

## **Integrated Pest Management of Insect Pests in Alfalfa Hay**

Jon Carpenter, Agriculturist, Nevada Division of Agriculture  
Jeff Knight, Entomologist, Nevada Division of Agriculture  
Wayne S Johnson, IPM Specialist, Nevada Cooperative Extension

**A**lfalfa is a perennial plant that is native to Southwest Asia. It has been cultivated for forage longer than any other crop. Not only does alfalfa have very high yield potential, but it is also one of the most palatable and nutritious forage crops. Because of its high protein and vitamin content, alfalfa is a primary component in the diet of dairy cattle as well as beef cattle and horses. Alfalfa is especially well suited to the unique environmental conditions in Nevada and is the most extensively grown crop in the state. More than 1.1 million tons of high quality alfalfa hay are produced in Nevada annually. A significant percentage of this crop is exported to California and Japan in the form of baled hay, compressed bales, and cubes.

Lush dense foliage and stands that usually remain in the field for several years result in a stable and favorable habitat for a variety of organisms. The majority of insects, mites, and other arthropods found in alfalfa are not detrimental to the crop. A small percentage are considered to be beneficial and only five or six species have a significant effect on crop yields (see table 1). Alfalfa is capable of sustaining some pest damage without significant yield or quality loss. The unnecessary use of pesticides reduces profits. Because of this, alfalfa is especially suited to integrated pest management.

Integrated pest management or IPM is a long term management strategy that uses a combination of biological, cultural, and chemical tactics that reduce pests to tolerable levels, with little cost to the grower and minimal effect on the environment. This fact sheet will focus on IPM strategies that reduce populations of insect pests, resulting in the production of quality alfalfa hay.

Insecticides are useful because they quickly kill a significant portion of an insect population and they sometimes provide the only feasible methods for preventing economic loss. They are convenient and effective management tools that can be incorporated into an IPM program. However, the complete reliance on insecticides is an undesirable approach to insect control. Insect pests may quickly become resistant to chemical pesticides. This results in the use of higher rates and more toxic materials to combat pests. Beneficial insects are often susceptible to chemical insecticides applied for the target pest, and an outbreak of a secondary pest, normally kept in check by beneficials, may occur.

Regulations established to protect endangered animals and plants limit the number of pesticide products that may be applied in areas where these species are known to occur. Public concerns about water quality, worker and food safety and the health of the environment are lending to the development and implementation of new IPM strategies. Because of problems associated with the use of chemical pesticides, researchers and farmers are looking at biological and cultural methods of pest control for more long term and ecologically sound means of sustainable pest control, Table 1.

The use of economic thresholds, field monitoring, and record keeping are important parts of an IPM program. These practices play a key role when making management decisions in an effective IPM program.

**Table 1. Major insect pests of alfalfa hay in Nevada, description of damage, and cultural and biological management options.**

<b>Insect Pest</b>	<b>Damage</b>	<b>Early Harvesting</b>	<b>Dormant season grazing</b>	<b>Natural enemy habitat</b>	<b>Predator/ parasite release</b>	<b>Resistant varieties</b>
<b>Alfalfa Weevil</b>	Larvae feed on foliage, may damage first cutting	X	X	X	X	
<b>Aphids</b>	Suck plant sap resulting in reduced yield and feed value	X	X	X	X	X
<b>Armyworms &amp; Cutworms</b>	Occasional pests, usually feed at night, cut off young plants and feed on the foliage of older plants	X		X	X	
<b>Grasshoppers</b>	Occasional pests, move to cropland from range or wasteland, all stages feed on foliage				X	
<b>Mites</b>	Suck plant sap resulting in reduced yield and feed value, sever during dry conditions	X			X	

### **Economic Thresholds**

An economic threshold is defined as the pest population level that produces damage equal to the costs of preventing damage. The threshold is the pest density level at which a control application should be made. It is important to take into account the overall health and vigor of the crop when making management decisions. A crop that is maintained in a vigorous condition by proper irrigation and fertilization is likely to tolerate more insect pest damage than an unhealthy crop.

### **Field Monitoring (Scouting) and Sampling**

Field monitoring is done by visual inspection and counting, using sweep nets or insect traps. Only after monitoring, it may be determined whether existing pest populations are at the economic threshold. Alfalfa weevil larvae, alfalfa caterpillars, and armyworms are typically sampled with a sweep net. Aphid populations are monitored by counting the number of aphids per stem. The scout shakes the stem onto a white pan or paper and counts the number of insects that fall off. It is important to correctly identify pests and pest damage. Local Cooperative Extension and Division of Agriculture personnel can provide assistance with identification and selection of monitoring techniques. It is equally as important to

properly identify and take into consideration the number of beneficial insects that are present. It is not uncommon for a high population of natural enemies to reduce an insect infestation to a tolerable level within a few days.

### **Record Keeping**

Keep detailed records of observations and counts for both pests and beneficial insects by date. This date is important for making management decisions during the current season and will give important historical perspective to the effectiveness of any controls implemented. It serves as a guide from year to year on when to expect certain pests and may be correlated with weather patterns and fluctuations in insect populations.

### **Resistant Varieties**

It is important to minimize pest problems before they start. Choose and plant alfalfa cultivars that are tolerant or resistant to insect pests and which grow most vigorously under local conditions. There are currently more than 75 cultivars of alfalfa available. Cultivars differ in their resistance to insects. Their vigor, and average yield vary under different environmental conditions and management.

## Early Harvesting

An alfalfa crop may be harvested early to reduce populations of insect pests. Early cutting combines the effects of food loss, decline in humidity, and increase in temperature to reduce populations of immature insects. This practice is used early in the season to kill larvae of the alfalfa weevil. Early cutting

pest populations from increasing to levels that cause economic damage. One approach to biological control is to import and release beneficial species into an area where they previously did not occur. This method is typically used on pests that have been imported from foreign regions. In Nevada, ladybird beetles have been introduced to suppress aphid populations and several

**Table 2. Major predators and parasites of alfalfa hay insect pests in Nevada.**

Predator or Parasite	Alfalfa weevil	Armyworms & Cutworms			Grass-hoppers	Naturally Occurring <sup>1</sup>	Commercially available
		Aphids		Mites			
Ladybird beetle		X		X		X	X
Green lacewing	X	X				X	X
Big-eyed bug	X	X				X	X
Damsel bug	X	X				X	
Minute pirate		X				X	X
Alfalfa Caterpillar parasite			X			X	
Parasitic wasps (many species)	X	X	X			X	X
<i>Nosema locustae</i>					X		X
<i>Bacillus thuringiensis</i> (Bt)			X				X
Predatory mites				X		X	X

1. Naturally occurring populations of predators and parasites may fluctuate, depending on environmental conditions and pest populations.

also helps to avoid damage from armyworms, alfalfa caterpillars, aphids, and mites. Because early cutting will reduce root reserves, repeat early cuttings within a growing season should be avoided.

## Dormant-Season Grazing

Livestock may use alfalfa forage produced between the final harvest and the first killing frost. Recent studies have also shown that dormant-season grazing may be an effective integrated pest management strategy. Cattle grazing on dormant alfalfa in Oklahoma reduced the number of alfalfa weevil eggs by 60 percent. Dormant blue alfalfa aphids were reduced from 220 to 2½ per stem according to research done in New Zealand.

## Biological Control by Insects

Biological control is the practice of using natural enemies such as predators and parasites to suppress a pest population. Insect pests of alfalfa hay have beneficial insects and pathogens that attack them, Table 2. These natural enemies can help prevent insect

species of parasitic wasp have been introduced to help control the alfalfa weevil.

In order to maintain an adequate number of beneficial insects necessary to keep pest species in check, it is sometimes necessary to add to the population of resident predators and parasites. The practice of adding native beneficials is known as supplementation. To be effective, supplementation must be done on a timely basis. It must be known when both beneficial and pest insect occurs. This is accomplished by regular and thorough field monitoring. Native beneficial insects such as big-eyed bugs, lacewings, predatory mites, and parasitic wasps are mass-reared and made available to farmers from a growing number of private suppliers. New technologies are providing innovative and practical methods of distributing beneficials evenly and safely to the target crop.

## Preserving Habitat for Natural Enemies

Because most of the biological control agents at work suppressing the insect pest populations are

naturally occurring, an important approach to biological control of alfalfa insect pests is to protect and conserve populations of these predators and parasites. Methods of habitat conservation used to enhance populations of enemies include harvesting the crop in alternate uncut strips or "strip cutting." Large alfalfa fields may be broken up into cutting cycles which also helps to maintain habitat for beneficials. Leaving uncut strips of hay on alternate irrigation levees or field borders may also preserve habitat for natural enemies. Uncut strips left at one harvest are cut the following harvest, and strips are then left uncut on the previously clean-cut levees.

### Augmenting Habitats for Predators

Improving plantings along fence lines, waste areas, and range sites next to hay fields may augment habitat for natural and introduced predators. Select plants that encourage increases in predator populations. Cultural management with grazing, mowing, irrigation, and weed control may significantly help increase the population and activity of the predators by enhancing their habitat.

### Biological Control by Pathogens

Microbial insecticides are products that contain naturally occurring organisms that cause disease in insect pests. *Nosema locustae*, a protozoan, also known as grasshopper spore or nolo bait, is a biological insecticide consisting of a pathogen that attacks grasshoppers. *Nosema locustae* must be consumed to be effective and its application should be aimed at young grasshoppers. *Bacillus thuringiensis* (Bt) is a bacterial organism, which causes paralysis in the insect's gut, and is fatal when eaten. Products containing Bt are most effective when used against the young larval stage of armyworms and other caterpillars. Both of these microbial insecticides are available through agricultural chemical dealers.

### Summary

When using integrated pest management as an approach to control insect pests of alfalfa hay one must be committed to the long term. Regular field monitoring must be done to keep track of both pest and beneficial insect populations for an IPM program to be effective. Proper identification of insect pests and a

basic knowledge of economic thresholds are essential for an IPM program to be successful. When kept in a vigorous and healthy state an alfalfa crop is more likely to sustain only minor damage from insect pests. Proper management of beneficial insects is important in order to keep insect pests below the economic threshold.

Pesticides are also a part of an IPM program. Because of regulations adapted to protect endangered species, insect resistance, and public concerns about the health of the environment, pesticides are only used when other strategies such as early harvesting or control by beneficial insects and pathogens are not effective at maintaining insect pest populations at tolerable levels.

Check with your local Nevada Division of Agriculture, Cooperative Extension or Natural Heritage Program office for possible endangered species restrictions in your area. They can also make available a listing of suppliers of biological controls agents upon request.

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