

PEST MANAGEMENT



Iowa is known around the world for being a food producing state. The abundance and diversity of plant and animal life throughout thousands of years is an essential element in maintaining Iowa's rich soil...some of the richest soil in the world. More than 90% of Iowa land is in agricultural production, a higher percentage than in any state in the United States. How we care for Iowa's natural resources such as soil and water, and all the plants, animals and people that share our space is important now and for the future.

Why is it important to Iowans that agricultural pests are managed?

Reducing the population of pests that can hamper food production makes food more plentiful and thus less expensive. In some cases, it also can make food safer by eliminating harmful bacteria or other substances that could enter the food supply. Agricultural pest control also can reduce the populations of pests that can bother us in our everyday living, such as flies, rodents, and weed pollen. Some human health threats, like rabies and the West Nile virus, are reduced when pests are kept under control. In addition, pest-control methods that reduce pesticide use and limit environmental contamination improve the environment for humans and wildlife.



A tractor sprays a pesticide to make food safer, more plentiful and less expensive.



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Iowa Department of Agriculture and Land Stewardship
www.IDALS.org

Iowa Department of Education/Iowa FFA Association
www.state.ia.us/educate/
www.ffaiafoundation.org/www/assoc.htm

Iowa Egg Council
www.iowaegg.org

Iowa Farm Bureau Federation
www.ifbf.org

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www.iowapork.org

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www.sheepusa.org

Iowa Soybean Promotion Board
www.iasoybeans.com

Iowa Turkey Federation
www.eatturkey.com

ISU Agricultural Education & Studies Department
www.ag.iastate.edu/departments/aged/

Iowa State University Extension 4-H Food Fiber Environmental Science Program
www.extension.iastate.edu/growinginthegarden/

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www.LivingHistoryFarms.org

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www.midwestdairy.com

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www.silosandsmokestacks.org
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**Iowa Agricultural
Awareness Coalition**

Why and how do Iowa farmers manage pests that affect our food supply?

Iowa farmers face many challenges as they work to produce the crops that feed the people and animals in our state and much of the rest of the world. Along with the trials of weather and changing market prices, pests can be a major problem to farmers. Whether the crop they are producing is hay, grain, meat, milk, eggs or wool, it seems there are pests that are never far behind.

A pest is any living creature that upsets the ecosystem of another organism. The mosquitoes that bite you in your back yard, the ants that invite themselves to your family picnic, and the mice that might like to camp out in your attic, are all pests. So are the weeds that can cause people with allergies to sneeze and have headaches. They are an annoyance to you and your family -- and can sometimes even threaten your health -- because they have invaded your space, upsetting your "ecosystem."

For farmers, pests can cause a variety of problems. Sometimes they create economic loss, because they destroy or damage crops, which also makes farm operations less efficient. Farmers would



Field mice can be a pest that farmers need to control.

need to use more land to raise the same amount of crops if they could not control pests. Infestations from pests also can damage the quality and even threaten the safety of the food farmers produce. This ultimately affects all of us, because without pest control, our food could be more expensive and potentially hazardous to our health.

Pests have been a problem for people throughout history. The ancient Greeks used smoke to chase insects away and natural poisons such as arsenic to destroy them.¹ Locusts caused one of the 10 plagues of Egypt that threatened to destroy civilization.² The Irish Potato Famine (from 1845 to about 1850) was caused by a disease called potato late blight, which was accidentally introduced to Ireland from North America. It caused most of the potato crop to rot in the fields during warm, wet weather. More than one million Irish people died of starvation.³

Grasshoppers also caused devastating losses to mid-western farmers in the late 1800s. Huge swarms of grasshoppers devoured entire gardens and fields of food crops within a few hours. Crops were eaten off to the ground, as well as the wool from live sheep and clothing off people's backs. Paper, tree bark, and even wooden tool handles were eaten.⁴

Today, deer are a pest that you often see in Iowa. They love to eat corn, and they consume more than their fair share of Iowa's corn crop. If a farm family has less corn to sell, they make less income, and may need to purchase extra feed for their livestock.

People can act like pests, too. When we litter parks and waterways with garbage or start a forest fire with an unattended campfire, we upset the ecosystem of other animals and plants. When we build roads, houses, industrial sites, or malls on wildlife areas, pastures, or cropland, we destroy the homes of many animals and plants. On a smaller scale, we are pests when we cut down healthy trees or destroy plant life that was once a habitat to animals, or when we spray the wrong chemicals or too many chemicals on our yards.

In food production, pest management is an ongoing concern. The need to protect crops and livestock is always changing. New pests may be introduced, or established pest populations can develop resistance to the ways farmers control them.⁵

The biggest challenge for farmers is to control pests and protect their crops effectively, economically and, above all, safely. The safety of people (including farmers and their own families), animals, insects, land, and water must be protected as pests are controlled. Farmers also need to make decisions regarding how many pests they are willing to tolerate before they take steps to manage them. They have to set "tolerance levels" that help them decide how many pests is too many. It is a delicate balance that farmers must achieve to be successful.

The following is a snapshot of the major pests that affect food production in Iowa:



Corn rootworms are a major pest for Iowa farmers. The larvae stage of the rootworm beetle eats away the root of the corn plant.



Multiflora rose is a problem pest in for many farmers because its thick growth habits hampers corn and bean production.

Common Agricultural Pests in Iowa

Insects

There are many insects that play a part in crop production in Iowa - some are good and some bad.

One example of a “good” insect can be the lady beetle, which eats thousands of aphids, “bad” insects that suck the juices from plant leaves and cause the plants to die. If not stopped, “bad” insects can suck and chew plants, bothering plant growth, damaging grain quality, and sometimes killing the plants while creating even larger populations for the next growing season.

Different insects can cause problems in different years, depending on weather conditions and other factors. Bean leaf beetles may be a major threat in one year; soybean aphids may plague crops the next year. Other insects, such as the European corn borer, return every year and must be dealt with annually.

Insects are a challenge to livestock producers. Biting flies, lice and mites can make animals uncomfortable and less capable of producing milk or gaining weight. Severe insect problems also can weaken animals’ immune systems, making them less able to fight off diseases. Finally, mosquitoes can spread diseases, like the West Nile virus, among animals, especially horses. The West Nile virus can also infect humans.

Weeds

A plant that is growing where it is unwanted is a weed. Left uncontrolled, weeds can grow so aggressively that they crowd out other food-producing plants. They also compete with plants for water, nutrients, and sunlight and can cause slow growth or even death of crop plants.

Weed seeds can be transplanted hundreds of miles when carried by wind, water, and animals. Some plants, such as morning glories, sunflowers and multiflora rose, can be considered desirable in yards and gardens, but are weeds when they grow among food crops.

Both cropland and pastures need weed control. In Iowa, the biggest weed challenges for row crops include grass, ragweed, water hemp, and velvetleaf. In pastures, grass is a wonderful thing, but multiflora rose, leafy spurge, cedar trees, and musk thistles can become challenges.

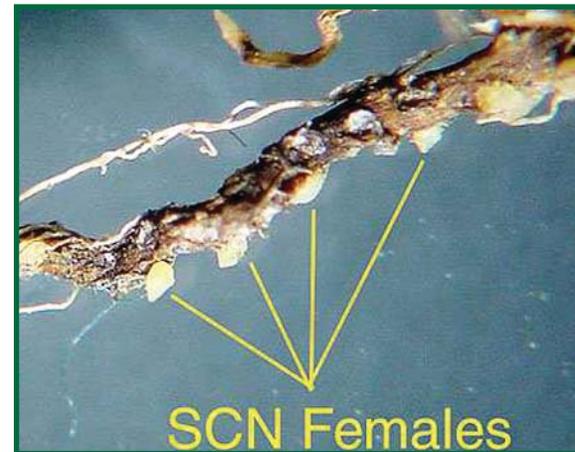
Nematodes

You have probably never seen one, but these tiny, worm-like creatures can cause big problems for Iowa farmers. Soybean cyst nematodes, for example, can cause up to 50 percent loss in soybean yield, because they feed on soybean plant roots and cause plants to produce fewer pods and smaller seeds.⁶

Rodents

Rats, mice and other small rodents are unwelcome visitors in your home, and the same is true for the

Soybean cyst nematodes on the root of a soybean plant. These worm-like creatures eat away at the roots of plants.



farm. Rodents can consume and damage large quantities of grain in storage. In fact, it is estimated that rodents and insects destroy 10 percent of the world's crops each year after harvest.⁷

Rodents also can spread diseases like Salmonella to livestock. Orchard and Christmas tree farmers suffer losses to rodents when they chew bark at the base of trees, causing damage or even death of the trees.

Other Animals

Larger animals also can hamper crop production. Wild turkeys and deer consume large quantities of unharvested hay and grain from Iowa fields. They damage plants by using cornfields to bed down, breaking several rows of corn stalks with their large bodies or wings. Deer also can spread diseases like tuberculosis to cattle. Cats and dogs, especially wild ones, also can be pests. Like rodents, they can spread disease to food-producing animals, as can birds. Dogs, as well as coyotes, are constant threats to cattle and sheep producers who graze their animals in open pastures. Even if they do not kill the sheep and cattle, their presence can cause livestock to become scared and stressed, making cows and sheep less able to gain weight, fight disease and take care of their offspring.

Flies, birds, and other animals can transmit bacteria

from animals to other locations. Wild birds can carry serious bird flu, also known as avian influenza, from poultry house to poultry house and from farm to farm. People also unknowingly can bring bacteria into livestock facilities.

Employees are often required to shower before entering and leaving poultry and hog buildings. These and other practices are called bio-security measures and are done to protect livestock from pests. That is why there are fewer opportunities for public tours in livestock facilities.



Wild deer and wild turkeys can destroy crops

The Role of Pesticides

Clearly, farmers need to take measures to protect their growing crops and livestock from pests. Among the tools they use to do this are pesticides. Although pesticides are often thought to be only farm chemicals, the U.S. Environmental Protection Agency defines a pesticide as “any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest.”⁸

Many of the common household products you and your family use -- such as disinfectants, cleaners to kill mold and mildew, insect sprays and repellents, weed killers and even swimming pool chemicals -- are pesticides.⁹

In food production, following are some types of pesticides that are commonly used:

- Fungicides - Kill fungi, including blights, mildew, molds and rusts
- Bactericides - Kill bacteria, both crop and animal or human infection causers
- Herbicides - Kill weeds and other plants that grow where they are not wanted
- Insecticides - Kill insects
- Nematicides - Kill or slow the development of nematodes
- Rodenticides - Kill mice, rats and other rodents¹⁰

Although these are general definitions, pesticides do not always kill to control pests. Some substances such as insect growth regulators and plant growth regulators disrupt the growth or reproduction rate of the pests rather than killing them.¹¹ What that means is the plant or insect is kept from growing normally so that it doesn't reach a development stage where it can cause damage or reproduce.

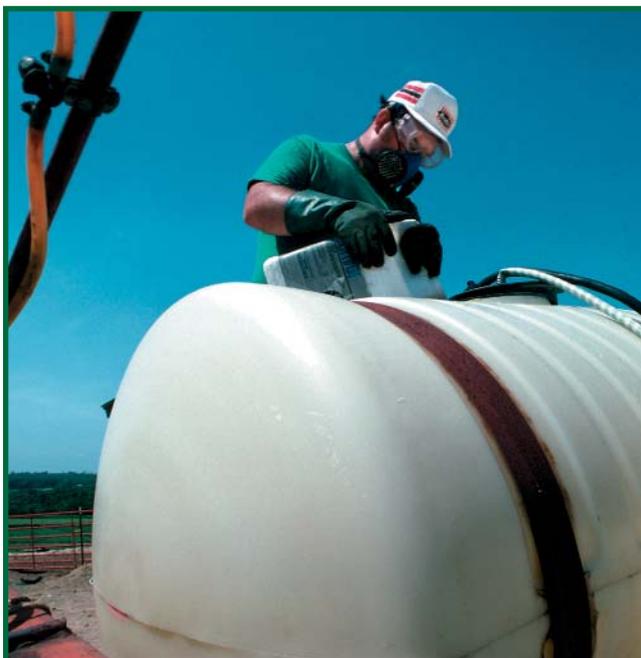
By their very nature, most pesticides create some risk of harm to humans, animals and the environment, because they are designed to kill or otherwise adversely affect living organisms. At the same time, pesticides are useful to society because of their ability to kill potential disease-causing organisms and control insects, weeds and other pests.¹²

Farmers have the responsibility to use pesticides carefully and at the lowest amount needed to control the targeted pest. Most pesticides used today are applied in much lower amounts than in the past. In addition, people now use safer application methods than used in applying pesticides of the past.¹³ Use of pesticides in Iowa is regulated under the “Pesticide Act of Iowa,” Chapter 206 of the Code of Iowa. Section 25 of the Iowa Administrative Code contains the rules that govern the use of pesticides, application, registration, and certification.

In the case of the especially hazardous pesticides, farmers are required to undergo additional special training to use them. These “restricted use pesticides” can only be purchased and used by certified “commercial applicators” who are specially trained to handle and apply them.¹⁴ Iowa State University Extension, in cooperation with the Iowa Department of Agriculture and Land Stewardship, provides pesticide applicator training and certification programs for both private (farmers) and commercial operators.

Using pesticides is not the only way that farmers control pests. Each time a farmer has a pest problem, he or she needs to evaluate how to manage the pest damage best so that the most money can be made and with the least possible hazard to people, property and the environment.¹⁵

Let us take a look at the variety of methods farmers use to control pests.



Farmers use care in applying pesticides. Pesticides are handled to preserve the safety of the farmer and may be applied in a concentrated manner by airplane to target specific fields or areas, minimizing use.

Pest Control

Controlling pests in agriculture requires a lot of thought and evaluation to determine the way that combines the best parts of effectiveness, safety, and economics. In all cases, the farmers must first assess a pest problem and decide if it is severe enough to need control measures. Then, if control is necessary, the farmer needs to decide what control measures to use, and how those actions will affect the pest population (effectiveness) and the area where they are applied (safety). Many pest-control programs cost a lot of money, so farmers need to weigh the cost of the control measure against the benefit it will provide in terms of crop yield and quality protection (economics).

The Food and Agriculture Organization of the United Nations, a group that promotes safe, effective pest control around the world, recommends the following steps:

- (1) Reduction of the pest population;
- (2) Use of cultural (or natural, physical) methods;
- (3) Enhancement of host plant resistance;
- (4) Where appropriate, the identification and use of biological control agents; and
- (5) Use of pesticides when necessary.¹⁶

Here are some examples of how each of these can be done in farming:

- Reduction of the pest population - Hunting of wildlife like deer and wild turkeys can help cut down on the damage these animals do to crops and livestock. Careful hunting also prevents overpopulation, which could otherwise lead to disease and suffering. Trapping of rodents and insects is another example. Insect and plant growth regulators also can limit growth and reproduction of harmful insects and weeds.

- Use of cultural methods - These are considered “natural” ways of controlling pest populations. Examples include using tillage, such as a hoe in the garden, instead of herbicides to control weeds in crops; hauling away manure and other substances that attract flies; sealing grain storage areas to remove the



A farmer conducts crop scouting to determine if there is a pest problem. After assessing the situation, he can decide if it is severe enough to need control measures.

food source for rodents; and eliminating standing water that could provide a habitat for insects such as mosquitoes.

Crop rotation is another common cultural method of pest control used by Iowa farmers. By planting corn on an area of soil one year, then soybeans the next, the natural cycle of many pests that thrive on a specific crop is broken.

- Enhancement of host plant resistance - Through biotechnology, great strides have been made in recent years in breeding plants that are naturally resistant to



These soybeans were planted in a field which was planted to corn the previous year. This crop rotation breaks the cycle of pests thriving on one specific crop year after year.



Bt plant hybrids are used to control the European corn borer.



The European corn borer destroys millions of bushels of corn annually.



The use of Bt and Roundup Ready crops reduce the need for additional chemicals to be sprayed, reducing potential water contamination.

pests. This is often done by taking a good trait from another species and putting it into the genetic make-up of a food-producing plant to make it more resistant to a pest. These crops sometimes are called “transgenic” or “genetically modified” crops.¹⁷

One widely used example of this science is the development of “Bt” plant hybrids to control the European corn borer, a caterpillar that can severely damage corn plants and reduce corn yields. “Bt” stands for *Bacillus thuringiensis*, naturally occurring bacteria that kill the larvae of butterflies and moths. Bt genes are taken from another organism and are then inserted into corn plants. When a European corn borer eats or “bores” into the middle of a Bt corn plant, it ingests a stomach poison that is activated to a deadly level by the insect’s own digestive system, and the caterpillar dies. This poison only works in the stomach of a few types of insects, so we can choose the bad insects while leaving others insects alone.

The Bt gene greatly cuts down on the need for chemical insecticide sprays to control the corn borer. It also is more effective, because sprays on the outside surface of the plant cannot reach the caterpillar, which bores inside the plant tissue.

In addition, reduced insecticide use on Bt crops means less risk of groundwater pollution (water carrying excess chemicals to streams or rivers) and chemical drift (wind blowing chemicals away from where they are placed.) What’s more, Bt crops are not harmful to other insects - just the targeted corn borer - while chemical insecticide sprays could kill beneficial insects along with the targeted ones. Bt also is not harmful to humans, other mammals, birds or fish.¹⁸ It is estimated that Bt plants have saved 60 to 70 million bushels of corn yearly that would have otherwise been destroyed by the European corn borer.¹⁹

Another example of enhanced plant resistance is the development of “Roundup Ready™” technology. This genetic modification of soybean plants allows for the application of a single, highly safe and inexpensive herbicide that controls most weeds in soybean fields, without killing the soybean plant itself. Production of traditional soybean varieties often involves several sprays with three or four different herbicides. Roundup Ready soybeans have reduced weed-control costs (chemicals and spraying) in the United States by an estimated \$200 million per year.²⁰ But we still need science to study weed

control because under repeated use of one weed killer like Roundup™, some weeds may slowly develop that are more able to survive. So we need to keep watch and be ready for any changes that happen.

- Identification and use of biological control agents - Biological control uses living organisms to control other organisms. It uses the “good” species to control the bad. One simple way that livestock farmers do this is to house a donkey or llama with cattle or sheep to protect their herds or flocks from predators like dogs and coyotes. The donkey or llama alerts the herd to threats and are more able to fight the dogs or coyotes.

Many beneficial insects help control other insects. For example, the minute pirate bug is a predator insect that kills aphids, thrips, spider mites and many caterpillars.²¹ Releasing natural enemies of harmful pests helps protect crops naturally by having the “good” insects do the hunting instead of using chemicals.

- Use of pesticides - Sometimes pesticides are simply the most effective way to control pests. These substances must be used responsibly. The evolution of pesticides has led to greater knowledge of scientists and farmers about the capabilities, limitations and risks of using pesticides.



Wide filter strips filter out excess pesticides and other nutrients before they enter streams through the waterway.

The precautions farmers take to use pesticides safely are:

- (1) Using sealed, “lock-and-load” pesticide containers that remove the possibility of human contact with or spillage of insecticides and herbicides;
- (2) Planting buffer strips of grass between crop fields and waterways to “filter out” excess pesticides and crop nutrients before they enter streams and rivers;
- (3) Spraying pesticides only on non-windy days to prevent drift onto neighboring areas;
- (4) Reading and following directions on the pesticide label; and
- (5) Checking equipment to make sure everything works as it should.

Mixing feeding stimulants with insecticides can make insecticides more effective at lower rates. Because the feeding stimulant tastes good to the targeted insects, they eat the spray droplets and ingest the insecticide, instead of relying on surface contact between the insecticide and the insect.²²

A comprehensive approach to pest management called “integrated pest management” or “IPM” also helps farmers use pesticides wisely and in combination with other pest-control methods.



A llama is an example of a biological control to guard flocks of sheep from predators.

IPM Basics

Integrated pest management (IPM) programs are intended to reduce the amount of pesticides needed to reduce crop damage to acceptable levels.²³ Pesticides still may be used, but more selectively and in much smaller quantities.²⁴ In general, IPM programs cause less damage to nature, are economical and are more effective than widespread use of pesticides alone. Here is how farmers use them:

(1) Set action thresholds or triggers - Sometimes a certain number of pests can be tolerated with no action to control them. In IPM, we understand how a pest grows and how it attacks the crop. From knowing that, we can set a point for an individual pest when the populations or environmental conditions tell us that we need to use a pest-control action.

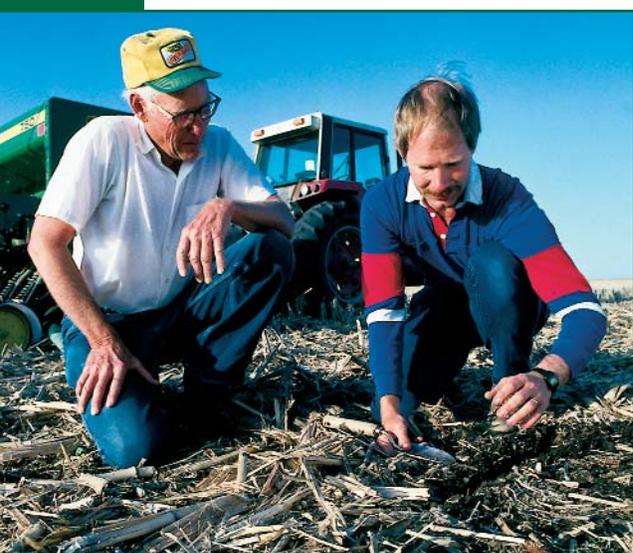
(2) Monitor and identify pests - Not all insects, weeds, and other living organisms require control. Many are harmless, and some are even helpful. Monitoring (counting how many and seeing where they are in the area) and identifying pests removes the possibility that pesticides will be used when they are not really needed, or that the wrong kind of pesticide will be used.

(3) Prevention - As the first line of pest control, IPM programs work to reduce the population of pests, limit their spread, or use cultural methods like tillage or crop rotation to control them.



(4) Control - If all of these measures fail to bring pests under control, IPM programs then evaluate the best control method for both what will manage the pest and what can be done with the least risk. Less risky approaches, possibly use of natural pesticides and biological control, are chosen first. If these approaches do not work, targeted spraying of pesticides may be the next step.²⁵

Timing and carefully monitoring crops for pests also play critical roles in effectively using IPM. For example, weeds are killed more effectively and with less herbicide when they are sprayed very early in their life and insecticides may work effectively at some stages of an insect's life cycle more than others.



Managing soybean cyst nematodes is one example of IPM that employs several different pest-control methods. There is not a simple chemical answer to this pest. Nematicides (chemicals that kill nematodes) are available, but are expensive and do not completely kill the nematodes. Instead, farmers can control the pest by rotating crops and planting resistant soybean varieties.²⁶

Above: Soybean research at Iowa State University sets cause and effect actions for producers to control pests when they reach certain populations, as well as analyzing results of current pest control methods.

Left: Timing and carefully monitoring crops for pests is critical. Farmers use less pesticides and herbicides if the problem is addressed early.

We All Benefit

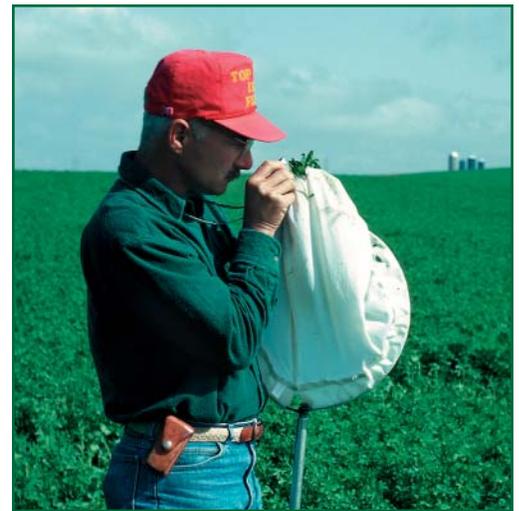
Pest control of food crops helps prevent plant and animal diseases, limits crop loss, and makes farming more profitable. Efficient, high-yield farming also means that more crops can be grown on fewer acres of land. That makes effective pest control a benefit to the environment and frees up land for non-agricultural uses such as parks and wildlife habitat.²⁷

By keeping pests in check, Iowa's farmers can do their jobs better, and we all can enjoy the rewards.

The Iowa State University Entomology Department is a good resource for farmers, school administrators, students, and the public to learn more about IPM. Check out their website and use their lesson plans to understand more about managing pests. The web address is <http://school.ipm.iastate.edu>.

Click on "Lesson plans for teaching IPM principles" at the bottom of the page.

Roundup Ready™ is a registered trademark of Monsanto Company.



Surveying and controlling pests minimizes damage done to field crops, reducing the need for chemicals and increasing the number of crops grown on the land.

Helpful Websites:

- National Agricultural Pest Information System, www.ceris.purdue.edu/napis/
- Department of Entomology, Iowa State University, www.ent.iastate.edu/
- Animal and Plant Health Inspection Service, USDA, www.aphis.usda.gov/
- Grain Inspection, Packers and Stockyards Administration, www.usda.gov/gipsa/
- Natural Resources Conservation Service, www.nrcs.usda.gov/
- Cooperative State Research, Education and Extension Service Pest Management, www.csrees.usda.gov/nea/pest/pest.html
- Integrated Pest Management at Iowa State University, www.ipm.iastate.edu/ipm/
- North Central Region of the National Integrated Pest Management Network, www.ipm.iastate.edu/ipm/nipmn/
- Iowa Department of Agriculture and Land Stewardship Pesticide Bureau, www.agriculture.state.ia.us/pesticidebureau.htm

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- 26 "Soybean Cyst Nematode," Iowa State University Plant Pathology Bulletin, Pm-879, October 1995



Maintaining healthy crops benefits both farmers and the environment.

