Management of Spider Mite Pests in Timothy

Doug Walsh, Ph.D.
Holly Ferguson, Ph.D.
Washington State University, Prosser

Hay from cool-season grasses is an important crop in several Washington State counties. This crop includes several different grass species including orchardgrass, smooth and meadow bromegrasses, tall fescue, intermediate and tall wheatgrasses, timothy, reed canarygrass, and creeping and meadow foxtails. Timothy and orchardgrass are the most economically important. Hay from perennial cool-season grasses is in strong demand for certain livestock classes and on occasion can command prices of two to three times that of alfalfa hay. In addition, these unique crops contribute to agricultural sustainability by preventing soil erosion and surface water runoff and providing wildlife habitat, and having lower input requirements and costs than for annual crops, flexibility of end uses, and high value if managed and marketed correctly.

Perennial grasses can be intensely managed in pure stands for specialty domestic and export grass hay markets, as a forage alternative in rotations with alfalfa, and in cases where environmental conditions are unsuitable for other crops including alfalfa. In addition, grasses are often mixed with perennial legumes at planting or are interseeded into thinning alfalfa canopies to extend stand life.

In Washington, cool-season grass hay is grown on 204,000 acres, with roughly a third of this acreage in timothy in Kittitas County in the central part of the state. From Kittitas County, WA, 30,000 tons are exported to Japan for thoroughbred race horse and dairy cow feed. In recent years, prices have escalated for all types of hay due to the rise in corn prices. For alfalfa hay, prices have fluctuated significantly (from $140 to $200+ per ton) in WA, though average prices for "good quality" hay from cool-season grasses are higher at about $200-250 per ton.

Pest management studies in cool-season grasses have been very limited. The list of registered insecticides and acaricides for cool-season grass crops is short. Sampling protocols, decision thresholds, influence of cultural practices on pest populations, and incidence of biological control are just a few of the areas that are largely unexplored. In Washington, cool-season grass hay production, primarily timothy and orchardgrass, is concentrated in Kittitas County (centrally located Kittitas Valley) and Grant County (the Columbia Basin). Timothy hay producers, in particular, have been plagued with spider mite problems over the past decade. Very little is known about the species composition of these spider mites or of their biology. In addition, there are no effective miticides registered for timothy hay. A SLN 24C registration of methidathion (Supracide 2E, Gowan Co., Yuma, AZ) for the control of spider mites, thrips, and grass scale on timothy or timothy/alfalfa was granted by the Washington Department of Agriculture for use in Kittitas County only; this registration was renewed in 2006. Currently, bifenazate is the candidate for the first registered miticide on grass hay crops. Spiromesifen is another miticide that is slated for registration via the USDA-IR-4 Project. We have conducted

several efficacy studies to test bifenazate, and spiromesifen and several other candidate miticides.

Spider Mite Biology

Several spider mite species can achieve pest status at high population abundance in timothy. We have directly observed two-spotted spider mites (*Tetranychus urticae*), McDaniel spider mites (*Tetranychus mcdanieli*), Banks grass mites (*Oligonychus pratensis*), winter grain mites (*Penthaleus major*), and wheat curl mites (*Aceria tosichella*) are mite species we have observed on timothy hay grown in Washington State. Two-spotted, McDaniel, and Banks Grass mites are all closely related spider mites. Wheat curl mite is a microscopic eriophyid mite with a biology substantially different from spider mites.

All spider mite species develop through several stages: egg, six-legged larva, and eight-legged protonymph, deutonymph, and adult. Males typically reach maturity before females, and will position themselves near developing quiescent females. Under optimal warm weather conditions, most mite species can develop from egg to adult in six to ten days. Egg laying by adult females can begin as soon as one or two days following maturity. The spider mite species that infest timothy hay all overwinter as mated adult females. Damage from mite feeding can cause leaf bronzing, stippling, or scorching. In timothy economic loss is caused by a drop in color quality due to reduction in photosynthesis and the stippling damage that results from mite feeding.
Water stress, wind, and dust all contribute to the potential for outbreak of mite populations. Unfortunately at present no effective miticides, also known as acaricides, are registered on timothy.

Acaricides.

Acaricides are pesticides that are applied to suppress populations of pest mites, and their use has increased substantially over the past half century. Advances in production agriculture have intensified crop damage from mite infestation. Outbreaks of mite populations were uncommon historically in agroecosytems where productivity languished far below the levels achieved in modern production agriculture. Spider mite populations stayed below observable levels due to natural regulation by predators, disease, and poor nutrition from low-quality host plants. However, under modern agricultural practices mite populations often experienced outbreaks in agroecosytems where production levels were bolstered by the use of synthetic inputs including fertilizers and pesticides. When crop production is optimized (i.e., not limited by water, nutrients, or competition from weeds), the plants in production become an excellent food source for pests. Under these conditions, the developmental rate, fecundity, and lifespan of mites are increased and contribute to population outbreaks. Reduction of spider mite natural enemy populations (e.g. predatory mites and insects) from exposure to pesticides also increases the potential for spider mite population outbreaks.

Smothering Agents

Solutions containing petroleum-derived spray oils, vegetable oils, or agricultural soaps are applied to many crops. Application of these types of products kills spider mites

through suffocation. Unfortunately oils and soaps can prove to be phytotoxic to crop plants. We have tested several of these products on timothy in late winter and early spring conditions and have not observed any plant phytotoxicity.

Organophosphates

The organophosphate methidathion (Supracide 2E) does have miticidal properties. However, many mite populations following long-term exposure to organophosphates have developed resistance to this chemical. Additionally, methidathion is extremely toxic to all beneficial predatory or parasitic beneficial mites or insects.

Synthetic Pyrethroids

Lambda-cyhalothin (Warrior) and zeta-cypermethrin (MustangMax) are two synthetic pyrethroid insecticides registered on timothy. Neither of these products is particularly effective on spider mites and I do not recommend their use on spider mites. Spider mites have a well-documented history of rapidly developing resistance to pyrethroid insecticides, and resurgence of spider mite populations following pyrethroid application is typical. Additionally, pyrethroids are extremely toxic to all beneficial predatory or parasitic beneficial mites or insects.

Pending registrations: Bifenazate and spiromesifen are not registered for use on grasses grown for hay

1. Bifenazate (Acramite® Chemtura Corp)

Acramite's active ingredient, bifenazate, belongs to the carbazate class of chemistry. This is a relatively new mode of action for an acaricide. Bifenazate is registered for the control of mobile forms of mites on a number of ornamental and horticultural crops. Acramite™ is very active against all stages of spider mites. The proposed use for bifenazate is 0.75-1.0 lbs active ingredient per acre. One application per year will be permitted with a 14 days pre harvest interval. There will be a 12 hour re-entry interval requirement. Bifenazate provides quick mite knockdown through contact activity and long residual control. Acramite is not systemic in action; therefore complete coverage is essential for product activity. A final report has been drafted and a petition for tolerance will soon be submitted to the US Environmental Protection Agency.

2. Spiromesifen (Oberon® 2SC, Bayer Chemical Co.)

Spiromesifen (Oberon®) belongs to a new chemical class called tetronic acids. Oberon® is a new insecticide/mite control product for spray application to control white flies, mites and jumping plant lice. The proposed use pattern is 0.187 lbs active ingredient in a minimum of 5 gallons per acre by air application or a minimum of 10 gallons per acre by ground. A maximum of 2 applications per season will be permitted.

Spiromesifen is substantially farther behind in the registration process than bifenazate.

Application Technology

Mite pests can prove difficult to control with acaricides due to their potential for high population abundance, small size, and propensity to live on the bottom surfaces of leaves

or within the folds of plant tissues. Good acaricide spray coverage is essential for mite control, particularly for acaricides that kill the pest mite through contact.

Combating Miticide Resistance

Following repeated exposure, spider mite populations have a history of rapidly developing resistance to acaricides. Alternating acaricides that have different modes of action reduces the potential for development of resistance to acaricides within specific modes of activity. It will prove helpful to slow the development of resistance to have both bifenazate and spiromesifen registered. Other techniques to discourage resistance development include spraying only when necessary and treating only infested portions of the crop. Organophosphate and pyrethroid insecticide applications can induce spider mite outbreaks. If possible, avoid early-season insecticide application or apply insecticides that are less disruptive to beneficial arthropods. Careful selection and use of insecticides can potentially reduce the number of miticide applications required later in the season.