AgriCos e-Newsletter
ISSN: 2582-7049
Volume : 01 Issue : 04 August 2020 Article No: 43

Integrated Pest Management (IPM) in Organic Farming

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SUMMARY

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

INTRODUCTION

Integrated pest management (IPM) means the suitable combination of all preventive, cultural, mechanical and biological methods for minimizing infestation of pest below the economic injury level. It favours greater use of all ecofriendly practices like natural pesticides, beneficial insects, birds and special cultivation practices. As in organic farming use of synthetic chemicals are prohibited, the pest management is being done by adopting following methods.

- Use of cultural methods.
- Use of mechanical methods.
- Use of bio control agents and biopesticides
- Use of Organically acceptable chemicals

Cultural or Agronomic Practices

Sanitation: - It includes removal or destruction of diseased plants or pruning infested parts .Introduction of inoculums, pathogen through seed or propagating material, water, plant debris, FYM, compost, implements etc. should be prevented.

Tillage: - Deep ploughing in summer kills the pests, mainly due to exposure or debris destruction. Summer tillage destroys wheat streak virus reservoirs.

Application of manures and soil amendments: - Incorporation of various kinds of organic amendments to soil also holds promise in long-term control of nematodes. Use of chopped shoots, straw, saw dust, animal manure; cakes etc. have resulted in significant reduction in nematodes population. In India, oil cakes of linseed, mustard, peanut, castor bean, *mahuva* and neem have proved effective for nematode control in a variety of crops.

Habitat diversification: - Considering of potential pest problems while choosing crops/crop sequence would go a long way in pest management.

Following are some of the examples.

i. Crop rotation: - Rotation of pest host and non-host crops helps in control of soil borne pests, disease and feeding insects. Rotation of rice with corn or peanut reduce the incidence of rice diseases like leaf blast, bacterial leaf blight and insect pests like rice stem borer, brown plant hopper.

ii. Trap crop:- Trap crops are those crops, grown between the main crop to attract the harmful insect and the insect attacking trap crop can be killed by various method. For. e.g. cotton ball worm (*Heliothis*), is an insect pest of cotton lays down its eggs on maize crop, therefore when a few rows of maize are sown in the cotton field, the eggs are laid on maize, which can be destroyed. Trap crops can also be used for trapping various nematodes.

iii. Intercropping: - Lower incidence of insect pests was found on legumes intercropped with maize. Intercrops of clover, spinach, beans and tomato reduced the incidence of *Brevicoryne brassicae* and *Plutela xylostella* in cabbage substantially.

iv. Strip cropping: - Intervening strip of non-suitable crop prevent movement of insect pest from one strip of a crop to another. Also adjacent strips share unspecialized natural enemies which would move when insect pests build up on the neighboring strips.

v. Use of Resistant Varieties and agronomic manipulations: - Use of resistant varieties with appropriate manipulation of sowing, planting and harvesting dates can help in escaping the pest and disease incidence.

e. Water management: - The scab of potato is suppressed by irrigating potato at the time of tuber formation. Wet weather disease such as halo-blight and anthracnose of beans, early blight and charcoal rot of potatoes can be checked by furrow rather that sprinkler irrigation. Overhead sprinkler irrigation in potato effectively controlled potato moth.

Mechanical Control

There are several physical and mechanical control measures those can be used for the effective management of insect pests. Some of the ways are as follows.

i. Removal of affected plants or plant parts: - The virus affected diseased plants should be removed from the field to prevent the transmission of disease to other plants.

ii. Collection & destruction of egg masses and larvae: - Collect the egg masses and larvae from the field and destroy them to minimize the pest load.

iii. Installation of Bird perches:- Install dried twigs in the field above the crop height to provide shelter to the birds. During rest, birds predate larvae or moth available on the crop.

iv. Use of light traps: - Kerosene lamp traps or light traps are most widely used. Ultraviolet lamps are much more effective than ordinary electric bulbs. These light traps are used immediately after the emergence of moths, before they lay the eggs.

v. Pheromones: - Pheromone is exocrine secretions of insects which are used for communication among different individuals of the species. Insects are known to produce following types of pheromones which elicit different reactions in the insects.

a. Sex pheromone: - It brings together opposite sexes for mating.

b. Aggregation pheromone: - It attracts both sexes generally for feeding on a food source or for mating.

c. Alarm pheromone: - This pheromone alerts other individuals to some source of danger.

d. Trail pheromone: - It mark a trail laid by pioneering individuals towards a source of food. Other individuals follow it to reach the source.

e. Social pheromone: - It governs interaction among organized societies.

The sex and aggregation pheromone have great potential in management of insect pests of diff. crops.

Synthetic sex pheromones are commercially available and are used for surveillance, monitoring and control of many pests such Yellow stem borer of rice, gram caterpillar, Pink boll worm, tobacco caterpillar, Army worm etc.

vi. Use of sticky, coloured plates and other physical traps: - Different species of insect are attracted by diff. colour. The results indicated that yellow plastic plates coated with insecticide were effective in controlling leaf miner.

Use of Bio Control Agents and Biopesticides (Biological Control)

Biological control is one of the important Way to manage the pest & disease in the organic farming. There are several insects and biocontrol agents which do not destroy the crop but rather destroy the insect pests. Conservation of these naturally occurring farmer's friends or multiplying them in the laboratory and release in the fields is called biological control.

A. Bio-control agents: - Important naturally occurring bio-control agents are as follows.

i. Predators: - Predators are bio-control agents those hunt/eat the insect pests. The important Predators are as under

a. Spiders: - Spiders are significant predator. They feed on eggs, larvae, nymphs & adults of the pest or neutral insects. Wolf spider, Dwarf spider, Jumping spider and Lynx spiders are commonly available in nature.

b. Beneficial insects: - Plays an important role in minimizing the pest population.

Commonly available beneficial insects in nature are as follows

Lady bird beetle: - Feed on small plant hopper, small larvae and exposed eggs.

Ground beetle: - They are voracious and consume 3-5 larvae per day.

Cricket: - They feed on eggs and nymphs of plant hopper and leaf hopper.

Assassin bug: - They feed on larvae, moth and butterfly

Mirid bug:- They feed on eggs and nymphs of plant hopper and leaf hopper
Ant: - They feed on wide range of pests
Earwing: - Enters borer tunnels in search of larvae.

ii) Parasitoides: - Parasitoides are friendly species which complete their life cycle on different stages of insect pests. There are several types of parasitoides including egg parasitoides, larval parasitoides, Pupal parasitoides, adult's parasitoides, egg-larval parasitoides, larval-pupal parasitoides etc. Some of the parasitoids species are as below

Trichogramma spp., *Bracon Spp*., *Apntales spp*. *Chelonus spp*., *Brachymeria* spp. etc.

iii) Microbes: - These are microscopic organisms which cause various diseases in the insect pests and pests are killed. The major groups are fungi, bacteria and viruses.

i. Fungi as bio-control agents: - e.g. *Beuvaria spp, Trichoderma* sp., *Hirsutella* sp., etc.
ii. Virus as bio-control agents: - e.g. Nuclear Polyhydrosis Virus (NPV), Granulosis Virus (GV)
iii. Bacterial as bio-control agents: - *Pseudomonas* sp., Bacillus *thuringiensis* etc.

Benefits of Using Bio-Control Agent

- They increase the productivity agricultural produce
- Various beneficial organisms are conserved.
- They are eco-friendly
- They are safe both for human and environment
- They have more export avenues.

Bio-Pesticide

Biopesticide can be defined, as these are certain type of pesticides derived from natural materials as animals, plants bacteria and certain minerals, which are known for their qualities of bio-rationality, bio-deterioration and safe to environment. For e,g. Canola oil and baking soda have pesticide application and considered as bio-pesticides. Bio-pesticides can be classified under the following main categories namely, Microorganisms, Macro organisms, Natural products Semio chemicals, and Genes.

Some examples of Bio-pesticides:-

- Microorganisms: - *Bacillus thuringiensis* strains, *Pseudomonas fluorescens, Trichoderma harzianum and Trichoderma viride*.
- Macro organisms: - *Adalia bipunctata* (Ladybug beetle) and *Trichogramma brassicae*.
- Natural products: - Abamectin, Azadirachtin (Neem), Gibberlic acid and spinosad.

Different parts of the neem tree can affect more 200 insect species and some mematodes, fungi, bacteria and viruses. Neem contains several active chemical, which work in different ways; as a result it is very difficult for any insect to develop resistance to neem. The most well-known chemical in neem is azadirachtin. Total Nine neem limonoids have been found effective to block insect growth. Among these azadirachtin, salannin, meliantriol, and nimbin are most significant. Neem is effective against grass hopper, leaf hopper, Leaf minor. Neem is fairly good in managing beetle, aphids, and white flies. Neem shows considerable potential for controlling pests of stored products. In the traditional practice, neem leaves are mixed with grain kept in storage for 3-6 months.

- Semio chemical :- Sex pheromones
- Genes:- *Bacillus thuringiensis genes* and Class II EPSP synthase genes.

Advantages of Biopesticides

- Biopesticides are less toxic than conventional pesticides
- It avoids environmental pollution.
- Biopesticides generally affect only the target pest and closely related organisms.
- It helps in ecological management of soil

- When used as a component of Integrated Pest management programme, biopesticides can greatly decrease the use of conventional pesticides, while the crop yield remains high.

Biopesticides and IPM products for management of various pest and diseases

Pest/Disease	Bio-control agent
Boll worms, cut worms, borers	BT, Trichogramma, NPV, GV, Chrysoperla, Trap and lures
White fly, Aphides, Jassids and Thrips	Neem 1500 ppm and above, Chrysoperla, Verticillium, Beuvaria, sticky traps,
Mites	Neem 1500 ppm and above, Chrysoperla, Verticillium, Beuvaria,
Wilts, Root rot, leaf spot, anthracnose, mildews	Trichoderma
Bacterial wilts and blights	Pseudomonas
Nematodes	Trichoderma

CONCLUSION

The widespread use of insecticides is ineffective and economically wasteful in the long run. Many insecticides do in fact accomplish the intended task of controlling pest populations. However, their detrimental health and environmental effects make them an inadequate long term solution. In addition, most synthetic and natural pesticides are susceptible to ineffectiveness due to resistance buildup in insects. Thus the only viable solution for the future is integrated pest management. The economic benefits and reduced social costs of these systems present a logical answer to the pest control problem.

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