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Insect Pests Management in the Agriculture Plants and Crops

Ahasan Ullah Khan

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CHAPTER 1
BOOK: INSECT PESTS, DISEASES AND WEEDS MANAGEMENT

INSECT PESTS MANAGEMENT IN THE AGRICULTURE PLANTS AND CROPS

Ahasan Ullah Khan

Department of Entomology, Faculty of Agriculture, Sylhet Agricultural University, Sylhet-3100, Bangladesh
Climate-Smart Agriculture Lab, Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh

Subtitle: Prescription: A Handbook for Agriculturist

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Abstract

This chapter mainly attention to the management of the insect pests of different grain crops, vegetables, flower crops, oil crops, and others. The insect pests were very harmful to produce the quality crops/fruits and this paper study on the common name and scientific name of the common insects and pests in different plants. This paper investigated the use of biochemical, chemical, and biological insecticides in the field and also with the cultural practices in the seedbeds, fields, and storage condition. The farmers used balance fertilizer and also used chemical insecticides to minimize crop damage. It has been estimated that of the average at 36.5% of total losses where 15.1% damaged by insects, and pests. This chapter has efforted the prescription to the insect pests management in farmer fields. Hence, I think if this book is available for all agriculturists and farmers then they will benefit.

Keywords: Insects pests, plants, grain crops, vegetables, flower crops, oil crops

1. INTRODUCTION

Bangladesh is an agriculture-based country. The principal cash crops are rice, jute, potato, sugarcane, oil seeds are pulses, soyabean, bean, vegetables as brinjal, okra, cucumber, fruit as jackfruit, mango, banana, and so on. Plant insect pests cause enormous losses to crop quality and crop yield. Worldwide about 1.0 million insect pests species are known. As per rough estimate, globally, more than 70K species of insect pests are active. However, in case of Bangladesh, approximately 65K species of insect pests are present with varying scale, in which it is estimated that about 22K belong to this land. Insect pests diversity is directly and positively correlated with plant biodiversity. Insects are found in all types of environment and they occupy little more than two thirds of the known species of animals in the world. Insects affect human beings in a number of ways. Many of them fed on all kinds of plants including crop plants, forest trees, medicinal plants and weeds. They also infest the food and other stored products in godowns, bins, storage structures and packages causing huge amount of loss to the stored food and also deterioration of food quality. Insects inflict injury to plants and stored products either directly or indirectly in their attempts to secure food.

It has been estimated that of the average at 36.5% of total losses, 14.2% are caused by disease, 15.1% by insects and 6.2% by weeds. Insects that cause less than 5 % damage are not considered as pests. The insects which cause damage between 5-10% are called minor pests and those that cause damage above 10% are considered as major pests. Insects that cause injury to plants and stored products are grouped into two major groups namely chewing insects and sucking insects. The former group chews off plant parts and swallow them thereby causing damage to the crops. Sucking insects pierce through the epidermis and suck the sap. Many of the sucking insects serve as vectors of plant diseases and also inject their salivary secretions containing toxins that cause severe damage to the crop.

Most of the farmers of our country are illiterate. They don’t get enough advice from DAE due to lack of enough skilled personnel. With this view point, a prescription is prepared for plant insect pests of our country and control of insect pests by using proper chemicals in time on by adoption of other proper ways.

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1. Rice Insects

Insect Name	Prescription (Application/spraying)	Advices
Rice yellow stem borer *Scirpophaga incertulas*	Application of **Diazinon 10G** @16.60kg/ha. Using **Diazinon 60E** @ 1.70 litre/ha. Application of **Cartap 50 sp** @1.4kg/ha.	Resistant variety use such as BR_1, $BR_{10,}$ $BR_{11.}$ Using light trap to control adult.
Dark-headed stem borer *Chilo polychrysus*	Application of **Diazinon 10G** @16.60kg/ha. Using **Diazinon 60E** @ 1.70 litre/ha. Application of **Cartap 50 sp** @1.4kg/ha.	Resistant variety use such as BR_1, $BR_{10,}$ $BR_{11.}$ Using light trap to control adult.
Pink stem borer *Sesamia inferens*	Application of **Diazinon 10G** @16.60kg/ha. Using **Diazinon 60E** @ 1.70 litre/ha. Application of **Cartap 50 sp** @1.4kg/ha.	Resistant variety use such as BR_1, $BR_{10,}$ $BR_{11.}$ Using light trap to control adult.
Gall/Asian gall midge *Orseolia oryzae*	Using of **Diazinon 10G**, **Quinalphos 5G** & Carbofuran 3G @ 16.60 kg/ha. Application of **Diazinon 60EC**, **Phenthoite 50Ec** @ 1.70 litre/ha. Using of **Cartap 50 SP** @13.50 kg/ha & **Carbofutan 5G** @ 10.00 kg/ha.	Use rice gall midge resistant variety. Natural biological control agents such as *Platygasterid*, *Eupelmid* & *Pteromalid* wasps which paradise the larvae are effective.
Green leaf hopper *Nephotettix virescenx, N. nigropictus, N. modulates.*	Using of **Diazinon 10G** & **Carbofuran 3G** @ 16.60 kg/ha.	Light trap use to destroy hopper. Excess use of N fertilizer should be avoided.
Brown plant hopper *Nilaparvata lugens*	Using of **Diazinon 10G** & **Carbofuran 3G** @ 16.60kg/ha. Application of **Diazinon 60EC**, **Carbosulfan 20EC**, **BPMC 50EC** & **Chlorpyrifos 20EC** @ 1.00 litre/ha. Using of **Carbaryl 85SP**@ 1.40 kg/ha.	Cultivation of early maturing varieties. Resistant variety use-BRRI dhan 35. Dragonfly & damselfly prey on moving adults & nymph.
White-backed plant hopper (*Sogatella furcifera);* Rice bug (*Leptocorisa acuta);* Ear-cutting caterpillar *(Mythimna separate);* Zigzag leafhopper (*Recilia dorsalis);* Swarming caterpillar (*Spodoptera litura);* Whorl maggot (*Hydrellia philippina);* Rice hispa *(Dicladispa armigera);* Leaf roller *(Cnaphalocrocis medinalis);* Caseworm *(Nymphula depunctalis).*		

2. Wheat Insects

Insect Name	Prescription (Application/spraying)	Advices
Stem borer/Pink borer *Sesamia inferens*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Collection & destruction of egg masses by hand picking. Adult moth can be trapped by light trap.
Aphid *Rhopalosiphum rofiabdominales*	Application of **Marshal (Carbofuran) 20EC** @ 2ml/L of water. Application of **Admire (Imidacloprid) 20SL** @ 0.50 ml/L of water. Application of **Logor (Dimethoate) 40EC** @ 1ml/L of water. Application of **Ravthion (Malathion) 57EC** @ 2ml/L of water.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Wire worm/click beetle *Agriotes sp*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha. Application of **Lorsban (Chlorpyrifos) 15G** @ 15 kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
Termite *Odontotermes obesus* *Microtermes anandis*	Application of **Dursban (Chlorpyrifos) 20EC** @ 11.25 L/ha. Application of **Admire (Imidacloprid) 200SL** @ 1L/ha. Application of **Lorsban (Chlorpyrifos) 15G** @ 15 kg/ha.	Collection & destruction of queen termites. Destroying the termite nests. If it is possible field can be flooded (10-15 cm) for few days.

3. Maize Insects

Insect Name	Prescription (Application/spraying)	Advices
Cutworm *Agrotis ipsilon*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
Fall armyworm *Spodoptera frugiperda*		
Stem borer *Seamia inferens*	Spraying of **carbaryl** 0.1 % or **endosulfan** 0.07% thrice at an interval of 15 days from a month after sowing. Two whorl applications of 4 % **endosulfan** or 10 % **carbaryl** or 4% **cartap hydrochloride** granules, first at 5 kg /ha at 25 – 30 days after crop emergence and second at 10 kg/ha 10 - 15 days later. If infestation is severe, three applications at 5.0, 7.5 and 10.0 kg/ha are recommended.	Collection and destruction of the stubbles which are left in the field or heaped in one corner of the field since they act as a source of infestation, as the larvae hibernate in them.
Shoot borer *Chilo pertellus*	Application of **Spinosad** @ 0.4 ml/l of water, **Abamectin** @ 1.2 ml/l of water is effective to manage the borer.	Removal and destruction of all infested shoots, all fallen dry leaves and other debris from the field.
Leaf aphid *Rhopalosiphium maidis*	Application of **Malathion 57EC** @2ml/L water, Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Stem fly *Atherigona varia soccata*	Treatment of bean seed at planting with **Endosulfan 35 EC** Spraying should be done with **Dimethoate** (Tafgor 40 EC) or **Carbosulfan** (**Marshal 20 EC**) @ 2 ml/liter of water.	Avoid late plantings since infestations of bean fly are heavier than. Crop rotation followed.
Thrips *Caliothrips graminicola*	Using **Spinosad** as **Tracer 45SC** 200 ml/ha in 500 L water.	Establishment of optimum shade in plantation. Keeping the section weed free and improve drainage condition. Frequent plucking to remove thrips and their eggs.
Termite *Odontotermes obesus, Microlemes anandi*	Application of **Dursban 20EC** @ 11.25Lha. Application of **Admire 200SL** @ 1 L/ha. Application of **Lorsban 15G** @ 15.00kg/ha. Application of **Regent 3G** @ 16.8 kg/ha.	Destruction of temite nest with queen. Raton plantation should be avoided.
Weevil *Sitophilus Zeamais*	Application of **Sevin 85SP** @ 2g/L of water.	Removal & destruction of infested plants at the time of thinning. Crop rotation should be followed.
White grub (*Holotrichia* spp.); Cob borer/corn earworm (*Helicoverpa armigera);* American bollworm (*Heliothis armigera)*		

4. Barley Insect

Insect pests
Midge/Hessain fly (*Mayetiola destructor*); Wheat weevil (*Sitophilus granaries*)

5. Jute Insects

Insect Name	Prescription (Application/spraying)	Advices
Hairy caterpillar *Spilarctia oblique*	Application of **Diazinon 60EC** @ 2ml/L of water. Application of **Cymbush 10EC** @ 1ml/L of water.	Hand picking of egg masses, early instar larvae & killing them by burning/keratinized water. Light traps may be used to destroy the moths.
Semilopper *Anomis sabulifera*	Application of **Diazinon 60EC** @ 2ml/L of water. Application of **Sevin 85SP** @ 2g/L of water.	After harvest the land should be ploughed well. Perching in the field for insectivorous birds.
Stem weevil/apion *Apion corchori*	Application of **Sevin 85SP** @ 1.7 kg/ha.	Removal & destruction of infested plants at the time of thinning. Crop rotation should be followed.
Yellow mite/white mite *Hemitersonemus latus*	Application of **Dicofol 18.5EC** @ 2 L/ha. Application of **Ethion 46.5 EC** @ 1.26 L/ha.	Heavy rainfall causes significant reduction of the population of JYM.
Field cricket *Brachytrypes portentosus*	Application of **Dursban 20EC** @ 2ml/L of water.	Thinning should be done at time when the plants are about 20-25 cm tall.

6. Cotton Insects

Insect Name	Prescription (Application/spraying)	Advices
Spotted bollworm *Earias vitella* *E. insulana*	Application of **Decis 2.5EC** @500ml/ha. Application of **Asataf 75SP** @750ml/ha. Application of **Marshal 20EC** @ 1.5L/ha.	Using pheromone traps. Destruction of infested plant. Resistant variety use.
Cotton jassid /leafhopper *Amrasca devastans* *A Biguttula*	Spraying with **Admire 20 SL** @ 0.125L/ha. Spraying with **Actara 25 WG** @ 100gm/ha. Spraying with **Asataf 75 SP** @ 750/ha. Spraying with **Marshal 20EC** @ 1.5L/ha. Spraying with **Talstar 2.5 EC** @ 900ml/ha.	Use of sticky traps. Destruction of alternate host okra.
Pink bollworm *Pectinophora gossypiella*	Spraying with **Chlorpyrifos 20Ec** @1250ml/ha. Spraying with **Profenofos 50EC** @1500ml/ha. Spraying with **Cypermethrin 10EC** @600ml/ha. Spraying with **Spinosad 48EC** @100ml/ha.	Using light traps to control moths. Sex pheromone use to control male moth.
Red bug *Dysdercus cingulatus*	Spraying with **Ripcord/Cymbush 10EC** @ 1.5me/ha of water. Spraying with **Carbaryl 85WP** @ 2g/L of water.	Use of baits to attract cotton strainers-heap of cotton seeds/peeled sugarcane.
Aphid *Aphis gossypii*	Application of **Malathion 57EC** @2ml/L water, Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Many parasitoids & predators attack aphids. Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
American bollworm *Helicoverpa armegira*	Spraying with **Profenofos 50EC** @ 2ml/L water. Spraying with **Cypermethrin 10EC** @ 2ml/L water. Spraying with **Fenvelarate 20EC** @ 2ml/L water. Spraying with **Spinosad 48EC** @ 12ml/L water Spraying with **Emamectin benzoates 5EC** @ 1ml/L water.	Using light traps & sex pheromone to control moth. Destruction of alternate host & plant debris of cotton.
Cotton leaf roller (*Sylepta derogate);* Cotton white fly (*Bemisia tabaci);* Thrips (*Thrips tabaci)*		

7. Sugarcane Insects

Insect Name	Prescription (Application/spraying)	Advices
Top shoot borer *Scirpophaga excerptalis* *Tryporyza nievella*	Application of **Fenthion 50EC** @ 1.00L/ha/**Furadan 5G/Basudin 10G** @kg/ha is effective.	Egg parasitoids: *Telonemous* spp, *Trichogramma* spp, *Tetrastichus* spp etc Larval parasitoids: *Goniozus indicus*,*Stenobracon, Chelonus* etc.
Stem borer *Chilo tumidicostalis* *Chilo auricilia*	Setts should be treated by dipping in 0.1% BHC/Malathion 57EC for 2 hrs before planting. **Furadan 5G/Padan 1UG** @40kg/ha intrench 2 times at 1-month interval may be used/**Fenthion 50EC** @1.00 L/ha is effective.	Moths can be trapped by light. Water may be drained off in low-lying areas. Eggs parasitoids are most effective.
Root stock borer/Root borer *Emalocera depressella*	Application of **Lorsban (Chlorpyrifos) 15G** @15kg/ha. Application of **Admire (Imidaclorpid) 200SL** @ 1L/ha.	Discouraging rationing & removal of all plant's stubbles from fields.
Termite *Odontotermes parvidens* *O. lokanardi* *O. obesus*	Application of **Dursban 20EC** @ 11.25Lha. Application of **Admire 200SL** @ 1 L/ha. Application of **Lorsban 15G** @ 15.00kg/ha. Application of **Regent 3G** @ 16.8 kg/ha.	Destruction of temite nest with queen. Raton plantation should be avoided.
Wooly aphid *Ceratovacuna lanigera*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Whitefly *Aleurolobus barodensis* Mask. and *Neomaskellia bergii*	Spray **imidacloprid** 0.01% or **monocrotophos** 0.05% or **acetamiprid** @ 0.01% after removing infested lower leaves. At least two or more sprays will be required at fortnightly intervals.	Discourage ratooning in low lying areas and avoid water logging. Remove lower leaves containing pupae periodically.
White grub (*Holitrichia seticollis);* Early shoot borer (*Chilo infuscatellus);* Pink borer (*Sesamia inferens);* Pyrilla leafhopper (*Pyrilla perpusilla);* Mealy bug (*Saccharicoccus sacchari);* Scale insects (*Melanaspis glomerate)*		

8. Tea Insects

Insect Name	Prescription (Application/spraying)	Advices
Mosquito bug *Helopeltis theivora*	Using **Malathion** 2.25 L/ha in 500 L water or **Acephate** 500g/ha in 500L water.	Pruning, training and clean cultivation of tea garden. Proper management of soil nutrient.
Thrips/assam thrips *Scirtothrips dorsalis*	Using **Spinosad** as **Tracer 45SC** 200 ml/ha in 500 L water	
Termite (*Microcerotermes* spp.)	**Chlorpyrifos as Predator 50EC** 3.50 L /ha in 1000 L water	
Red spider mite *Oligonychus coffeae*	Using **Dimethoate as Rogor 40EC** @2.25 L/ha in 1000 L water	
Mole and field cricket	Using waste engine oil @1-2 spoon/hole	
Scale insect *Coccus viridis*	Using **Dimethoate as Tafgor 40 EC** @ 2.25 L/ha in 500 L water	
Aphid *Toxoptera aurantia*	**Application of Chlorpyrifos+Cypermethrin as Agroplus 55EC** @ 1.00 L /ha in 500 L water	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Nematode *Meloidogyne* sp., *Pratylenchus* sp.	Using **Cadusafos as Rugby 10G** @ 150 g/m3	Clean cultivation should be practiced.
Looper caterpillar, Jassid, Leaf roller, Flush worm follow the scale insect procedure.		

9. Coffee Insects

Insect Name	Prescription (Application/spraying)	Advices
White borer *Xylotrechus quadripes* Ch.	Application of **Lindane 20 EC** @ 1300 ml in 200 litres of water with 200 ml wetting agent may be swabbed over the stem once in April - May and twice at an interval of a month during October - December for effective control of infestation by the pest or 0.05% **monocrotophos or phosalone.**	Maintain optimum shade. The wilting branches and bushes should be removed and destroyed.
Berry Borer *Hypothenemus hampei* Ferrari	Spot spray 0.07% **endosulfan 35 EC** when most of the beetles are waiting near the naval region of fruit.	Timely and clean harvest. Use mats to prevent gleanings. Remove off-season berries and gleanings.
Green scale *Coccus viridis* Gr.	Spray application of **Malathion** 0.1% or **methyl parathion** 0.05% or **profenofos** 0.05 % or **phosalone** 0.07%.	Maintain optimum shade.

10. Tobacco Insects

Insect Name	Prescription (Application/spraying)	Advices
Hornworm *Manduca sexta*	Application of **carbaryl, permethrin, spinosad** insecticedes.	Use of *Bacillus thuringiensis* to control of larvae.
Budworm Heliothis virescens	Application of foliar insecticides such as **endosulfan, carbaryl, chlorpyrifos, dimethoate**.	Use nuclear polyhedrosis virus, *Bacillus thuringiensis*. Agricultural practices.
Aphid *Myzus persicae*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Cutworm *Agriotes ipsilon*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
White fly (*Bemisia tabaci);* Caterpillar (*Spodoptera litura)*		

11. Citrus Insects

Insect Name	Prescription (Application/spraying)	Advices
Lemon butterfly *Papilio demoleus*	Spraying **endosulfan** 0.07% or **phosalone** 0.05% or application **carbaryl** 5% dust.	Hand picking the larvae if the plants are few.
Citrus leaf miner *Phyllocnistis citrella*	Spray application of **dimethoate** 0.03% or **methyl demeton** 0.025% or **imidacloprid** 0.01%.	Neem cake soaked in water and the decantation when sprayed also controls the pest.
Whitefly *Aleurocanthus spiniferus*	Neem cake soaked in water and the decantation when sprayed controls the pest (given earlier).	Infested leaves remove and need clean cultivation. The affected shoot should be clipped off and destroyed.
Fruit sucking moths *Othreis fullonica* Linn. and *O. materna* Linn.	Spraying **oil emulsions** once in 10 days to act as a deterrent.	Growing tomato as a trap crop in the orchards to attract the moths. Bagging of fruits has been suggested.

12. Jackfruit Insects

Insect Name	Prescription (Application/spraying)	Advices
Jackfruit borer *Diaphania caesalis* Walker Jackfruit trunk borer *Batocera rufomaculata* De Geer	Application of **Bordeaux** paste with aluminum phosphide and sealing the hole.	Pruning and training are the best method to control of the borer insects of jackfruit.
Bud weevil (*Ochyromera artocarpi*); mealybug (*Drosicha mangiferae*); spittle bugs (*Cosmoscarta relata);* bark-eating caterpillar (*Indarbela tetraonis*); scale insects		

13. Mango Insects

Insect Name	Prescription (Application/spraying)	Advices
Hopper *Idioscopus niveoparsus* *I clypealis* *I clypealis* *Amirtodus atkinsoni*	Sprayed **Acephate 75% SP** @ 1.5 gm/l of water, **rofenophos 50% EC** @ 2ml/l of water, **Thiomethoxam 25% WG** @ 0.3 gm/l + **Wettable Sulphur 90% WDG** @3g/l at flower initiation stage and **Imidacloprid 17.8% SL** @ 0.3 ml + **Hexaconazole 5% EC** @2 ml/l.	The disease in the field is recognized by the presence of a black velvety coating, i.e., sooty mould on the leaf surface. Remove those infested leaves from the garden.
Fruit & stone weevil *Sternochaetus frigidus* *S mangiferae*	Spraying with **deltamethrin at 1 ml/l** when fruits are at marble stage. Insecticide sprayings meant for management of other pests should also be directed to the trunk during off-season to kill adult weevils.	Collection and destruction of fallen fruits. Cleaning the stem and branch junctions with hard broom to disturb the resting weevils.
Fruit fly *Bactrocera dorsalis*	Spraying **deltamethrin 2.8 EC** (1 ml/L) is effective to manage the fruit fly	An integrated management strategy involving crop sanitation, male annihilation technique and bait sprays has been standardized at Indian Institute of Horticultural Research, Bengaluru, to manage fruit flies.
Defoliator (*Cricula trifenestrata);* thrips (*Frankliniella occidentalis* Pergande), fruit borer (*Citripestis eutraphera* Meyrick), stone weevil (*Sternochetus mangiferae* Fab.),		

14. Banana Insects

Insect Name	Prescription (Application/spraying)	Advices
Leaf & fruit beetle *Nodostoma viridipennis*	Application of **Diazinon 60EC**(2ml/L)/ **Sevin 85 WP** (1.5g/L) should be sprayed 5 days before flower initiation, first fruit setting, & after all fruit setting.	Crop rotation should be followed. Clean cultivation, particularly the removal of grass, weeds from plantations.
Rhizome weevil *Cosmopolites sordidus* G.	Drenching with **chlorpyriphos** 0.1% emulsion in the soil before planting may afford some relief.	Adopt strict field sanitation by removing infected plants and destroying them. Use of healthy planting material and removal of outer layer of rhizome and sundry for 3 - 4 days before planting after smearing with slurry of cowdung and ash.
Stem Weevil *Odoiporus longicollis* Oliver	Application of **carbofuran 3g** @ 30g/plant at planting and @ 15g/plant at 60th and 90th day after planting. Spray application of **quinalphos 0.05%** or **chlorpyriphos 0.03%** or **carbaryl 0.2%** at planting. In case of severe infestation spraying may be repeated after 3 weeks.	Field sanitation by removing and destroying the affected plants alongwith rhizome and also the destruction of pseudostem and rhizome of harvested plants is the most important method.
Aphid *Pentalonia nigronervosa* Coquerel	Application of 25g of **phorate 10G** or 20g of **carbofuran 3G** /plant 20 days after planting around the rhizome in the soil. Application of 12.5g **phorate 10G** or 10g of **carbofuran 3G** /plant in the leaf axils or 25g phorate 10G or 20g **carbofuran 3G** /plant in the soil 75 days after planting which may be repeated 165 days after planting.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.

15. Litchi Insects

Insect Name	Prescription (Application/spraying)	Advices
Litchi mite/Erinose mite *Acaria litchi* keifer	Spraying **omite 250 EC** @ 2ml/liter of water	This infestation can easily be checked by pruning the leaves/ twigs when the mites make their first appearance. Use of recommended miticide (sulphur) sprays can check the mites. 2.3 kg wettable sulphur per 454 liters water at the start of a new growth flush, if necessary, by 2 or 3 additional treatments at monthly intervals to check mite attack.

16. Guava Insects

Insect Name	Prescription (Application/spraying)	Advices
Whitefly *Aleurodicus dispersus*	In case of severe attack, spray **Dimethoate 40 EC** (Perfecthion/ Rogor/Roxion/Tafgor 40EC) @ 2ml/lit of water or **Imidacloprid 200SL** (Admire 200SL) @0.5ml/L of water.	The affected shoot should be clipped off and destroyed. At initial stage spraying of detergent @ 10g/10 L of water Spraying of neem oil 5ml/lit of water mixing with 5ml Trix/lit of water or neem seed kernel @50g/lit. of water during March-April and August-September.
Mosquito bug *Helopeltis antonii* S.	Periodical spray application of **Malathion** 0.1 percent has been reported to minimize damage.	Need to clean cultivation and remove the old leaves.

17. Sapota Insects

Insect Name	Prescription (Application/spraying)	Advices
Leaf webber *Nephopteryx eugraphella* Rag.	Application of **cypermethrin 0.025 %** affords protection.	The damaged leaf webs with larvae should be collected and destroyed.
Hairy caterpillar *Metanastria hyrtaca* C.	Spraying of **cypermethrin 0.025%.**	Burning the groups of larvae found on tree trunks with torches.

18. Pomegranate Insect

Insect Name	Prescription (Application/spraying)	Advices
Anar butterfly *Deudorix isocrates* F.	Five spray application of **fenvalerate 0.01 %**, or **carbaryl 0.2 %** or **triazophos 0.05%** or 0.03% **phophamidon** at intervals of three weeks commencing at initiation of fruit setting.	The fruits if screened with polythene or paper bags may escape infestation. Removal and destruction all the affected fruits.

19. Temperate Fruits Insects

Insect Name	Prescription (Application/spraying)	Advices
San Jose Scale *Quadraspidiotus perniciosus*	Spraying the dormant trees in winter with 3% miscible oil as **emulsifiable** forms having 85 – 95% of actual oil.	In addition to spraying, the parasitoid, *Encarsia pernicoisi* may also be released to check the over wintering population of San Jose scale on wild host plants growing around.
Wooly aphid *Eriosoma lanigerum* Hausman	Foliar spraying with 0.03% **dimethoate** or **phosphamidon** or **oxydemeton** methyl during March – April (spring) and again in June.	Soil application (80 - 100 mm deep) of dimethoate or thiometon granules @ 15g / tree during spring and summer against the root forms. The aphid population can also be effectively checked by an exotic parasitoid, *Aphelinus mali* Hald.
Fruit fly *Dacus ciliatus* Loew	Spray application of three to five rounds of **profenofos 0.05 %** or **fenthion 0.1 %** or **carbaryl 0.1 %** at intervals of 15 days commencing from flowering may be useful.	To check the damage by these flies, fruits should be harvested before they start ripening. All the fallen and infested fruits should be collected and destroyed to prevent the carryover of the pest.
Apple codling moth *Cydia pomonella* Linnaeus	Application of 0.2% **Pyrethrum** extract is also helpful in checking the pest infestation. The protective treatment may be applied about ten days before ripening of the fruits.	Strict domestic quarantine is to be followed by screening of consignments of fruits to prevent the spread of the insect from Ladak to other apple growing regions. Collect and destroy the infested fruits to prevent the carryover of the pest.
Peach leaf curl aphid *Brachycaudus helichrysi* Kaltenbach	Spray with 0.03% **dimethoate** or **oxydemeton methyl** or **phosphamidon** or **quinalphos** or 0.04% **diazinon** or **dichlorvos** just before flowering (pink bud stage) and again after 7 - 10 days.	Collection & destruction of infested leaves, twigs and shoots. Ladybird beetle, spider & damselfly etc. feed upon aphid.

20. Coconut Insects

Insect Name	Prescription (Application/spraying)	Advices
Rhinoceros beetle *Oryctes rhinoceros*	The grubs in their breeding places should be killed by spray application of **carbaryl 0.1 %** solution at least once in three months.	**Proper sanitation** should be maintained. Keeping the **decaying matter in a selected place** as compost and **thoroughly treated with a persistent insecticide** at suitable intervals. Keeping of the **manure in a selected place** will **act as traps** for the pest breeding. Such breeding trap should be cleaned. **Hook out the adult while it is feeding in the crown by metallic rod**.
Red palm weevil *Rhynchophorus ferrugineus*	The infested portion should be scooped out and dressed with tar. A solution of 1 % **pyrocone E** (a mixture of pyrethrin 1 part + piperonyl butoxide 10 parts) i.e. 1 part in 100 parts of water, or 1 % **carbaryl** or **monocrotophos** 36 WSC 5 ml + DDVP 76 WSC 5ml when injected through a hole on the crown at 1000 - 1500 ml per grown up tree brings about appreciable control of the pest.	The dying and already damaged palms should be destroyed and as far as possible inflicting mechanical injuries on trees should be avoided.
Black-headed caterpillar *Opisina arenosella* Wlk.	In the case of young trees **carbaryl 0.1%** may be sprayed. Trunk injection of **monocrotophos 36 WSC** at 5 ml/palm is also effective.	The infested fronds should be cut and burnt. Periodically releasing of its parasitoids such as *Goniozus nephantidis*, *Bracon brevicornis*, *Elasmus nephantidis* and *Trichospilus pupivora* is recommended.

21. Potato Insects

Insect Name	Prescription (Application/spraying)	Advices
Cutworm *Agrotis ipsilon*	Soil drenching with **chlorpyriphos 0.1** emulsion before planting.	Hand picking and destruction of larvae.
Aphid *Myzus pericae*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Tuber moth *Phthorimaea operculella*	Fumigation of tubers with **methyl bromide** at 2.5 - 5 kg/1000 cu.m. for 3 hours brings about control of the pest in storage. Spray of **phosalone** @ 0.07% upon the initial occurrence of the pest in the field.	Earthing up the crop to close the crevices helps in minimizing infestation and in godowns the tubers may be stored in sand. Release of the parasitoid *Copidosoma koehleri* @ 1.5 lakhs / ton of stored potato.
Whitefly *Bemisia tabaci*	Spraying with 0.05% **formothion** or **dimethoate** or 0.01% imidacloprid or 0.1% acetamiprid.	The affected shoot should be clipped off and destroyed.
Wire worm *Phthorimaea operculella*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha. Application of **Lorsban (Chlorpyrifos) 15G** @ 15 kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.

22. Brinjal Insects

Insect Name	Prescription (Application/spraying)	Advices
Shoot & fruit borer *Leucinodes orbonalis*	Application of ***Bacillus thuringiensis*** (Bt) @ 2 ml/l of water, **Spinosad** @ 0.4 ml/l of water, **Abamectin** @ 1.2 ml/l of water, **Azadirachtin** @ 3 ml/l of water at 7 days interval are effective to manage the borer.	Removal and destruction of all infested shoots, all fallen dry leaves and other debris from the field. Releasing *Trichograma* (egg parasitoid) @ 1gm (about 25,000 egg) at first weekend and *Bracon* (larval parasitoid) @ bunker (800-1200 larvae) at next weekend are found most effective. The use of effective sex pheromone lures (E-11-hexadecenyl acetate) in traps at the rate of 100 traps per hectare.
Epilachna beetle *Epilachna dodicastigma*	Spraying **Malathion** 50 EC @ 2 ml /L water. The treatment should be applied as soon as the pest appears and repeated at 15 days interval.	Collection and destruction of all the life stages which are exposed on leaf surfaces. The larvae and adults can be shaken down in pail of kerosinized water early in the morning.
Cut worm *Agrotis ipsilon*	The soil around bases of the vegetable seedling should be sprayed with **Chloropyriphos 20 EC** @2L/ha with sufficient water just after transplanting of seedlings for the control of the cutworm.	Collected and killed the pest larvae hidden under the soil to bring the pest population below EIL. The pest larvae can be effectively controlled by using kerosene oil in the irrigation water at the time of its application.
White fly *Bemisia tabaci*	Spraying with 0.05% **formothion** or **dimethoate** or 0.01% **imidacloprid** or 0.1% acetamiprid.	Infested leaves remove and need clean cultivation. The affected shoot should be clipped off and destroyed.
Aphid *Aphis gossypii*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Spotted leaf beetle *Henosepilachna vigintioctopunctata* (Fabr.	Spray application of **carbaryl 0.1%** or **cypermethrin 0.025%** or **profenofos 0.05%**.	In the initial stage, collection and destruction of affected leaves along with the eggs, grubs and adults.

Grey weevil *Myllocerus subfasciatus* or *M. maculosus*	Application of 5% **carbaryl** dust. **Drenching** 0.1% **chlorpyriphos** emulsion into the soil before transplanting.	Inter-culture of the crop regularly to prevent population build up and carry over of these weevils.
Leaf hopper *Amrasca biguttula*	Spraying of 0.04 % **phosphamidon** or 0.05% **monocrotophos** or 0.01% **imidacloprid**. Application of 5% **dimethoate** granules in seed furrows @ 20 kg/ha.	Light trap use to destroy hopper. Excess use of N fertilizer should be avoided.
Jassid *Amrasca devastans*	Spraying with **Admire 20 SL** @ 0.125L/ha. Spraying with **Actara 25 WG** @ 100gm/ha. Spraying with **Asataf 75 SP** @ 750/ha. Spraying with **Marshal 20EC** @ 1.5L/ha. Spraying with **Talstar 2.5 EC** @ 900ml/ha.	Use of sticky traps. Destruction of alternate host.
Thrips *Thrips palmi*	Using **Spinosad** as **Tracer 45SC** 200 ml/ha in 500 L water.	Establishment of optimum shade in plantation. Keeping the section weed free and improve drainage condition. Frequent plucking to remove thrips and their eggs.
Red spider mites *Tetranychus urticae*	Subterranian termites can be controlled by destroying queen either by digging it out or dropping **aluminium phosphide** tablets inside the termetorium @ **2 tabs/termetorium** of 1m or pouring chlorpyriphos 20 EC diluted @60 ml/18 liter of water. Dusting with **sulphur** dust or spray application with wettable sulphur powder. (ii) Spraying **dicofol** (kelthane 18.5 EC) 0.0185%.	Destroy termitaria (termite mounds) in the vicinity of fields and treat the spot with sprays. This should be practiced on community basis in villages/farms. Use only well rotten manure, otherwise termite incidence is aggravated.

23. Tomato Insects

Insect Name	Prescription (Application/spraying)	Advices
Fruit borer *Helicoverpa armigera*	Application of **Quinalphos** 25 EC (Debiqueen 25 EC/Kinaluz 25EC) @ 2ml/L of water at an interval of 7-14 days where necessary.	Removal and destruction of all infested fruits with borer larvae inside during the vegetative and reproductive phase of the plant. Use of piercing in the field. The use of effective sex pheromone lures 15 traps per hectare. Inundative release of egg parasitoid *Trichogramma chilonis* @1g (40000-45000adult)/ha. and larval parasitoid *Bracon hebetor* @1bunker (800-1200adult)/ha.
Cut worm *Agrotis ipsilon*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
Whitefly *Bemisia tabaci*	Spraying with 0.05% **formothion** or **dimethoate** or 0.01% imidacloprid or 0.1% acetamiprid.	Infested leaves remove and need clean cultivation. The affected shoot should be clipped off and destroyed.
Leaf miner *Liriomyza munda*	Spray application of **dimethoate** 0.03% or **methyl demeton** 0.025% or **imidacloprid** 0.01%.	Neem cake soaked in water and the decantation when sprayed also controls the pest.
White Tailed Mealy Bug *Ferrisia virgate*	Spray application of 0.05% **monocrotophos** or 0.5% **phosphamidon** or **phosalone**.	Remove and destroy mechanically all the affected leaves and twigs in the early stages of infestation.

24. Bean Insects

Insect Name	Prescription (Application/spraying)	Advices
Pod borer *Maruca vitrata*	Application of *Bacillus thuringiensis* (Bt) @ 2 ml/l of water, **Spinosad** @ 0.4 ml/l of water, **Abamectin** @ 1.2 ml/l of water at 7 days interval are effective to manage the borer.	Uproot and burn the plants well before planting the new crop. Removal and destruction of all infested shoots and fruits during vegetative and reproductive stages of the plant.
Aphid *Aphis craccivora*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection and destruction of infested leaves, twigs, inflorescence and flowers. Many predators like syrphid-fly larvae, the ladybird beetles and the aphid lions kill the aphid. Spraying soap water suspension at the rate of 25ml liquid detergent per liter of water is found effective. Spraying Neem oil @5ml/lit of water mixing along with 5ml Trix at lower surface of the leaf.
Thrips *Magalutrothrips usitatus*	Using **Spinosad** as **Tracer 45SC** 200 ml/ha in 500 L water.	Establishment of optimum shade in plantation. Keeping the section weed free and improve drainage condition. Frequent plucking to remove thrips and their eggs.
Red mite *Tetranychus urticae*	Application of **Dicofol 18.5EC** @ 2 L/ha. Application of **Ethion 46.5 EC** @ 1.26 L/ha.	Heavy rainfall causes significant reduction of the population of JYM.

25. Okra Insects

Insect Name	Prescription (Application/spraying)	Advices
Shoot & fruit borer *Earias vitella* Fab.	Application of *Bacillus thuringiensis* (Bt) @ 2 ml/l of water, **Spinosad** @ 0.4 ml/l of water, **Abamectin** @ 1.2 ml/l of water, Azadirachtin @ 3 ml/l of water at 7 days interval are effective to manage the borer.	Removal and destruction of all infested fruits with borer larvae inside during the vegetative and reproductive phase of the plant. Use of piercing in the field. The use of effective sex pheromone lures 15 traps per hectare.
Whitefly *Bemisia tabaci*	One spray with **Imitaf** 20 SL @ 0.25 ml/l water within 30 days after seed sowing	Infested leaves remove and need clean cultivation. The affected shoot should be clipped off and destroyed.
Jassid *Amrasca devastans*	**Spinosad: Tracer 24Sc** @ 1ml/ L, Beauveria bassiana @ 1 g/ L, Buprofezin: Award 40WSC @ 2ml/L, Emamectin benzoate: Emamectin benzoate 5SG@1g/L	Use of sticky traps. Destruction of alternate host.
Aphid *Aphis craccivora*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Red spider mite *Tetranychus cinnabarinus* Boisduval	Dusting with **sulphur** dust or spray application with wettable sulphur powder. (ii) Spraying **dicofol** (kelthane 18.5 EC) 0.0185%.	Heavy rainfall causes significant reduction of the population of JYM.
Mealybug (); Leaf roller (*Sylepta derogata* Fab.)		

26. Cucurbit Insects

Insect Name	Prescription (Application/spraying)	Advices
Fruit fly *Bactrocera cucurbitae*	Using sex pheromone can reduced the pest population by trapping male fly.	Growing of resistant or early maturing varieties Fruits should harvest before they start ripening. In areas where damage is observed every year, change in sowing dates All the fallen and infested fruits along with the larvae should be collected and destroyed to prevent the carryover of the pest.
Epilachna beetle *E. vigintioctopunctata* Fab.	Spraying **Malathion** 50 EC @ 2 ml /L water. The treatment should be applied as soon as the pest appears and repeated at 15 days interval.	Collection and destruction of all the life stages which are exposed on leaf surfaces. The larvae and adults can be shaken down in pail of kerosinized water early in the morning.
Red pumkin beetle *Aulacophora foveicollis* Lucas	**Sevin 85 WP** @2 ml/L of water at 6-7 days interval to be sprayed till control. Soil application of **Furadan 5G** @2-3g/pit or around the base of the plant followed by light irrigation can kill the larvae.	After harvesting the infested field, must be immediately deep ploughed to kill the grubs in the soil. The creepers should be removed and destroyed at the end of the season to prevent the beetles from over-wintering in the field. Collecting and killing of adult beetle with kerosene oil. Netting the seedling upto 20-25 days to keep them free from insect attack.
Diamondback moth *Plutella xylostella*	Applications of **cypermethrin 10 EC** @ 1.0 ml/L of water give good result.	Application of microbial insecticide *Bacillus thuringiensis* has been reported to have positive effect in suppressing the pest population.

27. Cabbage & Cauliflower Insects

Insect Name	Prescription (Application/spraying)	Advices
Diamondback moth *Plutella xylostella*	Applications of **cypermethrin 10 EC** @ 1.0 ml/L of water give good result.	Application of microbial insecticide *Bacillus thuringiensis* @ 1 kg/ha has been reported to have positive effect in suppressing the pest population.
Cut worm *Agrotis ipsilon*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
Cabbage butterfly *Pieris brassicae*	In case of widespread infestation spray with 0.05% **dichlorvos** or 0.1% **Malathion**.	Pest can be checked by handpicking and mechanical destruction of caterpillars during early stage of attack when the caterpillars feed gregariously.
Tobacco caterpillar *Spodoptera litura*	Spray application of **profenofos** 0.05 % or **phosalone** 0.07 % controls the pest.	Monitoring of moth activity through pheromone traps. Collection and destruction of egg masses and gregarious early instars present on undersurface of leaves.
Leaf webber *Crocidolomia binotalis*	Spraying **cypermethrin** @ 30 g a.i./ha or fenvalerate @ 50 g a.i. /ha or **deltamethrin** @ 10 g a.i. /ha or **cartap hydrochloride** @ 175 g a.i./ha once at primordial initiation (22 days after planting) and repeated either thrice at 7 days interval or twice at 10 days interval.	Mustard sown as trap crop twice i.e. 12 days preceding planting cabbage and again 40 days later controls DBM.
Cabbage aphid *Brevicoryne brassicae*	When more than 5% plants are infested, spray with 0.025% **phosphamidon** or **methyl demeton** or 0.01% **imidacloprid**. Repeat the spraying after a fortnight if still 5% infestation is there.	As soon as aphid infestation appears, cut and destroy the infested shoots mechanically.
Painted Bug *Bagrada cruciferarum* Kirkaldy	In case of heavy infestation, spray with 0.05% **dichlorvos** or 0.05% **endosulfan** or 0.05% **phosalone**. Atleast 7 - 10 days waiting period should be there between treatment and harvest.	Clean cultivation by removing weeds harbouring this pest is imperative for avoiding infestation of these bugs.

28. Pulses crops Insects

Insect Name	Prescription (Application/spraying)	Advices
Chickpea pod borer *Helicoverpa armigera*	Spray insecticides like **Lambda-cyhalothrin** (Karate 2.5 EC) @ 1 ml/l water	Summer ploughing: Deep ploughing of field in hot summer months, May – June. Timely sowing: Early sown crop or short duration varieties escape the damage of pod borer. Intercropping and mixed cropping: Mixed cropping of chickpea with mustard, linseed, barley, coriander. Install bird perches @ 50/ha Sequential release of eggs and larval parasitoids (*Trichogramma* and *Bracon*)
Chickpea black cutworm *Agrotis ipsilon*	Application of **Furadan (Carbofuran) 5G** @ 18kg/ha.	Click beetles & their larvae are prey to both birds small rodents. Crop rotation should be followed.
Chickpea pod fly *Melanagromyza obtuse*	Treatment of bean seed at planting with **Endosulfan 35 EC** Spraying should be done with **Dimethoate** (Tafgor 40 EC) or **Carbosulfan** (**Marshal 20 EC**) @ 2 ml/litre of water.	Avoid late plantings since infestations of bean fly are heavier than. Use optimum level of fertilizer and mulching with rice straw enhance plant growth and induce tolerance to bean fly damage
Black gram hairy caterpillar *Spilosoma oblique*	Spray application of **profenofos** 0.05 % or **phosalone** 0.07 % controls the pest.	Hand picking of egg masses, early instar larvae & killing them by burning/keratinized water.
Black gram pod borer *Euchrysops cnejus*	Application of **Diazinon 10G** @16.60kg/ha. Using **Diazinon 60E** @ 1.70 litre/ha. Application of **Cartap 50 sp** @1.4kg/ha.	Collection & destruction of egg masses by hand picking. Adult moth can be trapped by light trap.
Mung bean aphid *Aphis craccivora*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Lentil aphid *Aphis craccivora*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.

	Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	
Grass pea aphid *Aphis craccivora*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Collection & destruction of infested leaves. Ladybird beetle, spider & damselfly etc. feed upon aphid.
Pigeonpea pod fly *Melanagromyza obtuse*	Treatment of bean seed at planting with **Endosulfan 35 EC** Spraying should be done with **Dimethoate** (Tafgor 40 EC) or **Carbosulfan** (**Marshal 20 EC**) @ 2 ml/litre of water.	Practice resistant variety Avoid late plantings since infestations of bean fly are heavier than. Crop rotation followed
Stem fly *Ophiemyia phaseoli*	Treatment of bean seed at planting with **Endosulfan 35 EC** Spraying should be done with **Dimethoate** (Tafgor 40 EC) or **Carbosulfan** (**Marshal 20 EC**) @ 2 ml/litre of water.	Practice resistant variety Avoid late plantings since infestations of bean fly are heavier than. Crop rotation followed Use optimum level of fertilizer and mulching with rice straw enhance plant growth and induce tolerance to bean fly damage Earthing-up (hilling) of bean plants will foster development of adventitious root systems and enable recovery of infested plants. Recent studies have demonstrated 30% yield increases due to use of the cultural earthing-up practice.
Mung bean pod borer (*Euchrysops cnejus);* Mung bean stem fly (*Ophiemyia phaseoli*) Pigeonpea pod borer (*Maruca vitrata, Euchrysops cnejus, Exelastis atomosa)*		

29. Mustard Insects

Insect Name	Prescription (Application/spraying)	Advices
Mustard Aphid *Lipaphis erysimi*	Application of **Marshal (Carbofuran) 20EC** @1.5L/ha. Application of **Admire (Imidacloprid) 20SL** @0.125 L/ha. Application of **Logor (Dimethoate) 40EC** @ 10002000ml/ha. Application of **Ravthion (Malathion) 57EC** @454ml/acre. Application of **Actara (Thiamethoxam) 25WG** @100 gm/ha.	Set up yellow stick trap to monitor aphid population. The crop sown before 20th October escape the damage. Burb out residues after harvesting. Releasing predatory insect ladybird beetle, spider, damselfly, syrphid-fly & green lace wing etc.
Mustard sawfly *Athalia lugens proxima* Klang	Spray application of **carbaryl** 0.1 % or **endosulfan** 0.07 % or **phosalone** 0.05% or **profenofos** 0.05%	Practice resistant variety. Avoid late plantings since infestations of bean fly are heavier than. Crop rotation followed.

30. Soybean Insects

Insect Name	Prescription (Application/spraying)	Advices
Leaf caterpillar *Hymenia recurvalis* Fb.	Spray application of **profenofos** 0.05 % or **phosalone** 0.07 % controls the pest.	Hand picking of egg masses, early instar larvae & killing them by burning/keratinized water.
Leaf roller (*Lamprosema indicate);* Soybean caterpillar (*Spilosoma/Spilarctia oblique)*		

31. Gourds Insects

Insect Name	Prescription (Application/spraying)	Advices
Fruitflies *Bactrocera cucurbitae* Coq. and *B. ciliatus* Loew	Spray application of three to five rounds of **profenofos** 0.05 % or **fenthion** 0.1 % or **carbaryl** 0.1 % at intervals of 15 days commencing from flowering may be useful. Baits prepared with 10% ripe banana, 10% jaggery mixed with 0.1% **Malathion** or 1g **carbofuran** used in bait traps was found effective or this bait mixture is to be applied as 200 spot splashes per hectare on the undersurface of cucurbit leaves. Use of 0.4 ml **methyl engenol** with 1ml of dichlorvos in bait traps was also found effective.	To avoid infestation by fruit flies, growing of resistant or early maturing varieties has been recommended. To check the damage by these flies, fruits should be harvested before they start ripening. All the fallen and infested fruits should be collected and destroyed to prevent the carryover of the pest. Frequent raking of the soil under the vines or ploughing the infested fields after the crop is harvested can help in killing the pupae.
Snake gourd semilooper *Anadevidia peponis* F.	Spray application of 0.02% **carbaryl** or 0.05% **endosulfan** or 0.05% **monochrotophos**.	The larvae when found in small numbers may be hand-picked and destroyed.
Pumpkin beetle *Raphidopalpa foveicollis*	Spray application of 0.2% **carbaryl** or 0.05% **endosulfan** or dusting 5% **carbaryl** dust or 4% **endosulfan** dust.	Cultural practices like clean cultivation and early sowing will reduce pest damage. After harvesting deep ploughing of infested field to kill the grub in the soil.

32. Til/Sesame Insects

Insect Name	Prescription (Application/spraying)	Advices
Hawk moth/Sphinx moth *Acherontia styx*	Application of liquid insecticides are **Malathion 57EC** & **Diazinon 60EC**.	Hand picking, collection & destruction of caterpillars.

33. Sunflower Insects

Insect Name	Prescription (Application/spraying)	Advices
Capitulum borer *Helicoverpa armigera* Hubner	**Endosulfan** (0.05%) on 25 and 45 DAS is ideal for management of this pest in a short duration variety like Morden. **Endosulfan** (0.05%), **cypermethrin** (0.005%), **fenvalerate** (0.005%) and **deltamethrin** (0.002%) spray @ 650 – 700 litre/ha against the head borer are found to be effective.	A significant reduction in pest density is achieved with the spray of NPV @250 Larval Equivalent/ha. NSKE (5%) and many neem origin pesticides are found effective in reducing damage due to *H. armigera*.
Tobacco caterpillar *Spodoptera litura* Fabricius	Spray of **monocrotophos** 0.05% or **dichlorvos** 0.05% or **cypermethrin** 0.005% in 500-liter water/ha in case of severe incidence.	Monitoring of moth activity through pheromone traps. Collection and destruction of egg masses and gregarious early instars present on undersurface of leaves.
Hairy caterpillar *Spilosoma oblique* Walker	Spraying contact insecticides **endosulfan** or **quinalphos** or **carbaryl** at 0.05 – 0.1 %.	Collection of infested leaves which show characteristic drying symptoms will reduce the population to a great extent because of the gregarious nature of young larvae.
Green semiloopers *Trichoplusia ni, Thysanoplusia orichalcea* Fabr.	Spray **quinalphos** 0.05% in case of severe incidence.	After harvest the land should be ploughed well to expose and kill the hidden pupae in the soil or crevices.

34. Ground Nut Insect

Insect Name	Prescription (Application/spraying)	Advices
Leaf miner *Aproaerema modicella* Deventer	Dusting **phosalone** 4% or **carbaryl** 10% or spraying **fenitrothion** 0.025 % or **phosalone** 0.05% or **monocrotophos** 0.05 % or **chlorpyriphos** 0.05 %.	Neem cake soaked in water and the decantation when sprayed also controls the pest.
Red hairy caterpillars *Amsacta albistriga* Wlk. and *Amsacta moorei* Butler.	Grown up larvae are killed by spray application of **phosalone** 0.05 % or **endosulfan** 0.075%.	The pupae may be collected at the time of summer ploughings and destroyed. Setting bonfires or light traps to attract the moths up to 11.00 P.M. Collection and destruction of egg masses should be carried out during the early stages of attack.

35. Sweet Potato Insects

Insect Name	Prescription (Application/spraying)	Advices
Pink-spotted hawkmoth *Agrius cingulate*	Application of liquid insecticides are **Malathion 57EC** & **Diazinon 60EC**.	Hand picking, collection & destruction of caterpillars.
Green semiloopers *Thysanoplusia orichalcea* (Fabr.)	Spray **quinalphos** 0.05% in case of severe incidence.	After harvest the land should be ploughed well to expose and kill the hidden pupae in the soil or crevices.
Sweet potato weevil *Cylas formicarius* Fb.	Application of **Sevin 85SP** @ 1.7 kg/ha.	Removal & destruction of infested plants at the time of thinning. Crop rotation should be followed.

36. Chili Insect

Insect Name	Prescription (Application/spraying)	Advices
Thrips *Scirtothrips dorsalis* Hood	Spray with 0.03% **dimethoate** or **phosalone** or **monocrotophos** or 0.2% **carbaryl** or 0.04% **triazophos** or 0.075% **acephate**.	Establishment of optimum shade in plantation. Keeping the section weed free and improve drainage condition. Frequent plucking to remove thrips and their eggs.

37. Sorghum Insects

Insect Name	Prescription (Application/spraying)	Advices
Shoot fly *Atherigona soccata* Rond.	Application of 10% **phorate** (Thimet) or **carbofuran** 3% granules at the time of sowing at the rate of 2.5 kg a.i./ha. Spraying of **endosulfan** @ 0.07% or **cypermethrin** @ 0.005% or **cartap hydrochloride** 0.5 kg a.i. /ha or **triazophos** @ 0.5 kg a.i. /ha twice a week after sowing or during second week.	A higher seed rate @ 12 kg/ha is adopted and the affected seedlings are pulled out and destroyed.
Stem borer *Chilo partellus*	Spraying of **carbaryl** 0.1 % or **endosulfan** 0.07% thrice at an interval of 15 days from a month after sowing. Two whorl applications of 4 % **endosulfan** or 10 % **carbaryl** or 4% **cartap hydrochloride** granules, first at 5 kg /ha at 25 – 30 days after crop emergence and second at 10 kg/ha 10 - 15 days later. If infestation is severe, three applications at 5.0, 7.5 and 10.0 kg/ha are recommended.	Collection and destruction of the stubbles which are left in the field or heaped in one corner of the field since they act as a source of infestation, as the larvae hibernate in them.
Midge *Contarinia sorghicola* Coq.	Spraying of **endosulfan** 35 EC 1 liter, or **phosalone** 35 EC 1 liter, or **Malathion** 50 EC 1 litre, or carbaryl 50WP 2 kg per hectare at nearly 90% ear-head emergence and repeated after 4 or 5 days. Phosalone 4% or endosulfan 4% or Malathion 5% or carbaryl 10% or quinalphos 1.5% dust at 12 kg/ha is also effective.	Use resistant variety. Natural biological control agents such as *Platygasterid*, *Eupelmid* & *Pteromalid* wasps which paradise the larvae are effective.

38. Pepper Vine Insects

Insect Name	Prescription (Application/spraying)	Advices
Flea beetle *Longitarsus nigripennis* M.	Spray the spikes with a repellent mixture like **Bordeaux mixture.**	Precautions may be taken to hoe the soil well to kill the underground pupae.

39. Polyphagous Pests Insects

Insect Name	Prescription (Application/spraying)	Advices
Desert Locust *Schistocerca gregaria* Forskal, Migratory Locust *Locusta migratoria* L., Bombay Locust *Patanga succincta* Linnaeus	Treating the crop with NSK extract @ 0.1 % to 0.5% was found to prevent damage by locust. Poison-baiting using wheat bran moistened with enough water to make it crumby and treated with some stomach poison. Chemicals, such as chlorpyriphos, if sprayed or dusted as strip application on the egg-infested fields.	Mechanical destruction of locust hoppers by burning the whole congregation of hoppers with flame-throwers, driving the marching bands of hoppers into trenches made specially for burying them alive. Eggs had to be destroyed by mechanical means like digging out, ploughing or flooding the egg-infested land, etc.
Termite *Odontotermes obesus* Rhamb.	Subterranian termites can be controlled by destroying queen either by digging it out or dropping **aluminium phosphide** tablets inside the termetorium @ 2 tabs/termetorium of 1m or pouring chlorpyriphos 20 EC diluted @60 ml/18 liter of water. Dusting with **sulphur** dust or spray application with wettable sulphur powder. (ii) Spraying **dicofol** (kelthane 18.5 EC) 0.0185%.	Destroy termitaria (termite mounds) in the vicinity of fields and treat the spot with sprays. This should be practiced on community basis in villages/farms. Use only well rotten manure, otherwise termite incidence is aggravated.

40. Stored Insects

Insect Name	Prescription (Application/spraying)	Advices
Rice weevil *Sitophilus oryzae* Maize weevil *Sitophilus zeamais* Confused flour beetle *Tribolium confusum* Red flour beetle *Tribolium castaneum* Khapra beetle *Trogoderma granarium* Saw-toothed grain beetle *Oryzaephilus surinamensis* Lesser grain borer *Rhizopertha dominica* Pulse beetle *Callosobruchus chinensis C. maculatus* Angoumois grain moth *Sitotroga cerealella* Potato tubeworm *Phthorimaea operculella* Indian meal moth *Plodia interpunctella* Rice moth *Corcyra cephalonica*	**Fumigation** is the best treatment for control of the stored insect pests. **Ethyline bromide** (EDB) ampules @ 3ml per quintal with exposure period of 4 days, **Methyl bromide** @ 3.5kg per 100m^3 of space with 10-12 hours exposure, 2-3 **phostoxin** 57% (aluminium phosphide) or Selphos 57% tablet for 1-ton seed with an exposure period of 7 days As insecticide **Sumithion** 50 EC (Fenitrothion) may be used.	For small quantity of seed using metal bin and for bulk storage of seeds using pucca seed store is the best way to protect the seed from infestation. There should be proper treatment of the store-house and the bin before storage. New stock should be kept in other godown if possible. The bags should be kept at least one meter away from the walls and between two vertical rows of the bags. Before storing, the seed moisture must be kept between 8-12%. The grains must be complete dry, fully ripen and free from leaves and straw. Any insect life is likely to be destroyed by natural sunning. Old gunny bags should be disinfested by dipping them in 0.125 percent fenvelerate or cypermethrin for 10 minutes and drying them in shade before filling with grains or using new gunny bags. Insecticide such as Malathion or Sevin (Carbaryl)@ 50ppm can be applied to the bags as protectants. For small scale storage neem oil may also be applied to the seeds as protectants.

Conclusions

From the above study, we can say that if these prescription chapters are with an educated farmer or an agriculturist, then they can be easily produced without any loss of crops or fruits. Not only that, the crops will be good and so I think it can be easily exported in any country.

CHAPTER 1
BOOK: INSECT PESTS, DISEASES AND WEEDS MANAGEMENT

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