INTEGRATED PEST MANAGEMENT PLAN (IPMP)

Climate Smart Agriculture and Water Management Project (CSAWMP)

BANGLADESH WATER DEVELOPMENT BOARD (BWDB) DEPARTMENT OF AGRICULTURAL EXTENSION (DAE)

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ABBREVIATIONS AESA Agro-ecosystem analysis AI Active Ingredient Bangladesh Agricultural University BAU BRRI Bangladesh Rice Research Institute **BWDB** Bangladesh Water Development Board CIG Common Interest Group **CSAWMP** Climate Smart Agricultural Water Management Project Department of Agricultural Extension DAE ECEmulsifiable concentrates EPA FFS Farmer Field School FGDs Focus Group Discussions G Granular GAP Good Agricultural Practice IEE Initial Environmental Examination **IPM** Integrated Pest Management LEA Limited Environmental Assessment LEAFs Local Extension Agent for Fisheries M&EMonitoring, Record-Keeping and Evaluation The National Agricultural Policy NAP NIPMP The National Integrated Pest Management Policy OP **Operating** Procedure **PMPs** Pest Management Plans PPE Personnel Protective Equipment Sub-Assistant Plant Protection Officer **SAPPO** SLSoluble Liquid UAO Upazila Agriculture Officer UFO Upazila Fisheries Officer USAID United States Agency for International Development USD United States Dollar **USEPA** US Environmental Protection Agency WHO World Health Organization WMIP Water Management Improvement Project Water Management Organizations **WMOs** WP Wettable Power

EXECUTIVE SUMMARY

- 1. The Government of Bangladesh is now preparing the Climate Smart Agricultural Water Management Project (CSAWMP) for climate resilient agricultural water management introducing new activities related to on-farm water use efficiency and climate smart irrigation and water management technologies. The proposed project will scale up the pilot reforms program initiated under recently completed WMIP to deepen the participatory scheme management approach and institutionalize within BWDB structure.
- 2. The project is expected to bring positive environmental benefits to the project areas through the introduction and expansion of modern technologies that promotes sustainable practices and applications that can improve current cropping patterns and farming methods, increase efficiency in the management of water resources, protect agriculture soils, and roll out the integrated pest management. The diversification and intensification of agricultural activities under the project could lead to change in the application of pesticides for pest and disease controls. As per the World Bank safeguard policy Pest Management (OP 4.09, this standalone Pest Management Plans (PMP) has been prepared for the project based on Integrated Pest Management (IPM) principles.
- 3. The Project will assist and train farmers to be able to develop their IPM approaches to the management of pests and diseases. This will be holistically approach from seed selection, land preparation, planting and farm maintenance to harvesting and post harvesting issues. Farmers will be trained enough and encouraged to make detailed observations in their fields regularly so that they can detect early infestations and make the appropriate management decisions using agro-ecosystem analysis (AESA).
- 4. The PMP proposes that a detailed assessment of the pest management practices that are currently practicing at farmers level. The results of this assessment are then to be used in the preparation of an action plan to be implemented via the SCPPC focusing on the following actions. The action plan should outline and recommend measures with regard to the following areas.
 - Strengthening pest forecasting
 - Promoting the Agronomic Control
 - Promoting the Physical Control
 - Promoting the Biological Controls and
 - Discouraged or reducing the Chemical Control to rid from pest infestation.
- 5. The general norm of the action plan should be once pest or disease occurs in cultivation areas, agricultural mechanical control measure should be firstly considered, physical and biological measures secondly considered. Chemical drugs shall be lastly adopted only when all other control measures have failed and the pest/disease damage exceeds the economic threshold. When chemical drugs are applied, attention shall be made to select pollution-free drugs to reduce the drug resistance of the pests and avoid pollution to the environment.
- 6. Although farmers are likely using numerous IPM tactics, without really calling them that, IPM philosophy or planning is not generally an active part of crop production in Bangladesh plots; thus, a basic understanding of the steps or elements needed in an IPM program are addressed below:
 - Step 1: Learn and value farmers' indigenous IPM tactics.
 - Step 2: Identify key pests for each target crop
 - Step 3: Evaluate all management options.
 - Step 4: Choose IPM methods, identify Needs and Establish Priorities.
 - Step 5: Do effective activities and training to promote IPM.
 - Step 6: Partner successfully with other IPM implementers.
 - Step 7: Monitor the fields regularly:
 - Step 8: Select an appropriate blend of IPM tools:
 - Step 9: Develop education, training, and demonstration programs for extension workers:
 - Step 10: Monitoring, Record-Keeping and Evaluation (M&E)

1 INTRODUCTION

1.1 Project Background

- 7. The Government of Bangladesh is now preparing the Climate Smart Agricultural Water Management Project (CSAWMP) for climate resilient agricultural water management introducing new activities related to on-farm water use efficiency and climate smart irrigation and water management technologies. The proposed project will scale up the pilot reforms program initiated under recently completed WMIP to deepen the participatory scheme management approach and institutionalize within BWDB structure. The proposed follow on project will also strengthen WMOs formed under WMIP and include lessons from the pilot phase in formation of new WMOs. The project will be implemented by the Bangladesh Water Development Board (BWDB) under the Ministry of Water Resources.
- 8. Introducing climate smart agriculture and aquaculture is one of the components of Climate Smart Agricultural Water Management Project (CSAWMP). This Component includes interventions that promote and facilitate increased agricultural productivity, enhanced resilience (adaptation), and reduced GHG emissions (mitigation), as well as improved market access. The component aims to strengthen institutional capacity and increase farmers' adoption of climate-smart practices in selected rural landscapes associated with specific schemes being rehabilitated under sub-component. In addition, this component will also support capacity building of DAE officials for delivering improved extension serviced that focus on integrated agricultural water management.
- 9. The CSAWMP will include agricultural water management by not only improving irrigation infrastructure, but also introducing activities related to on-farm water use efficiency, as well as climate smart and climate resilient agriculture practices and technologies. The CSAWMP will scale up the participatory reforms initiated under the predecessor project.

1.2 Background of IPM based PMP

10. While the project is expected to bring positive environmental benefits to the project areas through the introduction and expansion of modern technologies that promotes sustainable practices and applications for improvement of current cropping patterns and farming methods, increase efficiency in the management of water resources, protect agriculture soils, and introducing integrated pest management plan. The diversification and intensification of agricultural activities under the project could lead to changes the application of pesticides for pest and disease controls. *As per the World Bank safeguard policy Pest Management (OP 4.09, this standalone Pest Management Plans (PMP) has been prepared for the project based on Integrated Pest Management (IPM) principles.* The PMP describes the relevant national regulatory framework, current status of pest and disease control, monitoring and supervision

mechanism, major experience and problems, and lessons learnt from past projects. It specifies a means of assessing and documenting the range of nonchemical methods used for pest management in the form of IPM across the country, the preparation of a detailed action plan and training and monitoring program to facilitate implementation. A list of all chemicals needed for the project that meet Bank requirements, which also comply with the World Health Organization's recommended categories, have been included in the PMP. The project will not partake in the procurement of pesticides or pesticide application devices.

- 11. The following IPM based Pest Management Plan (PMP) has been prepared in order to address the concerns related to the risks associated with the envisioned possible increase in the use of pesticides that will result from project as a whole and roll out Integrated Pest Management within the project in a strategic manner, while meeting safeguards requirements. IPM is not a single pest control method but rather involves integrating multiple control methods based on site information obtained through, inspection; monitoring; and reports. Consequently, every IPM program is designed based on the pest prevention goals and eradication needs of the situation. Successful IPM programs use this four-tiered implementation approach.
- 12. The development of high yielding varieties has been associated with increased pest infestation requiring increased use of pesticides with all kinds of adverse impacts. Environmental pollution is increasing, soil productivity is declining, beneficial insects are getting wiped out, and water bodies are getting polluted endangering aquatic flora and fauna, the most important of which is the open water fisheries. Among many factors, pollution of water bodies by pesticide wash outs is believed to be a major reason for the decline in fish production in Bangladesh. Many pesticides used in Bangladesh are banned or restricted under international agreements. In addition, several studies have shown that inadequate product labeling and farmers' lack of information have led to widespread overuse of dangerous pesticides. In fact, pesticide brands having adverse impacts have been banned in Bangladesh and these are shown in Appendix 1. In addition, farmers' lack of knowledge about precautions pertaining to handling of pesticides often creates health problems.
- 13. The project investments may increase the use of higher pesticides and other chemical inputs by promoting improved management practices in agriculture and horticulture as well as through increasing crop intensification due to improved access to water resources and area under irrigation. While such improvements on one hand will augment the production and income of the farmers, on the other hand due to its excessive and inappropriate use it would affect the natural resources, environmental services and food systems. In order to protect the environment and its services the project will promote the adoption of Integrated Pest Management approach. As part of the ethical practices, the project will not recommend or use pesticides which are banned, refused registration and restricted in use.

1.3 Objective of the PMP

- 14. The objective of the Pest Management Plan is to promote the use of a combination of environmentally and socially friendly practices (hygienic, cultural, biological or natural control mechanisms and the judicious use of chemicals) and reduce reliance on synthetic chemical pesticides and ensure that health, social and environmental hazards associated with pesticides are minimized under the Project and within acceptable limit requirements of key stakeholders (i.e. primary users among farmers and their immediate dependents/families).
- 15. The specific objectives of the PMP are to:
 - Ensure appropriate pest management techniques in to technologies supported under the Project
 - Effectively monitor pesticide use and pest issues amongst participating farmers
 - Provide for implementation of an IPM action plan in the event that serious pest management issues are encountered, and/or the introduction of technologies is seen to lead to a significant decrease in the application of pesticides
 - Assess the capacity of the country's regulatory framework and institutions to promote and support safe, effective, socially and environmentally sound pest management and to provide for appropriate institutional capacity support recommendations
 - Ensure compliance with regional standards, laws and regulations
 - Ensure compliance with World Bank safeguard policy OP 4.09 and
 - Ensure compliance with USAID requirements on pesticides procedures.

2. REVIEW OF POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORKS

2.1 Bangladesh Laws and Regulations

16. Laws/ Regulations relevant to environmental issues with respect to Pesticide Management in

Bangladesh include-

- National Agriculture Extension Policy 1996 and 2012
- National Agriculture Policy, 1999, 2013 and 2018
- National Integrated Pest Management Policy, 2002
- All these documents contain recommendations for using safer methodologies for utilizing pesticides, including use of IPM methods in one way or the other. The components of the IPM policy include:
- Maintenance of ecological balance,
- Executing appropriate actions on pesticides,
- Operating an effective system for implementing IPM program.
- Developing human resources as the core of IPM
- Conducting research on IPM
- 17. The National Agricultural Policy (NAP), 1999 stipulated that IPM will be the main policy for controlling pest and diseases. The NAP has given importance to the following activities for the pest control.
 - Farmers will be motivated to use more pest resistant varieties of crop
 - Modern cultivation practices will be followed to reduce incidence of pest infestation
 - Use of mechanical control measures such as light trap, hand net etc will be increased and popularized. Biological control measures will be used to destroy harmful insects and preserve the useful ones.
 - Regular training and discussion programs on IPM will be conducted among the farmers under the supervision of Union Agricultural Development Committee for successful introduction and popularization of the method at the farmers' level.
 - Pest surveillance and monitoring system will be strengthened.
 - The Integrated Pest Management Policy advocated, among others
 - Growing a healthy crop through proper management of soil, water, fertilizers, pests, etc.
 - Conservation of biological control agents by avoiding or reducing the use of toxic pesticides
 - Augmentation of biological control agents
 - Use of pest tolerant crop verities
 - Use of cultivation practices that can minimize pest populations

- Mechanical control of pests
- Monitoring of field by the farmer on a regular basis
- Build up farmers as experts in their own fields in taking Pest Management decisions
- Income generated activities such as growing of 'ail' (border) crops, fish culture in the rice field, etc.
- Use of pesticides that are not harmful to the environment as a last resort; The National Integrated Pest Management Policy (NIPMP) includes the following number of specific actions regarding the use of pesticides in addition to some others.
- New proposal for registration of any pesticide will be declined if it falls under WHO class 1A and 1B pesticide compounds.
- Experimental toxicity data on beneficially insects, fish and other aquatic animals in Bangladesh must be taken into consideration before registering any pesticide.
- GOB will provide support and incentives to the private sectors for producing bio-control agents (parasitoids, predators and insect pathogens such as fungi, bacteria and viruses) and botanical pesticides locally.
- GOB will monitor any misleading advertisement toward using pesticides and will initiate appropriate legal actions against such malpractice.

2.2 WHO Classification of Pesticide by Hazard and the Guidelines to Classification, 2009

18. No pesticide of WHO Class-1A category will be used in the CSAWMP Project. Pesticide brands based on the dirty dozen have been banned in Bangladesh and these are attached in the *Annexure-1*. To ensure that none of the banned pesticides will be used in the scheme intentionally, there will be needed for training of farmers on which pesticides are banned as well as proper storage, labeling and application processes. In addition, the sub-projects proponents will be instructed to observe this issue strictly.

2.3 World Bank Pest Management Safeguard Policy (OP 4.09)

- 19. The purposes of OP 4.09 are:
 - To ensure good practices that are applied in World Bank financed projects
 - To avoid excessive use of pesticides
 - To promote environmentally sound and sustainable pest management. Its objectives relevant to the CSAWMP Project include
 - To minimize the environmental and health hazards related to pesticide usage and
 - To ensure that pest management activities follow an Integrated Pest Management (IPM)

Climate Smart Agriculture and Water Management Project(CSAWMP)

approach.

- 20. The overall pest management approach is based on the capacity of the country's regulatory framework and institutions to promote and support safe, effective and environmentally sound pest management. OP 4.09 is triggered in the CSAWMP Project as:
 - The project is expected to introduce new pest management practices or expand or alternate existing pest management practices, and/or
 - The project may lead to substantially increased pesticide use and subsequent environmental and health risks because of the introduction of new crop varieties. In addition, use of pesticides and other agro-chemicals may increase as a result of the enhanced agriculture extension services activities by the DAE including supply of inputs like seeds of improved varieties, fertilizers etc.

3. MAJOR INSECTS PESTS & DISEASES OF MAJOR CROPS, VEGETABLES AND FRUITS AND CONTROLLING METHOD

3.1 Insects and Diseases

21. The major pests and diseases of rice, vegetables and fruits and the current methods and techniques of pest control in use in the CSAWMP schemes is following as

Name of the	Major insect pests	Major Diseases
Vegetables		
Brinjal	 Brinjal Shoot and Fruit Borer, Leaf Hopper, Epilachna Beetle Red Mite 	 Foot and Stem Rot/ Fruit Rot/ Fruit Blight Bacterial Wilt Root Knot Nematode
Tomato	Tomato Fruit BorerWhite fly	Early BlightLate Blight
Country Bean and Yard Long Bean	 Aphids Pod/Fruit Borer	AnthracnoseCommon Bean Mosaic Virus
Cabbage and Cauliflower	Diamond Back MothTobacco CaterpillarCutworm	Black Leaf Spot/Gray Leaf Spot
Radish and Carrot	Cutworm	Bacterial Soft Rot
Cucurbits	 Fruit Fly Red Pumpkin Beetle Tobacco Caterpillar Epilachna Beetle 	 Powdery Mildew Mosaic Virus Fruit Rot Fusarium Wilt Alternaria Blight and Fruit Rot
Okra	Fruit & Shoot BorerWhiteflyLeaf Hopper	Yellow Vein Mosaic Virus
Aroids	Tobacco CaterpillarAphidsMite	Leaf Blight
Green Papaya	Mealy Bug	 Papaya Mosaic & Leaf Curl Virus Damping Off Anthracnose

Table-1: Major Insect Pests and Diseases of Selected Vegetables, Fruits & Rice

> Fruits

1.	Mango	 Mango Hopper Mango Weevil Mango Fruit Fly Leaf Cutting Weevil Mango Thrips Mango Defoliator 	 Powdery Mildew Anthracnose Die-back Leaf Blight Malformation Rust
2.	Litchi	MiteFruit Borer	Leaf BlightDie Back
3.	Guava	Mealy BugFruit FlyWhite Fly	WiltAnthracnoseDie Back

> Rice

N it	<i>Kite</i>		
1.	Rice	Rice Stem Borer	Brown Spot
		• Brown Plant Hopper (BPH)	• Stem Rot/ Sheath Rot
		 White Back Plant Hopper 	• Blast
		(WBPH)	Sheath Blight
		Leaf Folder	Bacterial Leaf Blight (BLB)

During the project period according to changing crooping pattern of relevant scheme cereal (wheat, maize), pulse, oils, vegetables, fruits (dragon fruits) and other suitable high valued crops (cassava) etc. will be introduced at sub project area. Considering those crops major insects, diseases will be identified and managed.

3.2 Controlling Insect of Rice Using IPM

22. The climatic conditions of the country are favorable for sustaining various types of rice hybrids as well as monoculture practice of producing rice after rice encourage insect infestation in rice fields.

Table-2: Major Insect Pests of Rice and their Control Measures Using IPM

Sl.	Name of Insect Pest	Control Measures Using IPM
1.	Stem Borer	 Using tolerant variety Collection of insect's eggs and destruction Collection & killing of moths using light traps Perching for attracting insect-eating birds Delaying pesticide spray to help parasitic (friendly) insect to eat stem borer eggs Burning or mixing the debris and left-over stalk after harvesting the Aman rice Applying approved insecticide when about 5% white spike is observed
2.	Gall Midge	Using light traps to control grown up fliesUsing approved insecticide when 5 percent leaves show 'onion leaf' symptom
3.	Rice Hispa	 Catching insects by hand net or mosquito net & killing Using approved insecticide when 35% leaves are spoilt or four fully grown insects are present in every tillered plant
4.	Insect Leaf Roller	 Using light traps Perching for attracting insect-eating birds Applying approved insecticide when 25% leaves are damaged

Sl. no.	Name of Insect Pest	Control Measures Using IPM
5.	Rice Case worn	 Using light traps Collecting larvae by hand net & killing Removing water from the field & drying the soil Applying approved insecticide when 25% leaves are damaged
6.	Swarming Caterpillar	 Burning the left-over straw or ploughing down with soil after harvesting paddy Controlling the moths by light traps Perching for attracting insect-eating birds Applying approved insecticide when 25% leaves are damaged
7.	Brown Plant Hopper	 Planting rice seedlings at 25x15 or 20x20 cm distance to allow lot of air and light around the plants Using limited/regulated amount of urea, stopping top-dressing of urea in infested field Removing the standing water from the field and keeping dry for a few days if the insect is visible at the base of the plant Using approved insecticide if most of the plants are seen to have four adult female insects, with full belly eggs in each Spraying Abamectin 1.8 EC@ 1 litre/ha if 2-4 adults or 8-10 nymphs are found per plant
8.	White- backed Plant	• Same control measures as are used for Brown plant hopper (sl.7)
9.	Mealy Bug	Pulling up of affected plants & burying under the soilUsing approved insecticide only in the area of infestation
10.	Thrips	 Top dressing of urea after irrigating the seed plot /field Using approved insecticide if attack is severe
11.	Rice Bug	 Using light-traps Applying insecticide when, on average, one rice bug is observed in 2-3 bunches of rice plants It is more effective to apply insecticide in the afternoon
12.	Ear cutting Caterpillar	 Burning out the leftover straw Perching to attract insect-eating birds Irrigating the land few days before harvesting

3.3 Controlling Insects of Vegetables Using IPM

23. All the 19 vegetables grown in the country are infected with 34 species of vegetables. IPM measures for controlling many of these are available now for use.

Sl. No.	Name of Insect	Control Measures Using IPM
> BRIN	IJAL	
1	Shoot and Fruit Borer	 Using resistant varieties like Jhumka, Shingnath, Noyontara etc. Borer infested shoot and destroyed at least once in a week Sex pheromone trap is to be established in the field within 2-3 weeks of planting seeding Using organic pesticide spinosad- 45 EC (4ml/10 litre water) If infestation is very high , approved insecticide is to be sprayed 4-5 times at 10- 12 days interval (Bacillus thuringiensis formulation (1%) at weekly interval)
2	Epilachna Beetle	 Collection and destruction of infested leaf (with egg mass and grab) by hand picking In case of high infection, approved insecticide is to be sprayed at recommended doses Application of ash on the plants
3	Red Mite	 Practicing clean cultivation Applying sulphur group of fungicides (Cumlax, Theovit etc.) Spraying Ebamectin 1.8 EC, 15ml in 10 litre water
4	Leaf Hopper	 Cultivating tolerant variety (BARI brinjal-6) Using yellow sticky trap Cultivating trap crop such as Okra around the field Spraying of 5ml liquid soap in 1 litre water Spraying of neem oil+ Tricks (at 5 ml+ 5ml per litre of water) on the lower surface of the leaves Spraying of Bioneem 0.3EC@ 3 ml/l of water or Phytomax 3 EC@ 2ml/l of water for 3-4 times at 10-12 days interval

 Table-3:
 Major Insect Pests of Vegetables and Their Control Measures Using IPM

> TOMATO

1	Tomato Fruit	• Using sex pheromone traps (115 pheromone traps/ha)
1	Borer	 Using sex pheromone traps (115 pheromone traps/na) Use of perching Destruction of infested fruits Spraying neem seed extract (1 kg broken neem seed soaked in 20 litre of water, sieving the extract before spraying) three times at 10 days interval after flowering starts Use of bio-pesticide i.e. Spinosad -45EC (4ml per 10 liter of water) In case of severe infestation, use systemic insecticide such as imidocloroprid 20SL@ 125ml/ha or phepronil 50EC@ ml/ha. Fruits can not be eaten within two weeks of spraying Spraying bio-pesticide HNPV@ 0.1 g/l of water for 2-3 times at 10-
		12 days interval

	1	
2	White Fly	 Using of resistant varieties Spraying neem seed extract (1 kg broken neem soaked in 20 litre of water, sieving the extract before spraying) Treating seed with insecticides Cover seed beds with fine nylon net Using of yellow sticky trap For severe infestation, spraying Admire 200L (2.5ml/10 litre water)
3	Leaf Miner	 Collection and destruction of infested leaves Using of yellow sticky trap Spraying <i>neem</i> seed extract (1 kg broken <i>neem</i> soaked in 20 litre of water, sieving the extract before spraying) In case of severe infestation using recommended systemic insecticide. Fruits cannot be eaten within two weeks of spraying
> cot	NTRY BEAN AN	ND YARD LONG BEAN
1	Aphids	 Destructing aphids from infested leaves and twigs Using <i>neem</i> solution (1kg broken seed soaked in 20 litre water in 12 hours Spraying insecticide, malathion 57 EC 20 ml/10 litre water
2	Fruit Borer	 Collecting and destroying infested flowers and pods regularly Clean cultivation and destruction of dropped out flowers and pods Spraying of organic pesticide i.e. MNPV (0.2 gm per litre of water, 2-3 times and 10-12 days interval) Spraying of bio-pesticide i.e. Spinosad-45EC (4ml per 10 litre of water) at 2 weeks interval in case of severe infestation

CABBAGE AND CAULI FLOWER (CRUCIFEROUS VEGETABLES)

1	Diamond Back Moth	 Clean cultivation and burning of crop residues followed by ploughing Collection and destruction of egg masses and caterpillar Using trap crop such as mustard cultivation in between rows of cabbage Spray <i>Bacilus thuringiensis</i> formulation (1%) at weekly interval
2	Tobacco Caterpillar	 Collection and destruction of caterpillars at early stage of infestation Use of pheromone traps within 1 week of planting seedlings in the field Use of bio-pesticide SNPV @0.2g/l at 10 to 12 days for 2-3 times Use of neem seed solution (1kg broken seed/20 litre water in 12hrs)
3	Cutworm	 Collection and killing of caterpillar by hand picking in early morning or during night using torch as it is nocturnal pest Irrigation to the field during infestation with very low amount of kerosine oil Perching Use of poison bait (broken rice husk+ gur+ Carbarin insecticide) in infested portion or in a hole In severe infestation, spraying Chloropyriphos 20EC e.g. Dursban or Pyriphus 5 ml/litre near the seedling base during evening

CARROT AND RADISH

	1	Cut worn	 Collection and killing of caterpillar by hand picking in early morning or during night using torch as it is nocturnal pest Irrigation to the field during infestation with very low amount of kerosine oil Perching Use of poison bait (broken rice husk+ gur+ Carbarin insecticide) in infested portion or in a hole In case of sever infestation, spray Chloropyriphos 20 EC viz. Dursban, Pyriphos 5 ml/1 near the base of the seedlings during evening
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CUCURBITS (Bottle gourd, Pointed gourd, White gourd, Sweet gourd, Ridge gourd, Bitter gourd, Teasel, gourd, snake gourd and Cucumber). Most insects of Cucurbits are common. Therefore, names of the insects and their IPM control measures are shown together here.

Sl. No.	Name of Insect	Control Measures Using IPM
1	Fruit fly	 Clean cultivation Collection of infested fruit from plant as well as from the soil and burying it ml/l under soil Covering of young fruit by net or poly bag Joint of use of sex pheromone trap and bait trap (poison bait) In case of severe infestation, spray Carbaryl 50WP@ 3gm/l or Indoxacarb 0.5
2	Red Pumpkin Beetle	 Collecting and destroying the adult insects through hand picking Clean cultivation, keeping the field free from any debris Application of dry ash in plant Destruction of alternative host Covering the plant with net (for 20-25 days) in seedling stage Use any recommended granular insecticide such as Carbofuran 5G 2-5 g/pit followed by watering
3	Tobacco Caterpilla r/ Fruit Borer	 Collecting and destructing of caterpillar during early stage of infestation Use of bio-pesticide SNPV @0.2g/l at 10-12 days for 2-3 times Use of sex pheromone traps from the early stage of the crop In case of severe infestation, use contact poisons belonging to the Cyper methrin group such as Pyrithrin, Cymbush, Basathrin etc @ 10ml/l at 2 weeks interval for 2-3 times
4	Epilachna Beetle	 Application of ash in plant Destruction of egg mass and grub Practicing clean cultivation

> OKRA

1 Fruit & Shoot Borer	 Regular destruction of infested shoot and fruit at least once in a week Clean cultivation Cultivation of alternating host such as cotton should be avoided Use of bio-pesticide i.e. Spinosad-45 (4ml per litre of water) In case of severe infestation using recommended systemic insecticides. Fruits cannot be eaten within 2 weeks of spraying
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2	White Fly	Spraying of neem seed extract (1 kg broken neem seed to socked in 20
		Treating seed with insecticides
		Cover the seed beds with fine nylon net
		Using yellow sticking traps
		Spraying Admire 200 SL (2.5 ml/10 litre of water) in case of severe infestation
		litre of water, sieving the extract before spray)

GREEN PAPAYA

1	Mealy bug	Destruction of insects from infested leaves and twigs
		• Use of <i>neem</i> seed solution (1 kg broken seed per 20 litre water in 12 hours)

3.4 Controlling Insects of Fruits Using IPM

24. Fruits like mango, litchi and guava are attacked with insects but, fortunately, IPM methods for controlling them are available and the farmers are using many of those are shown in the following table:

Table-4: Major Insect Pests of Vegetables and Their Control Measures Using IPM

Sl. No.	Name of Insects	Control Measures Using IPM
> MAN	IGO	
1	Mango Hopper	 Avoiding dense planting, maintaining open canopy; overcrowd and overlapping branches at the end of rainy season Keep orchard clean by regular ploughing and removal of weeds Spraying of 0.2% Nimbicidin or Azadirachtin 3000 ppm@2m/l at initial stage of hopper population Spraying Permethrin 10 EC @ 1 ml/l 10 days before panicle initiation. If hopper population is more than 5-10/ panicle, second (at pea size) should be done Chemical spray is to be minimized and should be need based A rational of insecticide is desirable to counteract the tendency of pest to develop field resistance
2	Mango Weevil	 After harvesting of mango, weed and parasitic plant should be removed Digging of soil in 4m radius of mango plant in January- February` Removing waste and weed under the plant

	Fruit Fly	 Prior to harvest (30-40 days) collecting and destroying off infested and fallen fruits to prevent further, multiplication and carryover of population Ploughing of orchard during November- December for exposing pupae to sun's heat, which kills them Hanging of methyl eugenol wooden block traps soaked in rthanol, methyl eugenol and malathion (6:4:1) during fruiting period from April to August @ 10traps/ha tieing them tightly at 3-5 feet above ground level To control adult flies during severe infestation placing poison bait viz Protein hydrolysate +malathion 50ml+ 200ml molasses in litres of water be sprayed adding an additional 18 liters of water to bait poison. Commencing at preoviposition period and repeating at 15 days interval. Addition of 10ml methyl eugenol in place of molasses is also recommended Three weeks before harvesting, spraying Deltamethrin 2.8EC @ 0.5ml/l+Azadiractin (3000 ppm) or 2ml/l
4	Leaf Cutting Weevil	 Destructing of infested leaves as early as possible to kill the insect at immature stages Covering with net of the newly born leaves in nursery.
5	Mango Defoliator	 Killing of caterpillar with the leaves Collecting and destroying pupal cocoon Pruning Release of lady bird beetle as beneficial insect Spraying with 0.5% soap water and or extraction of neem leaves Avoid excessive use of nitrogenous fertilizer Infested and dropped fruits should be destroyed in the month of March-April Spraying with Spinosad-45 EC or Tracer-0.4ml per litre

> LITCHI

1	Mite	 After harvesting, infested portion should be broken and brunt Painting trunk with coal tar or lime spraying water or shampoo-water in the infested plant
	Fruit Borer	 Cultivation of resistant variety such as China-3 Burning the dropped and dried leaves to kill the caterpillar

≻ GUAVA

1	Mealy Bug	Breaking and destroying infested leaves and twigs
		Destruction of egg masses should be practiced
		• Covering by transparent polythene from the root portion soil to 15-20cm,
		so that mealy bug will not be able to climb

2	White fly	 Spraying of mixture (1kg broken neem seed per 20 litre water and kept in 12 hours) in the backward portion of leaves Using yellow colored sticky traps
3	Fruit fly	 Practicing clean cultivation Collection of dropped as well as infested fruit from plant and burying under soil Covering of young fruit by net or poly bag Use of sex pheromone trap to kill male insect Use of poison bait (ripped fruit of pumpkin-100gm+ Mipcin 0.25gm + 0.5gm Secufon + 100 ml water)

Besides, above all mentioned insects and pest, insects pests related introduced or cultivating crops will be controlled addressing IPM policy.

3.5 Controlling Diseases of Rice Using IPM

25. A good number of IPM measures are now applied for controlling diseases of rice under NATP-1

project and that could be followed by CSAWMP also as follows as

Sl. no.	Name of Disease	Control Measures Using IPM
1.	Rice Tungro	 Using tolerant varieties Burning or burying down the Arali grass Using right trap and hand net
2.	Bacterial Blight	 Using tolerant variety Using balanced fertilizer, urea application in three installments With holding irrigation for 7-8 days for drying the soil and applying 5 Kg potash fertilizer/bigha (0.33 acre)
3.	Sheath Blight	 Collecting floating debris along the borders and burying under soil Using resistant varieties (BR-22,BR-23, BRRI dhan 34 &BRRIdhan 41) Planting seedlings at a space of 25 x 20 or 25 x 15 cm and 3 seedlings together in one place. Burning out the dead plants Using crop rotation Using appropriate dose of urea Using approved fungicide
4.	Blast	 Using tolerant variety (BR-12, 15, 16, 24, BRRIdhan-33) Using seed collected from healthy plants Using balanced fertilizer, seed treatment Using organic manure in the field Keeping standing water in the field It needed, applying approved fungicide at initial stage of infection
5.	Leaf Scald	 Using tolerant variety Using balanced fertilizer and not to apply excessive urea Keeping the land dry for some days when the disease appear Collecting seed from healthy plants If needed using fungicide containing 80% sulphur

6.	Sheath Rot	• Burning out the affected straw
0.	Shoum Rot	Using healthy seed and seed treatment
		• Using tolerant variety (BP 2 BP 3 BP 5 BP 10 BP 16 BP 25 BPPIdban
		26 BRRIdhan-32 BRRIdhan-33)
		 Using balanced fertilizer
		• Keeping the land dry for some days when the disease appears
		If needed, using approved fungicide
7.	Ufra	• Using the tolerant variety, Raida and Bajail, for a few years
		• Burning out the left over straw after harvest of paddy
		 Keeping under control the grass type weeds
		• Using worm/larvae killing agent like Furadan 5G (2.5 kg/bigha) during early stages of the crop.
		• Purifying seedlings by submerging them for one night in water mixed with
		Furadan 5G (15 gm in one litre of water)
		Cutting the top parts of rice leaves at the initial stage of attack
8	Foot rot	Using resistant variety
	& Bakanae	Using disease-free seeds
		• Not using same land for seed bed continuously.
		• Using seed purified by soaking in fungicide mixed water.
		• Using soft seed-bed and keeping it moist all the time.
		• Drying land immediately after disease identification.
		• Throwing the disease affected seedlings.
		• Burning out the disease affected plants.
		• Using different varieties of rice at intervals or using crop rotation
		Using balanced fertilizer.
9	Brown Spot	• Using resistant variety.
		• Using healthy seeds. Hot water (53-54°C) or cold water soaking
		Planting seeds purified by fungicide (Thiram, Captan, Bavistin)
		Keeping seedbed moist
		Using large quantities of organic fertilizer
		Using balanced chemical fertilizer
10	Bacterial	• Using resistant variety.
	Leaf streak	• Killing insects so that leaf is not attacked by bacteria in the spots.
		• Drying the land by removing water.
		Using balanced fertilizer, less amount urea is desirable
11	Seedling	Purifying seed by using Vitabrex or Thirum before sowing
	Blight	• Mixing rice bran with seedbed soil.
		 Avoiding times with excessive cold for sowing seeds in seedbeds
		Keeping seedbed/land under standing water for some days
12	Seedling	Not keeping seedbed under water during germination of seed
	Damping off	Covering seedbed with polythene sheets during cold spells
		Purifying seed before sowing (4 gm Captan / 2 gm Copper oxychloride per kg of seed)
		Not to sow seeds in seedbed during heavy colds.

3.6 Controlling Diseases of Vegetables Using IPM

26. The common 19 vegetables widely infected by 20 d i f f e r e n t t y p e s o f diseases. IPM techniques could be used for controlling these types of diseases as follows as

teeningues could be used for controlling these types of discuses us 101

Table-6: Major Diseases of Vegetables and Their Control Measures Using IPM

Sl. No.	Diseases	Control Measures Using IPM
> BRINJ	AL	
1	Fruit & stem rot/ Fruit rot/ Fruit blight/ Blight & fruit rot	 Avoiding collection of seeds from diseased fruits and using pathogen-free seeds Adopting a crop rotation cycle of three of four years Prompt destruction of infested plant material to reduce initial inoculum Weed control (solanaceous weeds) such as nightshades Using resistance varieties e.g. Jessore local, Kata begun, Isharwardi-1 Mulching and furrow irrigation to reduce infection caused by water and soil splashing Spraying of BAU-Biofungicide (3%) Spraying bavistin @ 2g/l as a protective fungicide
2	Bacterial Wilt	 Removal and destruction of the affected plant parts Using diseases resistant varieties to reduce the diseases incidence Crop rotation with okra, tomato, potato, should be avoided Dipping seeds in asolution of Streptocycline (1g/40 litres of water) for 30 minutes before sowing
3	Root Knot Nematode	 Removal and destruction of weeds hosts and other host plants in and around the field Soil solarisation can control nematodes Leaving the field fallow in the summer after two or three deep ploughings Application of <i>neem</i> cake at 250kg/ha Application of carbofuran 3G @1 kg a.i./ha

TOMATO

1	Early blight/ Alternaria leaf blight	 Seed treatment with tricho-solution or garlic tablet Field sanitation Spraying tricho-solution (3%) at 7 days interval Spraying of Dithane M-45 at 7 days interval
2	Late blight of tomato	 Using diseases free seed Spraying BAU-Biofungicide (3%) Spraying of Mancozeb @ 7 days interval
3	Bacterial wilt	 Using diseases free seeds Use of seedlings from diseases free seed bed Crop rotation with cereals for at least 3 years if field becomes contaminated
4	Leaf curl of tomato caused by virus (transmitted by white fly)	 Growing seedlings under net Using of barrier crops in the field Using yellow sticky traps Uprooting of infested plants and weeds Spraying Dimethoate at 10 days intervals

COUNTRY BEAN AND YARD LONG BEAN

1	Anthracnose	 Seed should be always collected from healthy pods and disease-free area Seeds must be treated with Carbendazim@ 0.25% Field sanitation by burning of crop debris Grow crop on bower system to avoid soil contact Foliar spray of Carbendazim @ 0.1% or Chlorothalonil @0.2% but spray must be started soon after infection
2	Common bean mosaic virus	 Use of diseases free healthy seeds Spray Dimethoate or Admire (0.05%) to control aphids and vectors

CABBAGE AND CAULIFLOWER

1	Black Leaf Spot/ Gray	 Crop rotation, avoiding overhead irrigation Remove and destroy all crop debris immediately after harvest, since this diseases
	Leaf Spot	overwinters on plant residue
		• Hot water treatment of seeds at 50°C for 30 minutes
		Avoid overhead irrigation
		• Seed treatment with BAU-biofungicide (3% of seed weight)
		• Spraying BAU-biofungicide (3%)
		• Use fungicides when necessary. First foliar spraying with Calixin 75EC @0.1% followed by spraying with Mancozeb 0.25% a month interval

CARROT AND RADISH

1	Bacterial soft rot	 Seed treatment with Bavistin/ Captan/ Vitavex (0.4% fo seed weight) Crop rotation Application of Mustard oil cake (250kg/ha)
C1		
SI. No.	Diseases	Control Measures Using IPM

27. Most of the diseases of cucurbits (Bottle Gourd, Pointed Gourd, White Gourd, Sweet Gourd, Ridge Gourd, Bitter Gourd, Teasel Gourd, Snake Gourd and Cucumber) are common and their names and control measures with furnished together as below:

Sl.		
No.	Diseases	Control Measures Using IPM

1	Powdery Mildew	 Avoiding crowded planting of seedlings Maintaining field sanitation Applying wettable sulphur @ 0.2% or dusting finely powdered sulphur to cover the foliage, once or twice during plant growth season Spraying of BAU-Biofungicide (3%) Spraying Thiovit (2g/L) at weekly intervals
2	Mosaic Virus	 Using virus tolerant varieties Destructing diseases host including weeds Spraying insecticide (Metasystox@ 0.1%) to suppress the insects vectors
3	Fruit Rot	 Soil drenching with BAU-Biofungicide (3%) Fruits should be kept away from soil Rotation with non-host crops like pepper, tomato, eggplant Spraying of BAU-Biofungicide (3%)
4	Fusarium	 Planting resistant cultivars is the only reliable way to keep infested field in production Treating seeds with hot water at 55°C for 15 minutes and by drenching soil with Carbendazim Treating seed with BAU-Biofungicide (3% of seed weight) Drenching soil with BAU-Biofungicide (3%)
5	Alternaria Blight & Fruit Rot	 Using of diseases free seeds, clean cultivation and crop rotation are effective controls Spraying 0.25% Indifil M-45 at 10-15 days interval is effective in diseases control
	OVD /	

OKRA

1 Yellow Vein Mosaic or Vein Clearing Disease	 Using of disease free seeds Uprooting and burning the infested plants as soon as they are noticed is the best method to check the spread of this disease Use of tolerant variety like PusaSawani Controlling insect vector by spraying with Dimethoate (Rogor-30EC) or Monocrotopho (Monocil) @ 1 ml/ litre of water
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GREEN PAPAYA

1	Papaya Mosaic & Leaf curl Virus	 Uprooting and destroying the infected plants Regular spraying of insecticides to control aphids and other vectors
2	Damping off	 Seed treatment with BAU-Biofungicide (3% of seed weight) Use of high land and well-drained soil Use of Tricho-compost as soil amendment
3	Anthracnose	 Clean cultivation Applying Mancozeb or Carbendazim (g/litre)

3.7 Controlling Diseases of Fruits Using IPM

28. For the three major fruits of the country are infected by eight major diseases that could lead to loss are highly significant. Previous control measures using pesticides were either ineffective or less effective. On the other hand, the residual chemicals posed lot of health problems for the consumers. IPM measures have decreased these problems considerably. The IPM measures could be applied by CSAWMP as follows as

Sl. No.	Diseases	Control Measures Using IPM
≻ MA	NGO	
1	Powdery Mildew	 Clean cultivation Spraying thiovit @0.2% at 10-15days interval Spray BAU-Biofungicide @3% at 12 days interval
2	Anthracnose	 Clean cultivation (diseased leaves. Twigs and gall midge infected leaves and fruits, should be collected and burnt) Covering the fruits on tree, 15 days prior to harvest with news or brown paper bags Pre-harvest sprays of hexaconazole (0.01%) or Canbendazim (0.1%) at 15 days interval. Last spray should fall 15 days prior to harvest Spraying cupravit @ 0.03% on infected plant at 15 days interval Spray BAU-Biofungicide @3% at 12 days interval
3	Die-back	 Clean cultivation Scion wood selected for propagation should be free from infection Pruning the diseased terminals along with the basal 15-20cm healthy portion and painting cut end Spraying Cupravit @ 0.03% on infected plant at 15 days interval

≻ LITCHI

1	Leaf blight	• Spray gentamycin or kenamycin @ 0.05% at 15 days interval
2	Die-back	• Prune the malformed terminal alongs with the basal 15-20 cm health portion and paint cut end
		• Spray BAU-Biofungucide @ 3% at 12 days interval
		• Spray Curpavit @ 0.03% on infected plant at 15 days interval

GUAVA

1	Wilt	 Wilted trees should be uprooted and burnt Before transplanting, pits need to be treated with formalin and covered for 3 days Apply organic manure, oil cake and lime Spray BAU-Biofungicide @ 3% at 12 days interval
2	Anthracnose	 Spray curpavit @ 0.03% on infected plant at 15 days interval Spray BAU-Biofungucide @ 3% at 12 days interval
3	Die-back	 Avoid alkaline soil for orchard Prune the malformed terminal alongs with the basal 15-20cm health portion and paint cut end with any fungicide Spray curpavit @ 0.03% on infected plant at 15 days interval Spray BAU-Biofungucide @ 3% at 12 days interval

Besides, above all mentioned diseases, diseases related introduced or cultivating crops in sub project areas will be controlled addressing IPM policy.

4. POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

4.1 Potential Impacts

- 29. The use of various agro-chemicals especially pesticides would have substantial impacts on the environment during the implementation stage of the CSAWMP irrigation and storage interventions. The major impacts are
 - Health problems &
 - Environmental hazards

> Health Problems

- 30. There are acute and chronic health effects may manifest as local or systemic effects. They include
 - skin irritations, such as itching, rashes, blisters, burns, wounds etc.
 - irritation of throat leading to cough or difficulty in breathing with or without wheezing or choking etc.
 - chest pain, burning mouth and throat with pain on swallowing etc.
 - runny nose, sore throat, head ache, dizziness, sudden collapse with or without unconsciousness.
 - eye irritation, blurred vision, lots of tears or saliva or mucus secretion and sweating, nausea, vomiting, chest infections due to aspiration of vomits, fever, abdominal pain or discomfort, diarrhea, uncontrolled urination and defecation, slowing of heart beat or rapid heartbeat, weakness including muscles for breathing, muscle twitching or pains, tremors, convulsion, coma, hallucinations, pain and numbness in legs, allergic reactions.
 - Others are problems with liver, kidney, or nerves functions, improper functioning of the heart etc.

Environmental Hazards

31. The major environmental hazards lead by pesticides effects are as follows

- Contamination of drinking water and ground water
- Soil contamination
- Wildlife and domestic animals can be killed by spray drift or drinking contaminated water
- Exposure may also cause infertility and behavioral disruption
- Destroy or disrupts the food chain
- Loss of biodiversity and agricultural environments
- Reduce the plant resistance etc.

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4.2 Possible Mitigation Measures

4.2.1 Field Demonstrations

- 32. Field demonstrations are the practical way of convincing farmers on IPM practices, establishment of a Farmer Field School (FFS). FSSs can actually show farmers the successful crop yields that can be expected by IPM implementation and demonstrate user friendly mechanisms. This will assist in changing set mindsets and educate farmers on the programs, driving them to implement them as well.
- 33. The pesticide management measures that will be promoted in the project include: (1) Reduce pesticide application amount through project activities, (2) Forbid using unregistered pesticide in project activities, (3)Forbid using the type I pesticide of the World Health Organization in project activities, and (4) Promote IPM techniques.
- 34. The strategies to be followed for implementation of PMP are as follows:
 - Assessment ,monitoring and reporting
 - Training or capacity building
 - Awareness building

4.2.2 Awareness Creation

- 35. Awareness creation on the ill effects of pesticides will be conducted to the targeting communities. The programs will include along with project beneficiaries, various stakeholders residing in the project area, including the community, government officers, project staff and local politicians. Awareness materials would be but not limited, posters, flyers, brochures, etc. These will be made available via the Agriculture extension offices. The following materials would be covered as
 - Integrated Crop Management
 - Integrated diseases management
 - Integrated weed management
 - Health issues of pesticide application
 - Safe use of agrochemicals
 - Steps in integrated pest management

4.2.3 Building technical capacity via training

- 36. Training of beneficiaries and relevant stakeholders on IPM based pesticide management and safe use of pesticides will be conducted with the following areas as
 - Detrimental effects of pesticide use to human health/environment

- Decision making in use pesticides
- Transport, storage ,handling and distribution of pesticides
- Safe application of pesticides
- Risks on handling and use of pesticides
- Managing risks and pesticide poisoning via green mechanisms
- Intergraded Pest Management
- 37. Training programs will first be conducted among the project beneficiaries, successful applicants of the MGP, project/field staff and will also target local DOA officers, stationed in the project area. It is proposed that this program be conducted by reputed pest management specialists with experience working in Sri Lanka. This will thus provide the existing project staff with the capacity to conduct training programs in the field. Training material will be prepared comprehensively and cover the key areas highlighted prior, fashioned as a guidance book for long term use and support post training.

No	Area	Indicators
1.0	Training and awareness creation	 Types and number of participatory learning modules (PLM) delivered; Category and number of extension agents and farmers trained and reached with each PLM; Category and number of participants reached beyond baseline figures; Practical skills/techniques most frequently demanded by extension agents and farmers; and Crop management practices preferred by farmers.
2.0	Technology acceptance/ application field	 Category and number of farmers who correctly apply the skills they had learnt; New management practices adopted most by farmers; Category and number of other farmers trained by project trained farmers; Types of farmer-innovations implemented; Level of pest damage and losses; Rate of adoption of IPM practices; Impact of the adoption of IPM on production performance of farmers
3.0	Project benefits direct	 Increase in crop production; Increase in farm revenue; Low incidence of pests and diseases Social benefits: e.g., improvement in the health status of farmers; Level of reduction of pesticide purchase and use; and Number of project co families using preventive mechanisms against diseases.

Table-8: Training plan for execution of IPM based Pest Management Plan

4.2.4 Safer Use Actions/Mitigation

- 38. Where a project has direct control over pesticide use, assure the following. Where a project is supporting or recommending pesticide use but has less than complete control, take all practicable measures to assure the following:
 - Hydrology. Do not spray or rinse pesticide equipment in or within 30 meters of ponds, irrigation and drainage ditches, and other surface waters.
 Do not spray pesticides with high toxicities to aquatic organisms before an impending rainstorm, as they can be washed into waterways before breaking down.
 - Soils: Do not use or recommend for use herbicides or other pesticides with high leaching and groundwater pollution potential near drinking water sources, on highly sandy soils or soils with water tables close (2-3 meters) to the surface.
 - Soils: Since transport of soil particles with pesticides adsorbed to them is a likely transportation route to waterways, employ techniques to reduce farm soil erosion whenever erosion is likely. Such techniques include vegetated buffer strips, green manure, mulching, terracing, employing wind breaks, employing ground covers between rows, planting rows perpendicular to the slope, using drip irrigation, and so on).

4.2.5 Safer use Plan

39. As appropriate, the C S A W M P will promote low-risk preventive and natural chemical pest controls that are attached in the *Annexure-3* and incorporating these controls in the pest management plans (PMPs) developed under this CSAWMP.

4.2.6 Personal Protection

- Design of personal protective equipment, dresses, other utensils should be collected from the IPM projects of DAE by CSAWMP personnel and:
- The retailers of pesticides should be invited to discussion meetings and the protective equipment and dresses should be demonstrated in their shops.
- Pamphlets should be printed by CSAWMP and given to the shopkeepers for distribution by them among the farmers coming to buy pesticides.



5. Institutional Arrangement, Monitoring and Reporting and Budget

- 40. The CSAWMP financed crop demonstrations by WMG farmers from FFS (Farmer Field School) will be carefully assessed and monitored with a purpose to improve the quality of the CSAWMP crop production activities and enhance overall environmental sustainability. Crop development Component will monitor safe use of pesticides and implementation of proposed Integrated Pest Management Plan for cereal crops, pulse crops, oil crops, vegetables crops and differentfruits etc.
- 41. The CSAWMP uses Limited Environmental Assessment (LEA) form for selection of WMG farmers for crop demonstrations, it will make an effort to learn whether the selected farmer is currently using any hazardous pesticides impacting human and environmental health or the current use of pesticide is unsafe or overdosed. Based on that, during the assessment period, an Environmental Management Plan (EMP) indicating application of IPM will be suggested for crop WMG farmers.

42. The Project Management Unit of CSAWMP under WDB part will recruit an Environmental Safeguard Specialist/Climate Change and Adaptation Specialist who would ensure implementation of pest management plan. The Environmental Specialist on the quarterly visits the selected demonstration sites to observe the application of IPM measures. At the field, IPM and pesticides application management will be monitored by the SAAOs, SAPPOs. The Upazila Agriculture Officer (UAO) will will act as the local Authority to review the monitoring program of PMP. The Upazila Fisheries Officer (UFO) will be assisting the UAO in organizing the monitoring activities.

5.1 Monitoring Schedules and Participants

- Implementation of IPM by the farmers of FFS as well as WMGs to be monitored by the SAAOs and SAPPOs once in a crop season.
- Half Yearly Review and Planning Workshop, lasting two days to review progress of implementation of FFS & WMG activities of last six months and planning for WMG activities in the next season. The SAAOs and LEAFs will be participated in the workshop and given the opportunity to discuss any problems encountered during the implementation of the CIG activities.
- Leaders of WMG will be participated for reporting achievements, difficulties, shortcomings on the part of SAAOs, SAPPOs and LEAFs and further opportunities for improvement.
- All these issues and challenges will or may arise with the implementation of the

Project. Appropriate mitigation measures and implementation tools as well as monitoring indicators are therefore required to be instituted to contain any adverse occurrence. The key actors to be involved in the implementation of the mitigation and management need to be identified as well.

5.2 Institutional Arrangement

- 43. The DAE will form a Safeguard Team to oversee and ensure that the project complies with relevant safeguard policy documents prepared for the Project including this PMP and report to PCU.
- 44. The CSAWMP Project coordinators or PIU will communicate the content of the Pest Management Plan to all upstream project actors or participants such as the DAE at the national and relevant regional levels (i.e. within project beneficiary regions). It will establish on-going communication with both the national and relevant regional level pest and pesticide management representatives.
- 45. The CSAWMP will also organize an orientation workshop on IPM techniques as well as the PMP for relevant primary communities, which will in fact be at the forefront in terms of use of pesticides and are likely to be exposed to its various and gradual risks.
- 46. The PMP implementers will coordinate the pest management process with all relevant water resource regulators/users and other major land users in the project areas. Any activities that may have an impact on pest management will be identified and included in the pest management planning process. Contacts will be established with significant neighboring land owners and consult with them when appropriate and co-ordinate management activities with representatives of the identified government agencies and other land users when appropriate.
- 47. The purpose of the capacity building of farmers in particular is to help farmers develop their IPM approaches to the management of pests and diseases under the Project. The success of IPM depends largely on developing and sustaining institutional and human capacity to facilitate informed decision making by farmers and farm assistants, and empowering them to integrate scientific and traditional knowledge to solve location-specific problems, and respond to market opportunities. Poor communication between farmers/farm assistants, extension agents and researchers has often led to poorly-targeted research or to poor adoption of promising options generated by research. The full benefits of investments in agricultural research thereby remain untapped under these circumstances.

5.2.1 Dissemination Information About Pest Arrival

48. Arrangements should be made to disseminate information on pests that pose a threat to crops and public health especially at the beginning of the season. Additionally, information on

control programs already in operation should also be made public in appropriate manner.

49. The DAE (Regional/District/Upazila Officers) will collaborate with the FFS farmers of WMGs to identify and organize farmers groups for training (i.e. use of farmer field school to teach farmers on the efficient and responsible use of pesticides); prepare, organize and supervise training implementation plan; verify reports of persisting pest problems and farmers training needs; monitor performance of farmer trainers and post-training assignments; and prepare training progress reports.

5.3 MPLEMENTATION BUDGET

50. A budget estimate of USD is required to implement the PMP during a 3- year period, and this will be an annual estimated cost of USD and Details are provided in the table below. At the time of the preparation of this document the budget breakdown of items were not available from DAE. This information will be updated when the budget component breakdown for the IPMP is available from DAE.

	Activity/Programme		I	Budget, U	SD	
		Year 1	Year 2	Year 3	Total	Cost/yr
1.0	Capacity Building					
1.1	Orientation workshops (on PMP, IPM, and					
1.2	Training of trainers					
1.3	Farmer group training					
1.4	Study visits					
	Sub total					
2.0	Support/Advisory services					
2.1	Registration of pesticide suppliers					
2.2	IPM problem diagnosis					
2.3	Field guides/ IPM materials					
2.4	Public awareness/ sensitization					
2.5	Pest/ vector surveillance					
2.6	Laboratory analysis support-MRLs					
2.7	Emergency response support					
	Sub total					
3.0	Environmental management					
3.1	Pesticide monitoring in surface water					
3.2	Equipment, bed nets, chemicals					
3.4	Support to IPM R&D					
	Sub total					
4.0	Project management					
4.1	PMP coordination					
4.2	Monitoring and evaluation					

Climate Smart Agriculture and Water Management Project(CSAWMP)

4.3	Reviews and reporting			
	Sub total			
	GRAND TOTAL/USD			

Source: Consultant's estimate

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Annexure-1: Possible Impacts and Mitigation Measures under IPM based Pest Management Plan

Impact issue / Pest & pesticide threat/	Mitigation Measures	Implementation tool	Expected result	Monitoring indicators	Responsibility/ Key
Pollution of water resources and aquatic life	Control and supervise pesticide use by farmers	Adoption of IPM approaches/ techniques	Farmers trained in IPM techniques	Number of farmers trained, Training records	DAE
	Proper disposal of pesticide containers by resellers/farmers	Pesticide container collection and disposal plan	Pesticide container disposal plan developed and implemented	Number of farmers/ resellers aware of pesticide container disposal plan	DAE & DoF
	Monitor pesticides in water resources	Environmental quality monitoring plan (linkage with Project ESMP)	Pesticide concentration in water resources	Levels of pesticides in water resources	DoF
Public health concerns from water-borne or water related diseases in project areas under irrigation	Design appropriate irrigation systems and ensure functional operation system (removing aquatic vegetation, lining canals with cement or plastic, regularly fluctuating water levels, periodic rapid drying of irrigation canals)	 Adoption of environmentally friendly irrigation system designs Selection of experienced and proven contractors and consultants for project designs and construction Effective operational maintenance system 	Well-functioning and environmentally friendly irrigation system;	Number of times system breakdown in a given year	Department of health

Improper use of pesticides by farmers and farm assistants	Educate farmers and farm assistants on proper use of pesticides and pesticide use hazards	Pesticide hazards and use guide manual or leaflet for the project (include simple pictorial presentations)	Proper use of pesticides by farmers and farm assistants	Number of cases of pesticide poisoning occurring under the project	DAE, Pesticide companies
	Control and supervise pesticide use on farms	Adoption of IPM approaches/ techniques	Farmers trained in IPM techniques	Number of farmers trained, Training records	DAE
	Monitor pesticide residue in crops	Random sampling procedure for crops and storage products	Pesticide residue in crops within acceptable limit/MRL	 Levels and trend of pesticide residue in sampled crops Number of times exported crops are rejected due to pesticide residues 	DAE ,SRDI

Government of Bangladesh

Poisoning	from	Educate farmers, farm	Pesticide hazards and use	Farmers, farm	Number of cases of	DAE,
improper	disposal	assistants and local	guide manual or leaflet for	assistants, FBOs,	pesticide poisoning	Department of
of	pesticide	communities on	the project	local communities	through use of pesticide	health
containers		health hazards		educated on	containers; Number of	
		associated with use of		pesticide health	farmers returning empty	
		pesticide containers		hazards	pesticide containers at	
		Properly dispose	Pesticide container	Pesticide container	collection points; Number	DAE,
		pesticide containers	cleaning and disposal plan	cleaning and	of farmers, retailers	Department of
				disposal plan	trained in proper cleaning	health
				developed and	of pesticide containers	
				implemented	-	

Threat crop	Educated farmers to	Adoption of approaches	Farmers trained in	• Number of farmers	DAE
	a gri cultural (CAD)	IDM to sha i succes and a succes	IDM to sha swaa su 1	turing d Training reasons	DAL
diseases	agricultural (GAP)	IPM techniques/ approaches	IPM techniques and	trained, Training records	
from pests	and train adopt		GAP	• Incidence of crop	
other and	good practices			pests	
				Production losses	
				from crop pests	
	Apply EPA approved	Inspection of pesticides at	Applied pesticides	Records of pesticides	DAE
	and PPRSD	farm/storage gate prior to	registered and	applied at each farm	
	recommended	use (Project Policy)	approved by key		
	pesticide if necessary		stakeholders and in		
	1 5		conformity with		
			IPM		
Impact on post-	1. Provide adequate	Post-harvest loss reduction	• Post- harvest	Number of farmers trained	DAE
harvest losses due	and proper storage	plan based on IPM	losses avoided or	in IPM techniques for	
to pests	facilities	techniques in place	minimized	post-harvest storage;	
			• Applied	Number and condition of	
			pesticides	storage	
			registered and	facilities in use	
			approved by key		
			stakeholders and		
			in conformity		
	Monitor incidence of			Number of cases of post-	DAE
	post-harvest pests			harvest pests	
	Confirm status	Inspection of pesticides at	1	Records of pesticides	DAE
	and integrity of	farm /storage gate prior		applied at storage sites/	
	pesticides at	to use (Project Policy)		rooms	
	storage gate prior to				
	use				

Abuses in pesticide supply and sales	Identify all pesticide distributors and resellers interested in providing services and products to farmers under the Project	Registration policy for all interested distributors and resellers under project	Only approved and licensed dealers and resellers supply pesticides under project	 Company registration documents Evidence of license/permit to operate in pesticides Evidence of location and contacts of suppliers/resellers 	DAE
	Confirm status and integrity of pesticides supplied under project	 All pesticides are to be in the original well labeled pesticide containers prior to use No decanting of pesticides under this project Inspection of pesticides at farm gate prior to use 	 Only approved and registered pesticides used under project Banned pesticides avoided Fake and expired pesticides avoided Integrity of pesticide guaranteed at farm gate level 	 List of pesticides supplied and used in line with EPA and USE list of registered and approved pesticides Cases of pesticides found in non-original containers inspection records for pesticides at farm gate prior to use 	DAE, Upazila Administration
	Ban big pesticide containers to minimize decanting cases	Decanting policy (No decanting of pesticides under project)	All pesticides delivered for use are in the original containers	Cases of pesticides found in non-original containers	DAE

General health	Educate farmers to	IPM techniques with	Compliance with	Number of farmers	DAE
safety farmers/	adopt GAP based	emphasis on cultural and	national IPM policy	trained in IPM	
crops	upon IPM techniques;	biological forms of pest	and WB policy on	techniques; Number of	
environmental	and do not use	control	Pest/ pesticide	farmers implementing	
hazards	chemical pesticides		management	IPM on their farms	
	unless advised by DAE			Frequency of chemical pesticides usage	
	Provide PPEs to	Health and safety policy for	Farmers and	PPEs supplied or made	DAE, Health
	farmers/farm	farm workers	accompanying	available under the project	department,
	assistants for		dependents(children		Upazila Administration
	pesticide use in the) protected against		Administration
	fields		pesticide exposure		
			in the fields		
	Educate farmers/	Pesticide hazards and use	Farmers know and	Number of farmers trained	DAE
	farm assistants in the	guide manual or leaflet for	use pesticides	in pesticide use; Number	
	proper use of	the project (include simple	properly; pesticide	of farmers having copies	
	pesticides	pictorial presentations)	hazards and use	of the pesticide hazard and	
			guide leaflet or	use	
			flyers produced	guide flyers;	
	Properly dispose	Obsolete and unused	Obsolete and	Relationship between	DAE, Upazila
	obsolete and unused	pesticide disposal plan	unused pesticide	pesticide supply and usage	administration
	pesticides		disposal plan		
			prepared and		
			implemented		

Educate farmers to	Pesticide use policy/plan	Only pesticides	Relationship between	DAE
obtain or purchase		needed are	pesticide supply and usage	
quantities of		purchased; long		
pesticides required at		term storage of		
a given time and to		pesticides by		
avoid long term		farmers avoided		
storage of pesticid				
Provide emergency	Emergency response plan	Pesticide accidents	Number of pesticide	DAE, Health
response to pesticide		and emergencies	accidents and	department
accidents and		managed	emergencies	
poisoning		under the project		

Annexure-2: List of Banned Pesticide in Bangladesh

SL	SL	Т
30	30	v
31	31	B
32	32	D D
32	32	
24	24	Б
25	25	
35	35	A
36	36	Q
37	37	T
38	38	R
39	39	В
40	40	А
41	41	K
42	42	С
43	43	А
44	44	Т
45	45	M
46	46	P
47	47	U
48	48	F
49	49	S
50	50	Н
51	51	P
52	52	N
53	53	N
54	54	А
55	55	D
56	56	G
57	57	С
58	58	С
SL	SL	т
_		57 58 SL

SL	Trade name of Products	Registration	Name of Company
		Number	
30	Vapona	AP-79	Shell Company of Bangladesh Limited
31	Bidrin 85 WSC	AP-80	Shell Company of Bangladesh Limited
32	Dieldrin 50 WP	AP-82	Shell Company of Bangladesh Limited
33	Dieldrin 40 WP	AP-83	Shell Company of Bangladesh Limited
34	Furadan 3G	AP-85	FMC International S.A.
35	Actellic 2% Dust	AP-99	Bangladesh Manufacturers Limited
36	Quickphos	AP-102	Agrani Traders
37	Torque 550g/I	AP-115	International Services (BD) Limited
38	Ridan 3G	AP-131	Rupali Sangstha Limited
39	Bkzne 14G	AP-135	B. K. Traders
40	Aerocypermethrin 10 EC	AP-137	Liza Enterprise Limited
41	Karmex	AP-145	Beximco Agrochemicals Limited
42	Carbaryl 85 WP	AP-147	Shetu Corporation Limited
43	Agridan 3G	AP-154	Shetu Pesticides Limited
44	Tecto 2% Dust	AP-157	Alco Pharma Limited
45	Manex-II	AP-163	Shetu Corporation Limited
46	Phytox MZ 80	AP-164	Liza Enterprise Limited
47	Uniflow TM Sulphur	AP-167	Shetu Corporation Limited
48	Fenkil 20 EC	AP-169	Agrani Traders
49	Sunfuran 3G	AP-171	Shetu Corporation Limited
50	Hekthion 57 EC	AP-178	Farm Chemical Corporation Limited
51	Poligor 40 EC	AP-180	Farm Chemical Corporation Limited
52	Melbromid 98	AP-185	Horizon Trade Limited
53	Mebrom	AP-186	Bengal Wings Trade Limited
54	Agrine 85 WP	AP-187	Edgro (Private) Limited
55	Drawizon 60 EC	AP-190	Keeco Pesticides Limited
56	Gastoxin	AP-195	Bright Corporation
57	Cekomethrin 10 EC	AP-219	Premier Traders
58	Cythrin	AP-220	Bari & Company Limited
SL	Trade name of Products	Registration	Name of Company

59	Cekuthoate 40 EC	AP-225	Premier Traders	8	88	Vitacron 40 SL
60	Arifos 20 EC	AP-229	Bari & Company Limited	8	39	Monotaf 40 WSC
61	Malathion 57 EC	AP-230	Sabrina Trading Corporation		90	Tamaron 40 SL
62	Cardan 5G	AP-234	Bari & Company Limited		91	Folithion 50 EC
63	Diazinon 14G	AP-236	Liza Enterprise Limited		92	Macuprax 65%
64	Rizinon 60 EC	AP-239	Bari & Company Limited		93	Zithiol 57 EC
65	Zincphosphide	AP-258	Liza Enterprise Limited		94	Delapon Na-84
66	Davison Glyphosate	AP-266	Shete Pesticides Limited		95	Anthio 25 EC
67	Morestan 25 WP	AP-269	Beximco Agrochemicals Limited		96	Zolone 35 EC
68	Manzate 200	AP-301	Auto Equipment Limited		97	Rentokill CC Type
69	Dimecron 100 SL	AP-	Novartis (Bangladesh) Limited		98	Paramount CC Typ
70	Pillarcron 100 SL	AP-148	Shetu Pesticides Limited		99	Darsban 20 EC
71	Benicron 100 WSC	AP-06	Sabrina Trading Corporation		100	Darsban 20 EC
72	DDVP 100 W/V	AP-03	ACI Formulations Limited		L01	Basudin 10G
73	Chemo DDVP 100 EC	AP-245	Chemsfil Bangladesh Limited		L02	Diazinon 60 EC
74	DDVP 100 EC	AP-151	McDonald Bangladesh (Pvt) Limited		L03	Mortin King Mosqu
75	Nogos 100 EC	AP-	Novartis (Bangladesh) Limited		L04	Mortin Mosquito C
76	Phosvit 100 EC	AP-56	Data Enterprises Limited		L05	Sarfium 56%
77	Daman 100 EC	AP-325	Petrochem (Bangladesh) Limited		106	Sicofen 20 EC
78	Azodrin 40 WSC	AP-336	BASF Bangladesh Limited		L07	Cythrine 10 EC
79	Nuvacron 40 SL	AP-	Novartis (Bangladesh) Limited		108	Diazonyl T-60
80	Megaphos 40 SL	AP-175	McDonald Bangladesh (Pvt) Limited		109	Salmathion 57 EC
81	Phoskil 40 SL	AP-339	United Phosphorus (Bangladesh) Ltd		110	Basamid Granular
82	Kadette 40 WSC	AP-284	Bisco Pesticide & Chemical		111	Ducord 17 EC
83	Monophos 40 WSC	AP-328	Alpha Agro Limited		12	Argold 10 EC
84	Monodrin 40 WSC	AP-07	Sabrina Trading Corporation		L13	Dicofol 18.5 EC
85	Corophos 40 SL	AP-342	Corbel International Limited		114	Carbaryl 85 WP
86	Luphos 40 SL	AP-388	ACI Formulations Limited		L15	Amitage 20 EC
87	Amcodrin 40 SL	AP-340	Atherton Imbros Company Limited		16	Neoron 500 EC
117	Anvil 5 SC	AP-472	Syngenta Bangladesh Limited	1	60	Crack down
118	Ridomil Gold MZ 68 WG	AP-377	Syngenta Bangladesh Limited	1	61	Resigen 50 E
19	Folio Gold 440 SC	AP-1133	Syngenta Bangladesh Limited	1	62	Resigned OS
20	Dolma 5G	AP-1226	Syngenta Bangladesh Limited	1	63	Bilshot M 46.5 EC
121	Sonnet 50 SP	AP-1488	Syngenta Bangladesh Limited	1	64	Pharzeb 80 WP
122	Basudin 10GR	AP-532	Syngenta Bangladesh Limited	1	65	Phartap 50 SP

	-		
88	Vitacron 40 SL	AP-341	Shetu Marketing Company
89	Monotaf 40 WSC	AP-331	Auto Equipment Limited
90	Tamaron 40 SL	AP-188	Haychem (Bangladesh) Limited
91	Folithion 50 EC	AP-32	Haychem (Bangladesh) Limited
92	Macuprax 65%	AP-65	Bayer CropScience Limited
93	Zithiol 57 EC	AP-126	Rhone Poulenc Bangladesh
94	Delapon Na-84	AP-66	Rhone Poulenc Bangladesh
95	Anthio 25 EC	AP-64	Rhone Poulenc Bangladesh
96	Zolone 35 EC	AP-67	Rhone Poulenc Bangladesh
97	Rentokill CC Type 75%	AP-221	Getco Limited
98	Paramount CC Type	AP-300	BD Associate and Company
99	Darsban 20 EC	PHP-5	Auto Equipment Limited
100	Darshan 20 EC	PHP-85	Auto Equipment Limited
101	Basudin 10G	AP-23	Syngenta Bangladesh Limited
102	Diazinon 60 FC	AP-25	Syngenta Bangladesh Limited
103	Martin King Magauita	PHP-54	Backitt Banckiser Bangladesh Limited
104	Mortin Masquita Cail		Pagkitt Benckiser Bangladesh Limited
105	Saufium 569/	A D 680	Son Trado Eastilizon Limited
105	Signafor 20 EC	AF-089	Sar Trade Fertilizer Limited
100	Sicoren 20 EC	AP-624	Genetica
107	Cythrine 10 EC	AP-310	ACI Formulations Limited
108	Diazonyl T-60	AP-283	ACI Formulations Limited
109	Salmathion 57 EC	AP-1066	Agrimax Bangladesh Limited
110	Basamid Granular	AP-205	BASF Bangladesh Limited
111	Ducord 17 EC	AP-793	BASF Bangladesh Limited
112	Argold 10 EC	AP-409	BASF Bangladesh Limited
113	Dicofol 18.5 EC	AP-359	McDonald Bangladesh (Pvt) Limited
114	Carbaryl 85 WP	AP-150	McDonald Bangladesh (Pvt) Limited
115	Amitage 20 EC	AP-476	McDonald Bangladesh (Pvt) Limited
116	Neoron 500 EC	AP-551	Syngenta Bangladesh Limited
160	Crack down	PHP-193	Bayer CropScience Limited
161	Resigen 50 E	PHP-194	Bayer CropScience Limited
162	Resigned OS	PHP-196	Bayer CropScience Limited
163	Bilshot M 46.5 EC	AP-586	Pharma & Farm
164	Pharzeb 80 WP	AP-784	Pharma & Farm
165	Phartap 50 SP	AP-605	Pharma & Farm

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123	Ricon 60 EC	AP-533	Syngenta Bangladesh Limited	1	166	Cypercid 10 EC	AP-523	Pharma & Farm
124	Paprika 50 EC	AP-1250	Syngenta Bangladesh Limited	1	167	Glyphar 41 SL	AP-896	Pharma & Farm
125	Touchdown	AP-404	Syngenta Bangladesh Limited	1	168	Topsin M 70 WP	AP-193	Data Enterprises Limited
126	Touchdown HiTech 500SL	AP-873	Syngenta Bangladesh Limited	1	169	Homai 80 WP	AP-179	Data Enterprises Limited
127	Dual Gold 960 EC	AP-1111	Syngenta Bangladesh Limited	1	170	Padan 50 SP	AP-555	Data Enterprises Limited
128	Lintur 70 WG	AP-633	Syngenta Bangladesh Limited	1	171	Diazinon 14G	AP-554	Data Enterprises Limited
129	Koranda	AP-794	Auto Crop Care Limited	1	172	Diazinon 60 EC	AP-557	Data Enterprises Limited
130	Seda 50 SP	AP-420	Auto Crop Care Limited	1	173	Diazinon 90 ULVC	AP-560	Data Enterprises Limited
131	Lorsban 15G	AP-371	Auto Crop Care Limited	1	174	Trebon 10 EC	AP-161	Data Enterprises Limited
132	Autoguard 25 EC	AP-1147	Auto Crop Care Limited	1	75	Bassa 50 EC	AP-142	Data Enterprises Limited
133	Focus 50 SC	ΔP-828	Auto Crop Care Limited	1	176	Elsan 50 EC	AP-556	Data Enterprises Limited
134	Alert 50 EC	AP 648	Auto Crop Care Limited	1	177	Elsan 90 EC	AP 558	Data Enterprises Limited
125	Quinquard 25 EC	AR 1106	Auto Crop Care Limited	1	179	Vitevex 200P	AP 550	Bionger Equipment & Chemical Co
130	Quiliguard 23 EC	AP-1100	Auto Crop Care Limited	1	170	President 20 EC	AP-339	Pioneer Equipment & Chennical Co.
130	Fendor 5G	AP-2/9		1	179	Pyriban 20 EC	AP-581	Agro Development Services Co. (Pvt) Ltd
137	Edten 50 EC	AP-191	Sea Trade Fertilizer Limited	1	180	Aimal 57 EC	AP-1136	Agro Development Services Co. (Pvt) Ltd
138	Malatox 57 EC	AP-286	Sea Trade Fertilizer Limited	1	81	Asset	AP-364	Agrodev United
139	Edthoate 50 EC	AP-307	Sea Trade Fertilizer Limited	1	182	Padan 4 G	AP-372	Krishi Kallyan Limited
140	Metasystox R 25 EC	AP-493	United Phosphorus (Bangladesh) Ltd	1	183	Diazinon 10GR	AP-385	Krishi Kallyan Limited
141	Sumithion 3% Dust	AP-156	Shetu Corporation Limited		184	Limithion 57 EC	AP-264	ACI Formulations Limited
142	Sumibas 75 EC	AP-255	Shetu Corporation Limited		185	Knockout Liquid Insect Sprya	PHP-28	Shetu Pesticides Limited
143	Arozin 30 EC	AP-383	Bayer CropScience Limited		186	Victor 1G	PHP-340	Shetu Pesticides Limited
144	Basta SL 15	AP-265	Bayer CropScience Limited		187	Night Queen Mosquito Coil	PHP-46	Shetu Pesticides Limited
145	Baycarb EC 500	AP-488	Bayer CropScience Limited		188	Sovathion 50 EC	AP-240	Shetu Pesticides Limited
146	Curaterr 5G	AP-490	Bayer CropScience Limited		189	Pillartex 50 EC	AP-414	Shetu Pesticides Limited
147	Cupravit 50 WP	AP-489	Bayer CropScience Limited		190	Kap 50 EC	AP-216	Shetu Pesticides Limited
148	Hinosan EC 50	AP-491	Bayer CropScience Limited		191	Dipterex 80 SP	AP-561	United Phosphorus (Bangladesh) Ltd
149	Labaycid 50 EC	AP-492	Bayer CropScience Limited		192	Cekufon 80 SP	AP-257	Shetu Pesticides Limited
150	Sunrice Super 315 EC	AP-1777	Bayer CropScience Limited		193	Palash 57 EC	AP-312	Petrochem (Bangladesh) Limited
151	Benefiter 315 SC	AP-2105	Bayer CropScience Limited		194	Pounce 1.5G	AP-419	FMC Chemical International AG
152	Thiodan 35 EC	AP-1147	Bayer CropScience Limited		195	Acekro 20 EC	AP-318	McDonald Bangladesh (Pvt) Limited
153	Fantush 300 EC	AP-2569	Asia Trade International					
154	Ultima 40 WG	AP-2560	Mimpex Agrochemicals Limited					
155	Abate 15 G	PHP-118	BASF Bangladesh Limited					
156	Fendona 1.5 SC	PHP-84	BASF Bangladesh Limited					
157	Edfen 50 EC	PHP-40	Sea Trade Fertilizer Limited					
158	Coopex 25 WP	PHP-191	Bayer CropScience Limited					
159	Sislin 2.5 EC	PHP-192	Bayer CropScience Limited					

Name	Other Names	Use	Toxicity
1-Octen-3-ol	From clover,	Trap bait: mosquitoes	Low
Orange		Repels vertebrates	Low
Swietenia Mahagoni	Mahogony Fruit	Pesticide	Low
p-Methane-3,8 diol	Eucalyptus sp.	Repels biting flies, mosquitoes	Low
2-Phenylethyl-	From peanuts	Kills insects, ticks, mites & spiders	Low
propionate			
Pyrethrum	Chrysanthemu	Stored products use	
Red pepper	Chilli	Repels insects	Low
Rosemary	Herb		Low
Rotenone	Derris sp.,	Controls ticks	
Ryania	Ryania speciosa	Kills thrips, codling moth, corn borers	
Sabadilla	Schoenocaulon		
Sesame Oil	Sesamum	Pyrethroid synergist	Low
Soybean Oil	Soja	Kills insects, mites	Low
Thyme	Herb	Controls aphids	Low
1,2,4 Trimethoxy-	From squash	Trap bait: corn rootworm, cucumber beetles	Low
benzene			
Verbenone	From pine trees	Repels bark beetles	Low

Annexure-3: Botanical Active Ingredients in Pesticides, Repellents, and Baits

Annexure-4: Field Monitoring Form for Farmer Best Practices including GAP and IPM options

Date of site visit:					
Name of the Demonstra	ation Farm	er :			
Name of planted Crop:					
District / Upazila :					
Village/ Union:					
Location: Lat					Long
				• • •	
Environmental Screen	ing _		Chec	k ()	Comments
Checklist			Yes	No	
Environmentally consci design	ious				
1. What are the major percountered by the f	pests Farmer?				
2. Which of the attach Preventive and Cur GAP and IPM tools tactics are used by	ed ative and farmer?				
3. Are pesticides used by demo farmer?					
4. How are pesticides applied? (<i>backpack s</i> or others)	prayer				
5. What are the pesticides used?					
6. Does PPE have and	use?				
7. If yes, name of PPE used during spray?	3				
8. Had the farmer received IPM and S Pesticide Use traini	afe ng				
9. Are there any empty pesticide containers scattered in the field	?				
10. Are there signs that the backpack spray has leaks?	er				
11. Does the farmer understand the pesti- label information?	cide				
12. Is the pesticide stor safely out of the ho or away from kids?	ed use				

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13. Does the farmer use gloves for mixing the pesticide with water?			
14. What times of the day are the pesticides applied?			
15. Are pesticides applied during rain or windy conditions?			
16. Are women or children permitted to apply pesticides?			
17. Are empty pesticide containers are used to store water?			
18. Does the farmer rinse equipment away from streams and open water?			
19. Does the farmer wash clothes after applying pesticides?			
20. How does the farmer dispose of empty pesticide containers?			puncture/bury
21. Is there any evidence that pesticides are becoming less effective?			
Name of Evaluator:	Signa	ature:	

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Annexure-5:FarmandProjectRecordKeepingAssociated with PesticideUse

These should be customized, simplified and translated by AIP

DE NAVE	OF CHEVICAL	ENTS		CONCEN	FRATICNS - %]		PACKED MANUFACTURE REGISTRATION PLEASE NOTE Only failed staff Invenory must be Please use certo	t DETALS rrenkes alowedle divolved and use rn ser shemica fip	: Issue and hande O Ied at east croz eve to andpacked weight	HEMICALS IV week and documen) Fgrun
Date	New Stock Delivered Litre / KG	Opening Stock Utve/KG	Slock Iseund Lifte / KG	Floeson for lesse (Indicite Land Number and Precuet stemes will be applied to)	Cosirg Stock Lithe/KG	Issued By (Name)	Sgrølure	Received By (Name)	Sgrafure	Empry Containens on Hanc (Outers Induzted)	Vothad of Disposal	Espiy Case	Disposed By (Name)
wed by :	A Hites				Chancel St	ok Record - E 8.8 Version 2	15, NC 1.13					issue Dava :	04.0d 2007 Page 1 of 1

Annexure-6: Control Card for Pesticides Use-This card will stay with farmer, to keep a record on the use of pesticide by crop.

CONTROL	FORM FOR	THE USE	OF PERTICIDES
00111102			

GENERAL DATA			
FARMERS NAME			
Community:	Municipality:	Province:	Altitude:
USE OF PESTICIDES	S - 1st TREATMENT		
CROP:		SURFACE:	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental condit	tions:		
Justification for use			
Other recommended	control measures		
Result of application			
NAME AND SIGNAT	URE OF IG AND NRI	M SUPERVISOR:	
USE OF PESTICIDES	6 - 2nd TREATMEN	T I	
CROP:		SURFACE:	
Pest to be treated	Name of material	Date and time of application	Quantity used
Environmental condit	tions:		
Justification for use			
Other recommended	control measures		
Result of application			
NAME AND SIGNAT	URE OF IG AND NRI	M SUPERVISOR:	

Annexure-7: BASELINE INFORMATION ON THE ENVIRONMENT, AGRICULTURE AND PESTICIDE USE

- The BWDB has identified 19 potential schemes for financing under the CSAWMP. Detailed plans will be prepared for at least 6 selected schemes where interventions by each entity can be started in the first year of project implementation. It was agreed that BWDB will work with DAE and DOF teams to identify the nature of agriculture and fisheries/aquaculture activities that will be carried out in these priority schemes, including needed actions to facilitate farmers' access to markets.
- 2. For systematic recording of data, baseline environment is usually classified into physical environment, biological environment, and socio-economic environment; and important features/parameters under each category are identified and measured/ recorded during feasibility study. Each scheme specific IEE should provide an updated overview of baseline conditions for the whole program area (reflecting any changes on the ground since this preliminary baseline for the full program area was established at the time of preparation of this document), as well as a detailed analysis specific to the influence area of that phase. The following screening will be used for each scheme.

	Adverse	Flood	Monsoon	Land	Erosion	Hazard	Soil	Environmental	Salinity
	Ecological	Plain	Flooding	Classification			Texture	Sensitive Area	
	Zone			Based on					
				Flooding					_
Scheme	Yes/No	Yes/No	Severity	Land	Erosion	Hazard	Soil	Yes/No	Yes/No
			of	Classification	Zone	Туре	Texture	Identify	
			Flooding	Туре		and	Туре	wetland, beel,	
						Class		forest	

Table 1 Environmental	Screening
-----------------------	-----------

3. Team of Consultants along with the BWDB officials visited three BWDB zones, i.e., Central zone Dhaka, Mid-Western zone Faridpur, South Eastern zone Chittagong . Meeting were held with the official of local BWDB offices, Union Chairman and local representatives of the concerned schemes for some of the visited schemes and with the Upzilla Officials (DA and DoF) of the respective schemes.

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During field visits, discussions were held with the different stakeholders on different issues; discussions on; proposed schemes to be implemented under CSAWMP; and capacity and institutional arrangement for environmental management of the proposed schemes . Focus Group Discussions (FGDs) were held during these field visits to identify issues and problems to enable the institution to corrective measures and to identify lessons and opportunities to enhance project implementation mechanism. Discussions also have been held with the BWDB officials on different aspects of project implementation and management, particularly focusing on existing capacity and institutional arrangement for environmental management of the proposed schemes.

- 4. The following information were obtained during the focused
 - The type of crop, vegetable and fruit produced
 - Current pest management practices
 - Pesticide use
 - Availability of labour and labour out migration
 - Availability of inputs
 - Cost of production
 - Market facilities
 - Current market price of produce

Cost of Pesticide Use

5. Presents costs of inputs as percentages of cash and full costs per hectare, and Table shows costs of inputs as total and percentages of cash costs per hectare for irrigated *boro* paddy cultivation. Full costs include imputed land rent and imputed cost of family labor, but cash costs exclude these items



Figure 1 Percent Cost of Pesticide

	27A	100 C		8					
				Div	ision				
Input	FTF zone	Barisal	Chittagong	Dhaka	Khulna	Rajshahi	Rangpur	Sylhet	Bangladesh
	\$2. 	5	3	(C)	(taka)	\$		2
Seed/seedling	4,757	3,957	6,902	6,049	4,549	6,710	3,769	4,159	5,549
Mechanical irrigation	13,453	8,648	11,386	12,079	13,641	11,332	10,380	6,864	11,431
Manual irrigation	477	842	333	217	854	315	64	575	327
Land rent	14,565	10,763	12,973	14,434	15,110	18,854	16,892	14,414	15,623
Urea	3,696	3,647	3,464	3,489	4,031	3,494	3,419	2,398	3,487
TSP	3,445	4,581	4,182	2,494	3,889	2,463	2,532	2,041	2,858
DAP	771	5	185	1,147	849	1,193	848	25	885
MP	1,528	663	1,401	1,509	1,832	1,312	1,374	563	1,416
Zinc	700	449	351	277	1,217	417	196	85	408
Ammonia	16	-	8 8	3	21	5	27	(1)	9
Gypsum	1,048	32	66	165	1,005	372	408	77	338
NPKS	23	37	9	36	6	8	9	17	17
Calcium	225	470	173	357	307	148	104	111	232
Manure	1,382	252	1,760	1,402	634	1,930	3,395	516	1,751
Pesticides	2,112	3,263	2,187	1,373	2,010	2,864	1,835	761	1,907

Table 2 Per Hectare Cost of Pesticide

Region	Seed	Irrigation	Land rent	Fertilizer	Manure	Pesticide	Equipment	Family labor	Hired labor	Total
					(p	ercent)				
FTF zone	5.7	16.6	17.4	13.7	1.6	2.5	6.7	19.1	16.7	100.0
Barisal	5.4	12.9	14.6	13.3	0.3	4.4	14.2	16.2	18.7	100.0
Chittagong	7.3	12.4	13.7	10.4	1.9	2.3	6.3	15.1	30.7	100.0
Dhaka	7.0	14.3	16.8	11.0	1.6	1.6	6.4	20.1	21.1	100.0
Khulna	5.2	16.6	17.3	15.1	0.7	2.3	6.4	20.0	16.3	100.0
Rajshahi	7.7	13.4	21.8	10.9	2.2	3.3	5.7	18.7	16.2	100.0
Rangpur	5.0	13.8	22.3	11.8	4.5	2.4	6.3	20.0	14.0	100.0
Sylhet	6.3	11.3	21.9	8.1	0.8	1.2	7.8	17.7	25.0	100.0
Bangladesh	6.6	14.0	18.6	11.5	2.1	2.3	6.3	19.0	19.7	100.0

Source: IFPRI Bangladesh Integrated Household Survey, 2011-2012. The survey represents rural areas only. Note: Equipment include drought animal, power tiller and other agricultural machineries

Government of Bangladesh

Annexure-8: Acute Toxicity of Pesticides: EPA and WHO Classifications.

General Toxicity

1. Pesticides, by necessity, are poisons, but the toxicity and hazards of different compounds vary greatly. Toxicity refers to the inherent intoxicating ability of a compound whereas hazard refers to the risk or danger of poisoning when the pesticide is used or applied. Pesticide hazard depends not only on toxicity but also on the chance of exposure to toxic amounts of the pesticide. Pesticides can enter the body through oral ingestion, through the skin or through inhalation. Once inside the body, they may produce poisoning symptoms, which are either acute (from a single exposure) or chronic (from repeated exposures or absorption of smaller amounts of toxicant).

US Environmental Protection Agency (USEPA) and World Health Organization (WHO)

Toxicity Classifications

2. Basically, there are two systems of pesticide toxicity classification. These are the USEPA and the WHO systems of classification. It is important to note that the WHO classification is based on the active ingredient only, whereas USEPA uses product formulations to determine the toxicity class of pesticides. So, WHO classification shows relative toxicities of all pesticide active (or technical) ingredients, whereas EPA classification shows actual toxicity of the formulated products, which can be more or less toxic than the active ingredient alone and are more representative of actual dangers encountered in the field. The tables below show classification of pesticides according to the two systems.

Class	Descriptive term	Mammalian LD50		Mammalian Inhalation	Irritation		Aquatic invert/fish (LC50 or	Honey bee acute oral (LD50)	
		Oral	Dermal	LC50	Eye1	Skin	EC50)2		
1	Extremely toxic	≤50	≤200	≤0.2	Corrosive	Corrosive	< 0.1		
11	Highly toxic	50- 500	200- 2000	0.2-2.0	Severe	Severe	0.11-1.0	< 2 μg/bee	
111	Moderately toxic	500- 5000	2000- 20000	2.0-20	No corneal opacity	Moderate	1.1-10.0	2.1-11 μg/bee	
IV	Slightly toxic	≥5000	≥20000	≥20	None	Moderate or slight	10.1-100		
	Relatively non-toxic						101-1000		
	Practically non-toxic						1001-10,000	> 11 μg/bee	
	Non-toxic						> 10,000		

3. USEPA classification (based on formulated product = active ingredient plus inert and other ingredients)

4. Corneal opacity not reversible within 7 days for Class I pesticides; corneal opacity reversible within 7 days but irritation persists during that period for Class II pesticides; no corneal opacity and irritation is reversible within 7 days for Class III pesticides; and Class IV pesticides cause no irritation Expressed in ppm or mg/l of water.

		Oral LD50 fo	or the rat (mg/kg	Dermal LD50 for the rat (mg/kg		
Class	Descriptive term	body wt)		body wt)		
		Solids	Liquids	Solids	Liquids	
la	Extremely hazardous	≤5	≤20	≤10	≤40	
Ib	Highly hazardous	5-50	20-200	10-100	40-400	
II	Moderately hazardous	50-500	20-2000	100-1000	400-4000	
	Slightly hazardous	≥501	≥2001	≥1001	≥4001	
U	Unlikely to present acute hazard in normal use	≥2000	≥3000	-	-	

WHO classification (based only on active or 'technical' ingredient)

বিষয়: বিশ্ব ব্যাংকের চাহিদা অনুযায়ী সিএসএডব্লিউএমপি প্রকল্পের Safe guard documents বাপাউবো এর Website-এ disclose করা প্রসঙ্গে।

IDA অর্থায়নে CSAWMP প্রকল্পের দর কষাকষি (Negotiation) ৩১/১২/২০২০ ইং তারিখের মধ্যে অনুষ্ঠিত না হলে নির্দিষ্ট করা ১২০ বিলিয়ন ডলার স্থানান্তর করা হবে মর্মে বিশ্ব ব্যাংক কর্তৃপক্ষ অবহিত করে (সংযুক্তি-১)।

২। ইতিমধ্যে প্রস্তাবিত প্রকল্পটির ডিপিপি অনুমোদন প্রক্রিয়ায় ১৯/১১/২০২০ ইং তারিখ PEC সভা অনুষ্ঠিত হয়েছে। বর্তমানে ঐ সভার কার্য বিবরনী অনুযায়ী ডিপিপি সংশোধনের কাজ চূড়ান্ত পর্যায়ে আছে।

৩। অদ্য ২১/১২/২০২০ ইং তারিখ ই-মেইল পত্রে (সংযুক্তি-২) বিশ্ব ব্যাংক জানিয়েছে যে Safe guard documents গুলো ইতি পূর্বে disclose করা হয়েছিল যাহাতে অধিক সংখ্যক/উপ-প্রকল্প ও ভৌত অঙ্গ অন্তর্ভুক্ত ছিল। যাহা বর্তমানের ১৯ টি উপ-প্রকল্প ও সর্বশেষ ভৌত অঙ্গের তথ্য/সংখ্যা/পরিমান ও ব্যয় অন্তর্ভুক্ত হওয়াসহ পুনরায় বাপাউবো Website-এ প্রকাশ করা প্রয়োজন। Preferably অদ্য ২১/১২/২০২০ ইং তারিখের মধ্যে পুনরায় disclose করে তাদেরকে অবহিত করতে বলা হয়েছে।

8। এমতাবস্থায় Climate Smart Agriculture and Water Management Project (CSAWMP) প্রকল্পের (1) Environmental and Social Management FRAMEWORK (ESMF), December 2020. (2) Integrated Pest Management Plan (IPMP), December 2020.(3) Environmental Management Framework (EMF), December 2020 ডকুমেন্ট বাপাউবো এর Website-এ disclose করার জন্য মহা-পরিচালক মহোদয়ের সদয় অনুমোদনসহ সিনিয়র সিস্টেম এনালিষ্ট ,বাপাউবো এর নিকট প্রেরনের জন্য হার্ড ও সফট কপি (PDF) অত্রসাথ পেশ করা হলো।

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(এ.কে.এম.শরিফুল ইসলাম) তত্তাবধায়ক প্রকৌশলী আইসিজেড এন্ড ক্লাইমেট চেঞ্জ ম্যানেজমেন্ট বাপাউবো,ঢাকা

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(মোহাম্মদ মিজানুর রহমান) অতিরিক্ত প্রধান প্রকৌশলী আইসিজেড এন্ড ক্লাইমেট চেঞ্চ ম্যানেজমেন্ট বাপাউবো,ঢাকা

অ:দা:নং-ডিপিপি-২২৬ তারিখ:২১/১২/২০২০খ্রি:

অতিরিক্ত মহা-পরিচালক(পরিকল্পনা) বাপাউবো,ঢাকা।

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(এ. এম. আমিনুল হক) মহাপরিচালক বাপাউবো, ঢাকা।

(এ কে এম ওয়াহেদ উদ্দিন চৌধু তিরিক্ত মহাপরিচালক (পরিকল্পনা) বাগাউবো, ঢাকা।

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