



Extension Extra

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Insect Pest Management Alternatives

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Managing insect pests has changed significantly since the introduction of inexpensive synthetic insecticides. Making insect management decisions is easier. Traditional methods of insect management such as crop rotation, cultural control, and use of resistant varieties are relied upon less frequently because insecticides are so effective.

However, insecticide use has negative aspects such as insecticide resistance, resurgence of pest species, and harmful effects on non-target organisms. These problems as well as recent public concern over the use of synthetic chemicals in agricultural production systems are encouraging the re-evaluation of traditional methods of insect pest management.

Making Pest Management Decisions

The most effective pest management programs require a thorough understanding of economic thresholds and proper monitoring techniques combined with a knowledge of insect pest biology.

Economic Threshold

An economic threshold is the population density of an insect at which some form of management is required to prevent the insect from increasing to numbers that will cause economic damage to the crop.

Economic thresholds will be different for each insect species on each crop and will vary even for a specific insect-crop complex. For example, the economic threshold will vary with the value of the crop being produced and the cost of control. As the value of the crop increases, the economic threshold decreases. As the cost of treatment increases so will the economic threshold, because it will require more damage by the insect to equal the increased cost of control.

Economic thresholds also are altered by environmental factors. Crops under significant stress, such as drought, may have a lower threshold because the impact of insect damage combined

with drought stress will be much more significant than on a healthy and vigorous, unstressed plant.

Monitoring and Pest Biology

Successful pest management uses a rigorous scouting program to monitor harmful insect populations for the presence of economic infestations. For most insect pests, fields must be monitored at least weekly throughout the season and even more frequently during some critical time periods.

You can scout your own fields or have a professional consultant perform this service. Regardless of who does it or which management strategy is used, *it is essential to scout regularly.* A timely response may allow you to select a more efficient management strategy.

Monitoring requires a thorough knowledge of insect pest biology: you must know where, when, and what to look for in a field.

Do you have the knowledge of insect life cycle, biology, and economic thresholds, as well as the *time*, to conduct an effective pest monitoring program? If not, consider hiring a professional crop management specialist to scout for you.

Alternative Pest Management Strategies

It is necessary to understand pest management alternatives in order to maintain pest populations below economic threshold. Management strategies include crop rotation, tillage, biocontrol, and resistant plants.

Crop Rotation

Crop rotation significantly affects development and survival of some insect species. A good example is the corn rootworm complex. Corn rootworms are the most serious pests of corn in the Midwest corn belt, primarily because of the cultural practice of planting corn following corn. Rotating to a non-corn crop for a year nearly always eliminates corn rootworm damage.

Other examples of the importance of crop rotation include some of the stem-inhabiting pests of small grains such as Hessian fly, wheat stem sawfly, and wheat stem maggot. There simply are no reliably effective chemical controls for these species, so rotation to a non-susceptible crop or use of a resistant variety is the best management strategy available.

Effective use of crop rotations also benefits management of diseases and weeds and provides other agronomic advantages as well.

Tillage

Tillage operations can impact insect population densities, especially insects which dwell or overwinter in soil or in plant residue. However, it's still inadvisable to expect tillage to significantly increase or decrease this group of insect pest species. It has clearly been demonstrated for some insect species that destroying crop residue decreases the overwintering survival of the insect, but unless this residue destruction occurs over a wide geographic area, it will give little benefit to an individual producer.

Tillage timing also has an important effect on insect survival. For example, research has demonstrated that a shallow fall tillage can result in approximately 90% mortality of wheat stem sawfly larvae, whereas the same tillage operation in the spring may result in only about 30% mortality.

Tillage may be used effectively for pest management, but the choice of tillage practice for an individual producer will be influenced by pest biology as well as other agronomic and environmental factors.

Biocontrol

Biological control or natural control occurs constantly in our agricultural system, even without our intervention or awareness. For example, control of European corn borer often is achieved by natural populations of a fungus, *Beauveria bassiana*, and a protozoan, *Nosema pyrausta*. Many other naturally occurring parasitoids, such as was or flies, and predators, such as ground beetles, may be responsible for keeping pest population densities at levels below economic thresholds without producer intervention.

Classical biological control involves the importation and release of natural enemies into a crop system to control a pest species. However, examples of successful biological control in

field crops such as wheat or corn have been few. These crops generally do not provide the long-term system stability necessary for successful, classical biological control.

Perhaps the most impact South Dakota crop producers can have on enhancing biocontrol efforts is to use effective integrated pest management (IPM) programs. Such programs combine various alternative control strategies with the judicious use of pesticides only when economic thresholds indicate the need for a treatment.

Host Plant Resistance

Certain varieties of plants have developed natural defense mechanisms against attack from insects or diseases. In many cases, these natural defense mechanisms may have been enhanced or selected for in plant breeding programs designed to increase agronomic qualities of a plant line.

Plant resistance to insect attack may be physical, resulting from toughness or thickness of tissue that prevents or minimizes insect attack. Examples are solid-stem varieties of wheat, which minimize attack from wheat stem sawfly, and Hessian fly-resistant varieties.

Plant resistance to insects may be chemical, such as corn hybrids containing a compound referred to as DIMBOA that reduces feeding and survival by European corn borers.

New advances in plant genetics and plant engineering have redefined traditional plant resistance to insects. An example is the transfer of the Bt gene that produces an insecticidal protein in the corn plant to control European corn borer and other caterpillar species. Hybrids with these proteins may be available within the next few years.

In Summary

Using insecticides will continue to be an integral part of pest management. The most effective and sustainable insect management strategies also will utilize:

- Rigorous scouting programs.
- An understanding of pest biology.
- An understanding of economic thresholds.
- Traditional pest management methods—crop rotation, resistance varieties, and biocontrol.

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