

Why Zero Pests Is Not Always the Best Goal: The Importance of Residual Pest Populations for Conserving Natural Enemies

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A large number of farmers for many generations have thought that a healthy plant is a pest free plant. If there are just a few insects on a crop, people immediately begin to spray for them. Though this method might work in the short term, modern agricultural science has demonstrated that “zero pests” is not necessarily an optimal approach. Agricultural fields are ecosystems where crops, insects, birds, soil organisms and microorganisms live together in agricultural systems. Not every insect is pest and actually many of them are pest controllers that the nature has provided them as a pest controller. Predators and Parasitoids keep pest populations under control at no cost to the farmer. The indiscriminate use of pesticides also kills all beneficial organisms, leading to an imbalance and often to a greater infestation of pests. Thus, the aim of modern agricultural production is not to eradicate all insects, but to keep the pest populations at levels that are not economically damaging conserving beneficial insects that naturally control them in the process.

Nature's own pest managers

There are many organism in every crop field that are beneficial to the crop and are called natural enemies. These include predators, parasitoid and entomopathogenic microorganisms that help control pests. The ladybird beetle, green lacewing, spider, dragonfly, hoverfly, praying mantis and predatory bugs feed upon many insect pests during their entire life. The ladybird beetle can consume hundreds of aphids and the larvae of lacewings are sometimes referred to as “aphid lions” because they have a very voracious appetite. Parasitoid are small wasps which deposit eggs in or on insect pests. While the developing immature parasitoid feed on the host insect, eventually killing it. *Trichogrammas* (species of *Trichogramma* and *Bracon* spp.). The genus *Chelonus*, *Acerophagus* and others have proven to be valuable biological control agents in agriculture. In addition, microbial natural enemies like *Bacillus thuringiensis*, *Beauveria bassiana*, *Metarhizium anisopliae*, *nucleopolyhedroviruses* (NPVs) and *entomopathogenic* nematodes are also crucial in natural suppression. These beneficial organisms make an invisible army that can protect crops every day.

Why Residual Pest Populations are Needed for Natural Enemies?

As the livestock depends upon fodder and birds upon food, so beneficial insects depend upon prey or host. When all the pests are removed from a field, predators and parasitoids will become food and breeding sources. Consequently, they become extinct or decrease in numbers. There are several important roles of a small residual population of pests:

- It feeds predators on a continuous basis.
- It supplies living hosts for parasitoid to complete their life cycle.
- It enables the beneficial insects to be maintained in the crop ecosystem.
- It helps to keep pests in check by allowing natural enemies to be present from the start of pest infestation. So the presence of a few pests may not be a problem, but an investment in long-term biological control.

Crop field ecological balance

Crop fields are not static but living systems and have many interactions occurring on a daily basis. In a balanced ecosystem pests and their natural enemies are in harmony. An increase in feeding and reproduction will also indicate an increase in predators and parasitoids. This is a natural control mechanism which keeps pests from becoming a threat. Too many application of pesticides, however, disrupt this balance by killing beneficial insects in addition to the pests. Biological control is not significant and a pest can rapidly build up if natural enemies are absent. Consequently, farmers continue to be using even more pesticides and this simply creates another vicious circle, resulting in a high cost. The presence of some residual pest

Are you aware of the time to act?

Integrated Pest Management (IPM) advocates pest control only be initiated after the pests reach the Economic Threshold Level (ETL). ETL is the pest population at which management practices should be initiated to prevent economic loss. A few insects doesn't always indicate the need for pesticide application.

For example:

- Ladybird beetles and lacewings are attracted to a few aphids on mustard or cotton and are a natural means of controlling aphids.
- Rice spiders and parasitoids can often be effective in reducing the number of leaf folder in the crop. Predators may control small infestations of whiteflies or mealybugs in vegetable crops.

A set of real-life examples from Indian Agriculture.

Rice Ecosystems

There are a lot of beneficial insects present in the rice field such as spider, mirid bugs, damselflies, dragonflies, and parasitoid insects that naturally control brown plant hoppers and leaf folders in the rice fields. This practice of unnecessary insecticide sprayings to control these beneficial organisms has been repeatedly found to be the cause of severe outbreaks of plant hoppers.

Cotton Fields

Ladybird beetles, lacewings, predatory bugs, spiders and hoverflies are important for controlling aphids, jassids, whiteflies and young caterpillars. Farmers who maintain these natural enemies can typically decrease the number of pesticide applications and still achieve good yields.

Vegetable Crops

Parasitoids attack caterpillars and predators control aphids and whiteflies in crops like tomato, brinjal, chilli, okra and cabbage. Natural enemies can help keep pests down, and sometimes even eliminate them, without resorting to chemicals.

Papaya Cultivation

The papaya mealybug is one of the more extraordinary examples of biological control where the parasitoid *Acerophagus papayae* has been used to successfully control the pest. The introduction and conservation of this minuscule parasitoid brought a balance to the ecosystem and saved papaya crops in many parts of India from insecticide dependency.

Sugarcane

Early shoot borers are naturally suppressed by egg parasitoid like *Trichogramma chilonis*. This biological control agent is a parasitoid that can be conserved to decrease reliance on chemical insecticides.

Role of Digital Technologies

Farmers can accurately identify beneficial insects as well as pests using modern, digital tools. QR enabled Entomo-Cards, mobile applications and digital advisory systems can offer:

- High-quality photographs
- Identification guides
- Relationships between predators and pest

- Predator pest information.
- Economic threshold levels
- Recommendation on necessity of spraying

These technologies enable farmers to make decisions and encourage conservation biological control. Take a look at a discussion about the future of sustainable pest management. Pest management in agriculture is slowly moving from eradication to ecosystem-based pest management. The goal is not to eradicate all insects but to control them to ensure productivity, profitability and environmental sustainability. Conservation biological control sees natural enemies as valuable farm assets. Small populations of pests can be maintained and beneficial insects can also be encouraged – allowing farmers to benefit from the natural mechanisms of pest control.

Conclusion

A pest in a crop field does not always indicate a problem. These are also important food and host plants for natural enemies that are important in providing free and effective biological control in many situations. The goal of "zero pests" may endanger beneficial organisms, lead to pesticide dependence, cause pest reappearance and disrupt ecological balance. Rather, farmers should follow the principles of Integrated Pest Management (IPM), monitor pest numbers closely, and preserve natural enemies wherever possible. The goal of sustainable agriculture is not eradication of the entire pest population, but the establishment of an ecological equilibrium of beneficial organisms and crops.