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Latest Trends and Techniques of Insect-Pest Management in Commercial Vegetable Production

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Growing public awareness and concern about the adverse effects of pesticides on human health, soil and water resources and development of resistance among the insect pests have necessitated the need to look for eco-friendly, safer and effective methods of pest control. This article discusses some eco-friendly methods of pest control which are safe to environment.

Introduction

India is the second largest producer of vegetables, next to China. The existing area under vegetables cultivation is around 79.8 million hectares. India shares 11.8 per cent of world vegetable production with a productivity of about 16.7 tonnes per hectares (Anonymous, 2011). There is huge loss in production of vegetables because of insect pests and diseases. The insect-pest cause about 1-30% loss in vegetable crops, such as cock chafers, cut worms, beetles, borers, grasshoppers and leaf hoppers, aphids, mealy bug, ants, white ants and a very wide range of insect pests. Chemical pesticides are effective for the control of the pests, but their indiscriminate use has resulted in insecticide resistance in pests, resurgence of minor pests and high level of residual toxicity in direct consumables. The most alarming situation is the environmental pollution due to contamination of air, soil and water by these chemical pesticides which results in health hazards and appearance of new disease in human beings (Carson, 2007), their harmful effect upon human life, wild life and other flora and fauna. Growing public awareness and concern about the adverse effects of pesticides on human health, soil and water resources and development of resistance among the insect pests have necessitated the need to look for eco-friendly, safer and effective methods of pest control.

Why insect-pests in vegetable crops are difficult to manage?

- **Multiple generations**- Insects have short life cycle with faster rate of multiplication and can complete more number of generations in a year. For example whitefly can complete 11 generation/year, where as in Punjab mite is believed to complete 32 generation in a year.
- **Unlimited food supply**- Due to year around cultivation pests has sufficient food so there is no dearth period for them.
- **Lack of natural enemies**- Number of natural enemies is considerably abundant in open environment for checking the pest population but in an enclosed structure, where most of the vegetables are cultivated, these natural enemies are hard to exist.
- **Congenial environmental conditions**- The manipulation of environmental conditions inside protected structure favours the faster reproduction and multiplication of insect-pest

A) Ecological Management of Pests

The manipulation of the farming practices for reduction or avoiding pest damage to crops is known as cultural control. Since these manipulations are based on habitat management and require a thorough understanding of different components of the ecosystem in which the pest thrives, this approach has also been called as ecological management or environmental control. The purpose of cultural control practices is to make the environment less favourable for the pest and facilitate the augmentation of population of natural enemies. Cultural practices include planting time, seed rate, plant spacing, tillage, plant diversity, crop rotation and nutrient management.

i) Plant diversity: Ram and Singh (2010) studied the effect of intercropping of spices, cereals and root crops on the incidence of tomato fruit borer, *H. armigera* in tomato. The results obtained from study indicated that the incidence of *H. armigera* was found minimum when tomato intercropped with coriander. Effect of interculture of four cruciferous cultivars viz. *Brassica juncea*. PBR-91, *B. napus* var GSL-1, *B. napus* var. PGSH-51 and *Eruca sativa* var. TMLC-2 on incidence of *H. armigera* on tomato after burying them in soil were evaluated. When two rows of crucifers were buried simultaneously (six day after sowing), *B. napus* var. GSL-1 was the most effective in reducing the oviposition on tomato (1.37 eggs per plant against 2.73 in control).

ii) Mulching: Mulching is often recommended to reduce weeds, disease and pests, and conserve soil moisture. Plastic mulch is outstanding for preventing weeds while organic mulch lowers soil temperatures. Natural organic mulches like rice straw conserve soil moisture and add to the organic matter of the soil. Many vegetable crops have shown significant increase in earliness, yield and fruit quality when grown with plastic mulches and under low tunnels. Bhullar and Dhatt (2011) studied the effect of some cultural practices like training system and various types of mulching was observed on incidence of *Tetranychus urticae* Koch on brinjal grown under both open field and net house conditions. Mite incidence was more in open field conditions than in net house, while in net house crop, incidence of mites was less on crop grown with training system and black polythene mulch.

B) Mechanical Control of Pests

The reduction or suppression of insect population by means of manual devices is referred to as mechanical control. Mechanical control includes collection and destruction, preventative barriers and trapping.

i) Trellis system: Trellis system is effective method to control insect-pests. Incidence of inset-pest is less in trellis system because more penetration of light and pest monitoring is as easy as compared to traditional methods.

ii) Protected cultivation: Insect-pests are known to cause direct damage to vegetable and fruit crops as well as indirect damage by acting as vectors. Polyhouse act as a physical barrier for spread of the pest and consequently plant disease also. It is evident that incidence of insect pests per plant was higher under open field as compared to polyhouse. This could be due to the fact that polyhouse acted as a physical barrier that necessitated more number of spraying of insecticide under open field conditions. Results further indicated that net income was low in open field condition as compared to polyhouse. It was further evident that yield and economic loss were very higher under open field condition as compared to polyhouse

iii) Sticky barriers or traps: Small flying insect pests are attracted by the unique yellow colour and stick to the non-drying glue coating the trap. Many insect pests are difficult to control with insecticides. By catching the winged adults with Yellow Sticky Traps before they reach the plants, the build up of pests is delayed. Existing insect populations may also be reduced. Yellow sticky traps are a non toxic way to control and monitor – whiteflies, aphids, Onion fly, Cabbage white butterfly, fruit flies, thrips, cucumber beetles, fungus gnats, leafhoppers, froghoppers, moths, flea beetles, leaf miners etc. As an integral part of integrated pest management program they can be used in greenhouses, homes, orchards, flowers and vegetable gardens, anywhere insects are a problem.

iv) Lure and kill: Vines and creepers like cucurbits provide hiding place to insect-pest. Fruit fly lays eggs in fruit tissue, so that control of fruit fly is difficult and control measures directed toward adult flies. Some of the commonly used lure for attracting the adult fruit flies is Cue-lure, methyl eugenol, molasses etc. Chaudhary and Patel (2008) used two methods of fruit fly control, viz., aqueous sprays of poison bait (PB) and installation of lure traps as male annihilation (MA) technique, individual and in combination in pumpkin field. They found that combined use of cue-lure baited traps and sprays of poison bait with protein hydrolysate reduce the fruit infestation significantly over their individual treatments during different stages of pumpkin fruit growth as well as resulted in better yield of marketable fruits per unit area.

C) Host Plant Resistance

Plants with constitutive insect resistance possess genetically inherited qualities that results in a plant of one cultivar being less damaged than a susceptible plant lacking these qualities. Although insect resistant plants have been recognized for many years as a sound approach to crop protection, it is only during the last two decades that insect-plant interaction have been extensively investigated from

the behavioural, ecological and physiological points of view. A number of plant characteristics are known to render the cultivars less suitable or unsuitable for feeding, oviposition and development of insect-pest. Broadly, these characteristic can be classified into two categories; biophysical and biochemical. Sultani *et al*. (2011) studied the morphological and bio-chemical bases of resistance in okra genotypes against shoot and fruit borer, *E. vittella*. Resistance genotypes (HB-03-29-7B and HBT-1-19-1-1-2) exhibited adverse effect on various biological parameters of *E. vittella*. Trichome density and length and thickness of fruit pericarp varied significantly among genotypes but they did not show significant relationship with larval duration or survival except that thickness of pericarp manifested significant negative correlation with larval survival. Among phytochemicals; total sugars, total phenols, phosphorus and tannin contents of resistant genotypes caused adverse effects on larval survival, pupal weight and adult emergence. Significant effects were shown by tannin for larval survival, sugar and tannin for pupal weight and tannin for adult emergence.

Conclusion

Cultural practices are basic and eco-friendly way to minimize the insect-pest population. Traps can be used for monitoring and suppression of pest population. Insect resistance varieties should be used along with refuge crop. Various biorational pesticides which are selective and eco-friendly are available to control pests. IPM is the best technique for management of insect-pest.

Future Prospective

- Manipulation of local natural resources for pest management.
- Conservation and augmentation of natural enemies.
- Innovations in farmer's participation and training to utilize the developed techniques.

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