be managed by using a nursery where delayed field establishment is made possible.
Weeding	Stale bed methods that will reduce the incidence of weed during the early growing period was not practiced.	The project interventions have not sufficiently introduced innovative/ cost effective weed control approaches such as

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Regular hoeing or hand weeding was practiced to keep the field weed free up to 30 days of crop stage. Weed growth was suppressed by crop canopy covering the ground. Boundaries and crop fields are maintained weed free (remove all alternate weed hosts-wild cucumber/ volunteer cucumber). Weeds are removed before flowering stage to avoid spread of weed seeds.	stale bed technique/ shallow tillage before planting/ poly mulch. Dumping weeds/non removal of left over weed within the crop field and surrounding attract more P&D including spread of weed seed.
Irrigation	Project interventions have provided the sprinkler irrigation system. Sandy soil satisfactorily facilitates the drainage. Farmers preferred to keep high moisture levels around plants.	Technical interventions need more attention for improving FPOs skills on efficient water management to avoid any long term problems related to leaching nutrients/ chemicals and accumulation and increased environmental problems. Interventions need to address the effectiveness of sprinkler irrigation on growing cucumber on creeping method. Use of excess water/ high moisture levels promotes damping off/ diseases. Lack of water quality/ suitability testing facilities/ methodology may lead to poor crop growth/ P&D infestations due to unidentified levels of salinity/ pH, mineral/ micro-organisms.
Planting	FPO Farmers in study area carried out schedule planting as instructed by the company. Time of planting differs according to climatic conditions and availability of seed in the area.	Agriculture extension facilitators from DOA, private sector (linked company) and NGO (World Vision are active in promoting organic farming/ conventional farming of vegetables/ fruits/ Green cucumber in project operated areas.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	Based on climate and company maintained climate monitoring data base, year round cultivation is implemented. Land previously used for chena cultivation was used for growing green cucumber. Recommended plant spacing is used. Line planting with optimum plant density was implemented to minimize the effect of weeds. Direct planting- two seed per hill was common practice and implemented by FPOs. Seeds germinate in 7 days after planting. Plants are allowed to creep horizontally along the ground. Trellises for vertical growing not practiced.	Lack of coordination among these operators become a barrier for introducing PM approaches/ methodologies for project FPOs. Programs implemented in isolation and variation of crop types, time of planting, technology interventions in the area possibly influence the increased P&D incidences. ASMP interventions are yet to introduce alternate technologies such as border crops around boundary, intercrops that could reduce the incidence of sap sucking pests. The farmer adopted cultivation practices are highly conventional and ASMP interventions are yet to make a coordinated effort to compromising the type of crop, time of planting, technology development demonstrating better plant health management for improved productivity agreed by all extension operators in the village/ division/ district. Farmers use more than two seeds per hill which is thinned out after 7-10 days which was a costly action due to the high seed price to be incurred by the farmer. Loss harvest was reported by farmers due to creeping plants as hidden fruits are left without being harvested. Harvesting larger fruits incurred a lower price in comparison to the higher price earned for smaller fruits. Also if the harvest contains sand particles/ external matters the farmer will get a price below the agreed level.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Nutrient	FPOs follow the recommended practices according to company extension officers. Organic manure was used for each pit before planting the seed. P & K nutrients applied when planting the seed. Two splits of N fertilizer applied at 20 days after planting and 45 days after planting. Soil analysis based fertilizer recommendations are not available for FPOs Nutrient mixtures supplied by the company but farmers are not aware of the contents/ratios. Micro nutrients foliar applications are supplied by the company with instructions to apply during vegetative and flowering stages. Information and advice received through relevant company representative.	FPOs followed as instructed but lack skills/ knowledge regarding the nutrient requirement for the crop/soil. Lack of awareness could cause increased cost of production. Application of urea may influence P&D occurrence. Insufficient technical interventions to train/ identify/ use on different crop growth stages. No demonstrations/ experiments/ R&D by national level institute to increase farmer skills PNM for vigorous healthy plant growth. Poor nutrient management could lead to increased environmental and health hazards by especially polluting the water resources.
Pest & Diseases (PD)	Soil borne diseases and Nematodes are identified as potential incidences. The varietal characteristics indicated for their resistance on identified P&D. Irrespective of seed variety and resistance to P&D, routine pesticides application is promoted by the company. Thrips, aphids, white flies, Melon fly are common pests	Lack of awareness on varieties that are resistant for nematodes/ P&D. Lack of holistic crop production approach hindered to achieving potential crop yield/ quality/ small farmer income. Inadequate technology interventions/ promotions/ demonstrations on the importance of deterring the insects by installing reflective mulch (poly mulch), Light trap/ sticky traps/

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
	identified by FPOs. Leaf spot, cucumber mosaic virus, powdery mildew downy mildew are diseases reported by farmers. FPOs Vigilant towards for P&D Pest control was only by chemicals methods. Fungicides are used without any monitoring or observations for symptoms.	pheromone traps, biological measures, caused increased use of chemicals. Routine use of company specified chemical pesticides are a requirement under contract agreement. Stipulated regulation on pre-harvest interval requirement was not adhered but harvesting is carried out on a daily basis. Lack of confidence on traps/ cultural practices on pest monitoring/ control. Technology package not adequately identified/ introduced. Traditional practices such as soil raking, border crops, wind barriers, intercropping marigold, wild sunflower, sesbania, border crop like maize, castor trap crops/ Gliricidia repels/ act as barrier for vector insects, fruit flies, disease causing organisms. Potential for emerging powdery mildew disease due to poor ventilation/ air movement within the canopy. Predators/ Parasitic activities are reduced due to spraying chemical pesticides. FPOs not familiar with symptoms of physiological disorders. Farmers lacking technical knowledge on crop stage-wise PHM practices to maintain high tolerance level for P&D. . Poor awareness on potentials of P&D reduction by cultural/ biological/ mechanical practices have influenced FPOs to depend on chemical control measures.

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Green cucumber (GC) an export oriented vegetable industry continued for nearly three decades in Sri Lanka. Lack of diversification and competition in the overseas market led to the industry in Sri Lanka losing its demand in the market and currently only one company survives with production and processing for export. The particular company relies on small farm out grower production, covering large numbers of small farms in different provincial areas. It was observed that in order to reduce the risk of P&D infestation the company keep shifting cultivation to different locations to maintain the continuous supply of raw materials for processing and export requirements. This practice of shifting locations is mainly required to control the pest incidences due to year round production and routine chemical usage. The crop life cycle is only 70 days and a high volume of fertilizer and pesticides/fungicides applied to arrest the pest and diseases. In order to avert the risk of loss of yield and maintain the quality the company, identifies the frequency of chemical inputs application even though they keep the pest and diseases surveillance through farmers and linked extension operators. The latest addition was the Batticaloa District Vahare area where over 500 small farms are linked for growing and supply of GC. The FPOs reported that they have benefitted with increased revenue from two crop cycles of GC. The third crop cycle was not very beneficial due to the cultivation of a different type of seed that had problem with germination, P&D infestation, and poor yield performance. The ASMP intervention in this regard is important to strengthen the cooperation between the company and FPOs. It was reported that before GC was introduced the farmers practiced natural farming systems introduced by an NGO for cultivation of vegetables. However, due to the high income, a majority of farmers with potential changed the crop and shifting organic farming to conventional farming that influenced the use of chemical inputs creating an imbalance in the environment in the area. Considering the short life cycle of GC, the farmers as well as company avoids taking any risk on P&D infestation and preventive measures are adopted by using chemical pesticides. However, the farmers reported that the continuous cultivation could lead to major pest problems. The current observations of farmers indicate that Thrips, Caterpillars and fungus are major pests and disease identified. But the technical		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
interventions by the project is yet to look for the possibilities for introducing/ implementing monitoring and providing surveillance mechanisms for small farm fields. The farmers in the area are experienced in organically growing vegetables and use of biological/ mechanical/ physical/ agronomical technologies for control of pests and diseases as learned under World Vision interventions. It was revealed that a different type of extracts obtained from mixtures prepared by using seashells, cow-dung, Neem extract, Gliricidia, rice, tobacco leaf stalk, used to induce flowering, trap insects, control caterpillar infestations is available but not used by farmers due to limited man power resources and time factor. This may be an opportunity for developing an enterprise for manufacturing plant based bio pesticides to be promoted as an alternate to toxic chemicals. The growers informed that volumes of rejections have no markets and therefore they lose income as there is no place to sell. Also they are concerned about the horizontal creeper planting method on the ground which may be prone to infestation with pests or diseases. It was reported that pest control is not effective due to the diversity of crops and year round cultivation in the adjoining field and lack of coordination with area based agriculture development and extension facilitators such as DOA, and NGOs in the proximity. A holistic approach joining all extension facilitators/ service providers (PMC) operating in a particular area is a timely needed if pest management technologies adopted to be successful. It was also reported that the project interventions are not sufficiently coordinated with R&D institutions to identify the issues/challenges with current practices and provide farmers a better understanding and technical knowhow on combined PM methodologies/approaches for the crops in the provincial area. Nutrient management is an important area related to short term crops specially vegetables such as GC production and productivity. The private sector agribusiness operators proposes ASMP to initiate action to coordinate with relevant extension services (DOA/ NGO/ Private Sector/ Community organizations) in the field and intervene to make an attempt to determine a policy decision that could promote/ adopt/ implement appropriate PM technologies agreed to all.		

Crop stage-wise activity for PHM	Current practice by FPOs	Gaps/challenges related to PM
Overall, the FPOs, though guided to maintain records for crop production/ management activities, have not demonstrated any involvement on pest monitoring or scouting in order to determine the method for pest management/control. Technical interventions by the project has not sufficiently introduced/ demonstrated agronomical/ mechanical/ biological methods for picking and destroying, use of sticky traps, light traps, monitoring pest life cycles/ infestation, as long term sustainable PHM tools that could mitigate the challenges of P&D infestations and climate change issues in B/G cultivation in the provinces.		

4. General remarks

In general the ASMP/PPMU interventions in the provinces have set the stage for prompting and adoption of appropriate technologies for increased production and small farm income. It was also noted the project support extended towards infrastructure development facilities as well to sustain the technical interventions focused for many generations to come.

The PPMU to outsource the technical expertise on crops selected for pilot projects which is challenging due to the lack of experienced resources especially in DOA.

Though the FPOs are informed of the importance of soil testing for nutrient management and soil health management, farmers are yet to practice a scientific way of input supply based on the test reports and crop proposed for cultivation. Nutrient management was considered important for achieving uniform crop growth and yield to cater to the markets determined and agreed upon. However, in some provinces the crop growth was not uniform due to poor management. As an ATDP project it is important to provide crop stage wise technical know-how/ skills/ training to achieve uniform crop growth throughout the cycle. Over supply or inadequate nutrient supply could affect the healthy plant growth.

Land preparation activities are yet traditional and ASMP interventions need to address a more scientific approach identifying the importance for PHM and productivity.

Irrigation systems mainly used are flood irrigation waste of water and erosion and water logging in the surrounding areas leading to nematodes and other diseases/pest buildup. It was reported ASMP interventions made a turning point to promote and adopt efficient plant watering systems by introducing drip/ sprinkler. However, it was noted the FPOs, though adopted are still at a learning stage and the PPMU involvement need continued monitoring/ training until the farmers fully achieve the knowledge to determine water quantity, frequency, operation, maintenance, repairing, on particular systems with relevant crops.

It was noted that inadequate arrangements to facilitate communication between extension/ research/ PPMU and FPOs have hindered the adoption of appropriate technology, especially installation of insect proof nets, polymulch, pruning, bagging, irrigation, monitoring/ control/ avoiding pest infestations in different stages of crop growth. It is essential to provide stage-wise crop growth and participatory training for FPOs to understand/ observe and adopt technologies/ practices to achieve maximum benefits. Farmers are yet to adopt crop stage-wise PM methods, but continue to practice the traditional way of routine application- harming the nature and creating issues on toxic contamination. Interventions

for identified control mechanisms by crop stage-wise would be much economical as there are different types of P&D involved under various crop growth stages.

The visit and discussions had no response on combine technology adaptation for PM. However the farming practices/ crop management practices/ water management practices have unintentionally contributed to controlling the pest and disease infestation during the crop season.

Though the cultural/ Agronomic practices are followed, there is no proper understanding regarding the correct techniques of such practices and how these practices effectively suppress the pest infestations Farmers have experience on changing climatic conditions and rainfall patterns that could affect the crop production program during the seasonal fruit setting and maturity could be affected under extreme wet/ dry weather conditions. Also the emergence of pests and diseases due to intermittent climatic factors where pest life cycles could continue within the cultivation fields. However, these factors are yet to be addressed under the ATDP program.

In the Southern end of UVA, the private sector involvement for promoting modernized agriculture systems with identified farmer clusters highlighted the crop rotation, mixed cropping of selected vegetables focused on reducing the cost of production and increasing productivity/ farm income. The project essentially addressed technologies for managing pest incidences and reduced use of pesticides and identified as one the sites that could provide technical exposure for provincial FPOs.

In this regard, it is very important to consider demonstration plots in each ATDP in coordination with Research institutions and the Ex & T unit of DOA to educate the FPOs to implement right practices at the right time as a team to improve the crop yield and reduce the damages due to pest infestations. Farmers and officers should meet at scheduled intervals, may be in shorter intervals during dire straits to discuss the issues and make decisions to mitigate. Training on use of MA, method for vernalization process and packaging/ storing seed conducted through DOA resource persons.

Published by:

The Project Director
Agriculture Sector Modernization Project
Ministry of Agriculture
No: 288, Sri Jayawardenapura Mawatha,
Rajagiriya, Sri Lanka.

Report Prepared by:
Sampath and Prasad Holdings (Pvt) Ltd.,
74/6, Stanley Place, Pepiliyana Road, Nugegoda, Sri Lanka.
E-mail: sandpholdings@gmail.com