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Research Article

Eco- Friendly Pest Management in Sustaining Crop Production

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ABSTRACT

Most of the agricultural resources are exploited by modern agricultural technologies. Its urgent need to minimize this exploitation for safe hand over the agricultural resources to the next generation. Sustainable agriculture is a holistic approach of eco-friendly agricultural technologies. Insect pest management is the key input in sustainable crop production. Insecticides are most common pesticides used widely in crop production. They are general biocides having ability to cause toxic to all living organisms. Pesticides are highly potent chemicals that enter our food chain and then begin to increase in their concentrations at successive trophic levels. Till recently, the use of pesticides was considered most effective tool to overcome the pest problems. However, the indiscriminate use of pesticides has led to serious consequences like, harmful residues in the produce, pesticide resistance and outbreaks of secondary pests. This has brought a complete change in strategy of insect pest management. This pest management motivated agricultural scientists, administrators and leaders to promote Integrated pest management (IPM). It is a multidisciplinary eco-friendly approach for pest management, that is practical, economical, effective and protective to both public health and environment. IPM emphasizes the growth of the healthy crop with the least possible disruption to agroecosystems and encourages natural pest management mechanisms. Push and pull technique, Insecticide resistance management and Bioagents & safer insecticides were observed major current advances in eco-friendly pest management. The use of selective pesticides is perhaps the most powerful tool can be favour bioagents diversity. This paper was attempted to investigate the current advances in eco-friendly pest management in sustaining crop production using available literatures and reported studies.

Key words: *Sustainable crop production, Integrated pest management, Eco-friendly approach, Bioagents and Safe insecticides.*

INTRODUCTION

Sustainable agriculture is a holistic approach of eco-friendly agricultural technologies. Most of the agricultural resources are exploited by modern agricultural technologies without taking care of ecology and possible consequences.

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The modern agricultural technologies like, monoculture causing rapid erosion of crops, natural soil fertility and pest outbreaks, while chemical inputs causing environmental pollution and chemical hazards and mechanization causing high cost of cultivation are confined, capital intensive agriculture breakdown of social fabrics of rural communities. Its urgent need to minimize this exploitation for safe hand over agricultural resources to the next generations keeping healthy agriculture for wealthy nation. Insect pest management is the key input in sustainable crop production. Insecticides are most common pesticides used widely in crop production. They are general biocides having ability to cause toxic to all living organisms. Pesticides are highly potent chemicals that enter our food chain and then begin to increase in their concentrations at successive trophic levels[10]. Till recently, the use of pesticides was considered most effective tool to overcome the pest problems. However, the indiscriminate use of pesticides has led to serious consequences like, harmful residues in the produce, pesticide resistance and outbreaks of secondary pests. This has brought a complete change in strategy of insect pest management. This pest management motivated agricultural scientists, administrators and leaders to promote Integrated pest management (IPM). It is a multidisciplinary eco-friendly approach for pest management, that is practical, economical, effective and protective to both public health and environment. The integrated pest management is not a new concept. Many of the components of a sound IPM system were known and practiced before the advent of modern chemicals. It is an evolutionary stage in pest management strategy based on ecological principles and integrates multidisciplinary methodologies in developing agroecosystem strategies[16]. So, the integrated pest management is generally termed eco-friendly pest management. Recently the FAO[6] has defined, Integrated pest management means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

There are four basic principles of integrated pest management or eco-friendly pest management- 1.Pest surveillance 2.Understanding of ecosystem 3.Utilization of economic threshold level and 4.Application of minimum selective chemicals. Pest surveillance is a vital part in the integrated pest management. Surveillance is the constant observation of a subject like a crop or pest, recording the factors observed, compilation of information obtained and prediction of future events about pest population. The control of pest population is a function of the ecosystem itself by means of natural enemies and other factors. The most effective system for controlling pests can be derived only after understanding the ecosystem. The study of individuals is prime importance in forms of their biology and behaviour. This is the potent method for analysis of population phenomenon. The level of pest population is very important consideration for taking up control measures. The determination of threshold level is pre requisite for pest management strategy. The economic threshold level is the pest population density at which control measures should be determined. The application of chemical control measures to pest population has to be in such a manner that target pest population are just kept below the economic injury thresholds. By the application of minimum selective chemicals, the development of resistant population of pest is avoided or delayed the possibility of resurgence of treated population is decreased, adverse effect on non target organism and the cost of control is also lowered[11].

MATERIAL AND METHODS

An extensive survey was investigated on current advances in eco-friendly pest management in sustaining crop production with special reference to India. eco-friendly pest management and sustainable crop production are holistic approach worldwide. There are varieties of techniques for pest management have been practicing since traditional to modern. The integrated pest management termed eco-friendly pest management have been added varieties of new advances to discourage the development pest population onwards Stern *et al*.[17].The pest management techniques were observed to screen eco-friendly pest management techniques. This investigation was undertaken on current advances in eco-friendly pest management in sustaining crop production till recently by using books : Metcalf and Luckmann[9], David and Anatharishnan[4], and Pedigo and Rice[14]; reported studies and subject experts respectively.

RESULTS AND DISCUSSION

There were varieties of pest management techniques observed during study till recently. Push and pull technique, Insecticide resistance management and Bioagents and safer insecticides were observed major current advances in eco-friendly pest management in sustaining crop production

Push and pull technique

The Push and pull technique involves biorational approach of insect pests and their natural enemies by integration of stimuli that act to make the protected resources unattractive or unsuitable to the pest (push), while luring them toward an attractive source (pull), from where the pests are subsequently removed. The pests are repelled or deterred away from the resource by using stimuli that mask host apparency. The pests are simultaneously attracted, using highly apparent and attractive stimuli, to other areas such as traps or trap crops, where there concentrated, facilitating there elimination. The Push and pull techniques are under development and applied in major areas of pests management. The most successful example currently used in practice was developed in Africa for the management of Lepidopteran stemborers like *Chilo partellus, Eldana saccharina, Busseola fusca* and *Sesamia calamistis* in maize and great millet. The technique involves the combined use of intercrops and trap crops using plants that are appropriate to the formers and that also exploit bioagents. The stemborers repelled from the crops by repellent nonhost intercrops, particularly molasses grass (*Melinis minutiflora*), silverleaf desmodium (*Desmodium uncinatum*) (push). These are concentrated on attractive trap plants, primarily napier grass (*Pennisetum purpureum*) or sudan grass (*Sorghum sudanense*) (pull)[2,5].

Insecticide resistance management

Insecticide resistance is one of the serious problems in insect pest management due to continuously intensive use, misuse and overuse of insecticides. Therefore, the Insecticide resistance management is an important component of integrated pest management. Georghiou[7]. has suggested three chemical strategies of resistance management-management by moderation, management by saturation and management by multiple attacks. Metcalf[8], has given basic principles of insecticides resistance management-1.Monitor pests populations 2.Avoid the use of mixtures of insecticides 3.Extend the useful life of satisfactory insecticides 4.Choose a sequence of suitable alternative insecticides and 5.Reduced selection pressure by decreasing the frequency and extent of insecticide application. Some of the important applied approach of insecticide resistance management in the field are given below (Table-1)-

Table-1. Applied approach of insecticide resistance management in the field[3,12]

Species / Production	Site reported	Applied techniques / Limiting factors
More Successful		
Heliothis armigera /Cotton	Australia	Monitoring, thresholds / Area wise compliance
Psylla pyricola / Pear	Western U.S.A.	Monitoring, rotation, regulation, industry compliance / Difficult biology, chemical alternatives
Tetranychus urticae /Pear,apple	Western U.S.A., Australia	Monitoring, unstable-R, selective cpd, rotation formulation, biological control / Grower compliance
Insect pests /Apple	U.S.A.	Monitoring, selective pesticides, resistant bioagents, lack of resistance in key pests / Grower compliance
Less Successful		
Plutella xylostella /Vegetables	Tropical areas	Monitoring,cultural & biological controls / Biological constraints
Psylla pryi,P.pyricola /Pear	Eastern U.S.A., Italy,	Monitoring, synergists / No rotation, no resistance management programme
Heliothis virescens /Cotton	Southern U.S.A.	Monitoring,thresholds,mixures,synergists / Grower apathy,limited compliance

Bioagents and safer insecticides

The bioagents in agroecosystems are threated by pesticides application.The modification of pesticides application is the most commonly implemented form of conservation bioagents. Pesticides application can be modified to favour bioagents in variety of ways, including treating only when economic thresholds observed, use of less toxic formulations, lowest effective rate and timing of pesticides application and temporal & spatial separation of bioagents and pesticides. The use of selective pesticides is perhaps the most powerful tool can be favour bioagents diversity. Ecological selectivity is the judicious use of pesticide, based on critical selection, timing, dosages, placement and formulation with be goal of maximizing bioagents populations. Some of the important insecticides reported as comparatively safe to bioagents are given below (Table-2)-

Table-2. Insecticide reported as comparatively safe to natural enemies[15,1]

S.N.	Natural enemies	Status	Safe pesticides identified
1.	*Lycosa* spp.	Preadator	Phosphamidon
2.	*Coccinella septempunctata*	Preadator	Methyl demeton
3.	*Cyrtorthinus lividipennis*	Preadator	Phosalone, Phosphamidon
4.	*Criptolaemus montrouzieri*	Preadator	Methyl demeton, Endosulfan
5.	*Chrysoperla carnea*	Preadator	Fenvalerate, Phosalone, Endosulfan
6.	*Trichogramma japonicum*	Egg parasitoid	Endosulfan
7.	*Trichogramma perkinsi*	Egg parasitoid	Diazinon, Endosulfan
8.	*Trichogramma achaeae*	Egg parasitoid	Monocropothos, Phosalone, Permethrin, Deltamethrin
9.	*Trichogramma chilonis*	Egg parasitoid	Diazinon, Endosulfan, Deltamethrin, Fenvalerate, Diflubenzuron
10.	*Telenomus renus*	Egg parasitoid	Monocropothos, Phosalone
11.	*Bracon brevicornis*	Larval parasitoid	Phosalone, Endosulfan
12.	*Apanteles papilionis*	Larval parasitoid	Phosalone, Permethrin, Fenvalerate
13.	*Apanteles plutellae*	Larval parasitoid	Monocropothos, Phosalone, Permethrin, Fenvalerate, Cypermethrin
14.	*Apanteles angaleti*	Larval parasitoid	Phosalone, Phosphamidon, Permethrin, Deltamethrin, Fenvalerate
15.	*Eucelatoria bryani*	Larval parasitoid	Monocropothos, Phosalone, Cypermethrin
16.	*Tetrastichus pyrillae*	Egg- larval parasitoid	Quinalphos, Endosulfan
17.	*Chelonus vlackburni*	Egg- larval parasitoid	Phosalone, Permethrin, Diflubenzuron, Dimethoate, Fenpropathrin

By conclusion, pesticides are highly potent chemicals that enter our food chain and then begin to increase in their concentrations at successive trophic levels. The indiscriminate use of pesticides has led to serious consequences like, harmful residues in the produce, pesticide resistance and outbreaks of secondary pests. This has brought a complete change in strategy of insect pest management. This pest management motivated agricultural scientists, administrators and leaders to promote Integrated pest management (IPM). It is a multidisciplinary eco-friendly approach for pest management, that is practical, economical, effective and protective to both public health and environment. So, the integrated pest management is generally termed eco-friendly pest management. There are varieties of techniques for pest management have been practicing since traditional to modern. Push and pull technique, Insecticide resistance management and Bioagents & safer insecticides were observed major current advances in eco-friendly pest management. The use of selective pesticides is perhaps the most powerful tool can be favour bioagents diversity[10]. Obviously, this study will be adding to improve the knowledge for effective strategies in eco-friendly pest management.

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