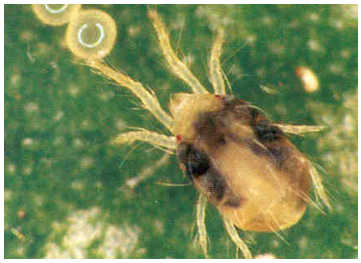
Promoting Conservation Biological Control of Spider Mites in Hops



Two of the most important arthropod pests of hop are the two-spotted spider mite and the hop aphid. There is a naturally occurring complex of predators and parasitic insects (parasitoids) that prey on these pests. Conserving and promoting these natural enemies can enable biological control to play a larger role in regulation of pest populations, reducing or even eliminating the need for chemical control measures in some situations. The potential for controlling these pests with biological control requires an understanding of the factors that promote and disrupt the ecological system within and around hop yards.

In general, conservation biological control can provide control of spider mites at or approaching commercially acceptable level, whereas in practice biological control of hop aphid at commercially acceptable levels is less common. Once developed, biological control of spider mites appears to be relatively stable and resilient. However, there are many production practices that can disrupt and discourage biological control. Achieving high levels of biological control requires examination of the entire production system, careful monitoring, consideration of natural enemies in treatment decisions, and time. This bulletin summarizes some of the key factors that are known to conserve natural enemies and promote biological control.

Early season mites

+

Early season predatory mites

+

Stethorus spp.

=

Early season control of spider mites

Mid-season mites

+

Mid-season *Stethorus,* predatory mites, and predatory bugs

=

Mid-season control of spider mites

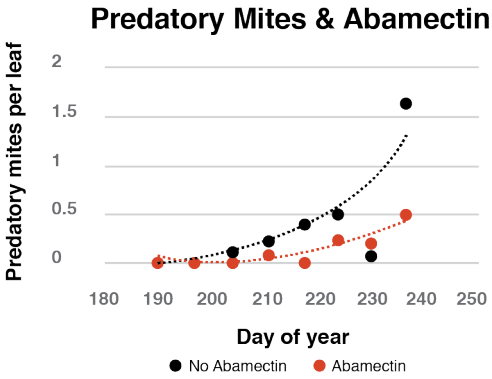
=

No cone damage

Factors Promoting Biological Control of Spider Mites

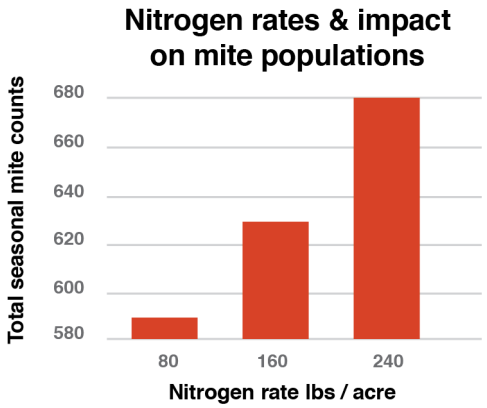
1 Selective miticides and pesticides

- Conservation of natural enemies is essential to implementing biological control. Fortunately, many of the currently registered miticides and insecticides are relatively non-toxic to beneficial arthropods such as bifenazate, hexythiazox, etoxazole, and various Bt products.
- Non-selective products include abamectin, bifenthrin and other pyrethroid insecticides, and ethoprop.



2 Moderate nitrogen rates

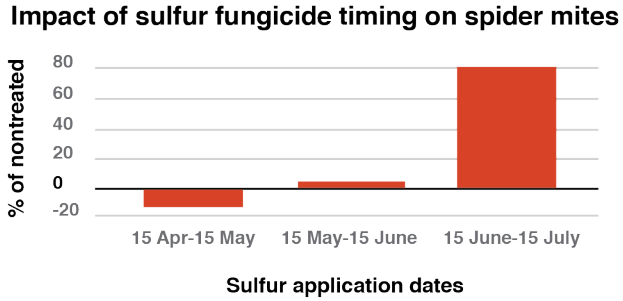
- The reproductive rate of spider mites is influenced by the nitrogen content of host plants. Nitrogen fertility rates should be reduced as low as possible to achieve yield goals. This is year and cultivar dependent. However, under good growing conditions, rates exceeding 200 lbs/A are generally unnecessary.



Factors Promoting Biological Control of Spider Mites

3 Time sulfur fungicide applications to end prior to mid-June.

- Sulfur fungicides applied for powdery mildew management can induce more severe outbreaks of spider mites due to toxicity to predatory mites and indirect effects on spider mites. Restricting use of sulfur fungicides to spring minimizes negative impacts on spider mites.



4 Use selective aphicides and reasonable aphid thresholds

- Several aphicides exist that have minimal toxicity to important predators of spider mites, such as spirotetramat, pymetrozine, and thiamethoxam. Choose these products whenever possible. Imidacloprid can increase mite fecundity and is toxic to certain predators, thus careful use of this chemical is advisable.

5 Manage irrigation and soil to reduce or avoid drought stress

- Water stress can cause a change in host quality and reproductive rates of spider mites and induce pest outbreaks. Careful attention to soil water and root health can reduce these impacts.

6 Dust suppression on roads near hop yards and within hop yards

- Factors that increase movement of spider mites tend to increase their fecundity. Dusty conditions irritate spider mites and outbreaks more severe. Cover crops both help reduce dust and can provide refugia for natural enemies.

Details to consider

- Two of the goals of establishing biological control are to reduce the number of chemical applications needed for pest management and to reduce the overall risk of severe pest outbreaks.
- Utilizing biological control for pest regulation can require years of investment. Studies in cv. Willamette in Oregon required four years for establishment of biological control.
- Utilizing selective pesticides is essential to establishing and maintaining biological control. Therefore, it is important to have some knowledge of pesticide resistance in the local mite population to choose selective miticides that are most effective. Even a single application of a broad spectrum insecticide can induce a pest outbreak in a hop yard where biological control was established.
- If the goal is to utilize biological control as a means of pest control, sampling of both pests and the key predators needs to occur regularly. A predator to prey ratio range of 5 mites to 1 predator or as high as 31 mites to 1 predator were adequate to provide control and suppress mite populations in a long-term study in Oregon. Sampling for both pests and natural enemies is labor and data intensive. Consultation with a pest management specialist is advisable to provide reliable sampling, identification, and recommendations when transitioning to more biologically-based pest management.

Other resources

- IPM guide https://www.usahops.org/resources/field-guide.html
- Pest management guide https://pnwhandbooks.org/insect/agronomic/hop

Authors:

Joanna L. Woods [1] Oregon State University, Department of Botany and Plant Pathology, Corvallis, Oregon 97331 [1]
Anne E. Iskra [1] Washington State University, Department of Entomology, Irrigated Agriculture Research and
David G. James [2] Extension Center, Prosser, Washington, 99350 [2]
David H. Gent [3] US Department of Agriculture, Agricultural Research Service, Corvallis, Oregon, 97331 [3]