BLUE ALFALFA APHIDS IN THE WESTERN US – MANAGEMENT CHALLEGES AND SUCCESS VARY BY LOCATION

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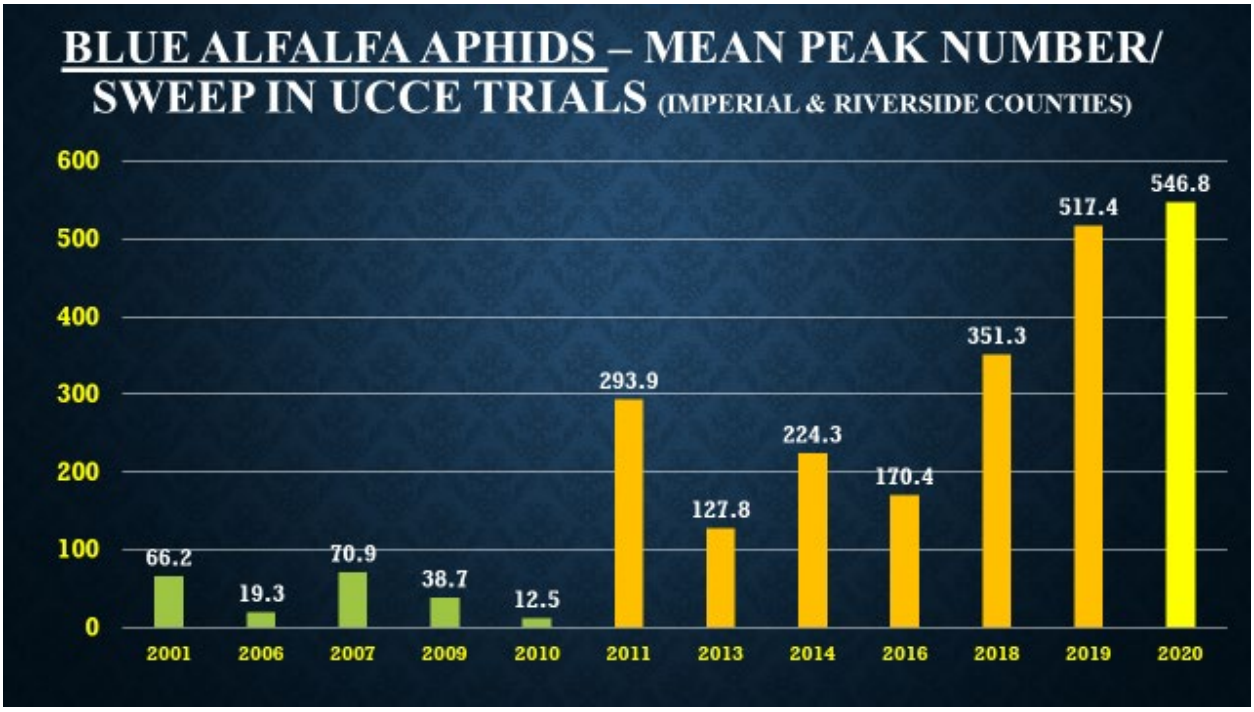
The blue alfalfa aphid, *Acyrthosiphon kondoi*, has become a major pest of United States alfalfa production areas from the Mexican border into the intermountain areas of California, Nevada, and Utah. This insect is problematic due to the toxin injected while feeding on alfalfa plants multiplied by the large numbers of blue alfalfa aphids that are often present.

Populations of blue alfalfa aphid have been high the past 10 years than the previous decade, with 2020 numbers having the highest mean peak population at just under 550/sweep recorded thus far in the 21st century.



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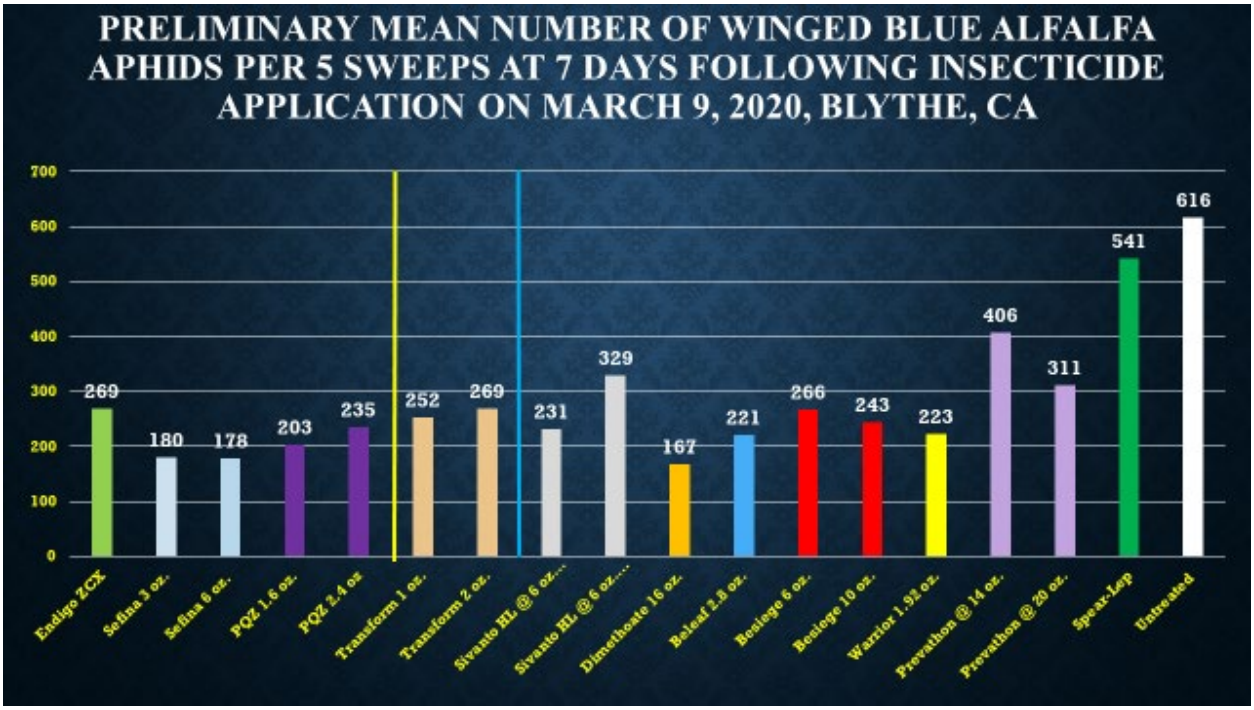
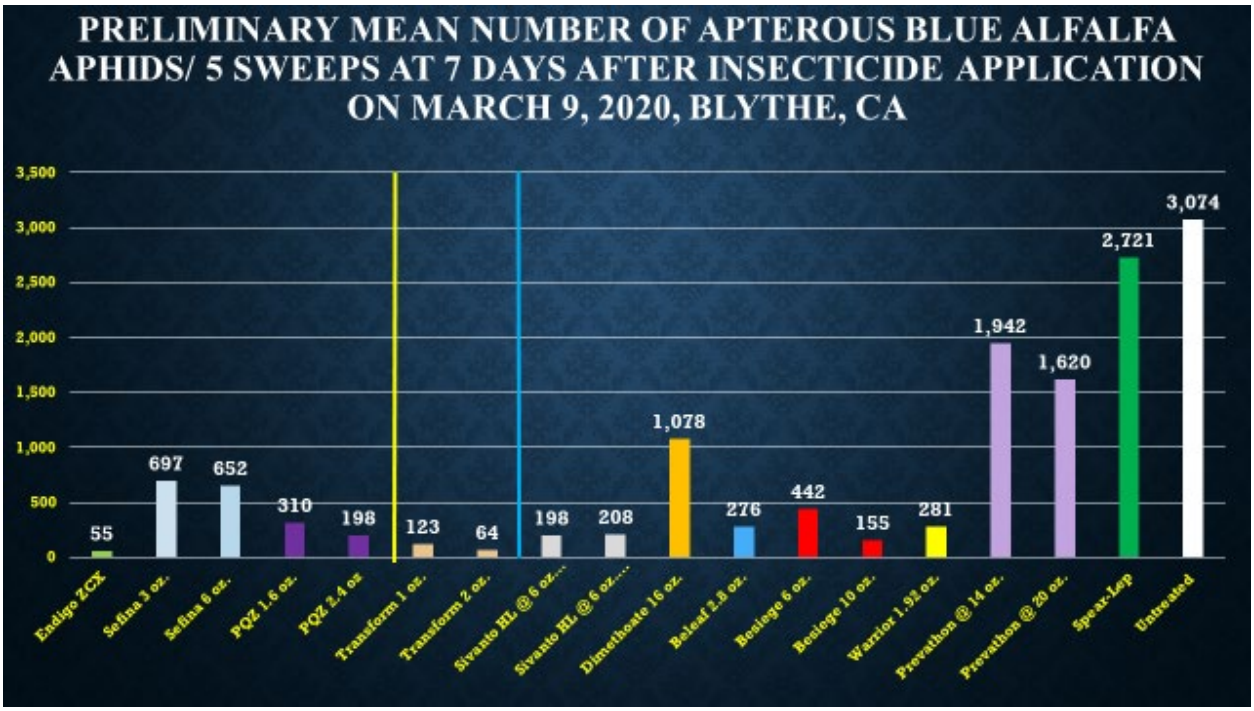
Geographical location is often a large factor in blue alfalfa aphid outbreak but also plays a role in control. The blue alfalfa aphid does not survive hot summer temperatures in the low desert, and is not known to survive freezing temperatures. In Japan, sexual morphs (female and male) have been noted from northern colder climates, but evidence of egg production has not been documented or been able to be found under varying laboratory conditions. This signifies that for most of the U.S., alfalfa fields must be annually re-infested by blue alfalfa aphids flying into the area.

What have we seen in recent years?

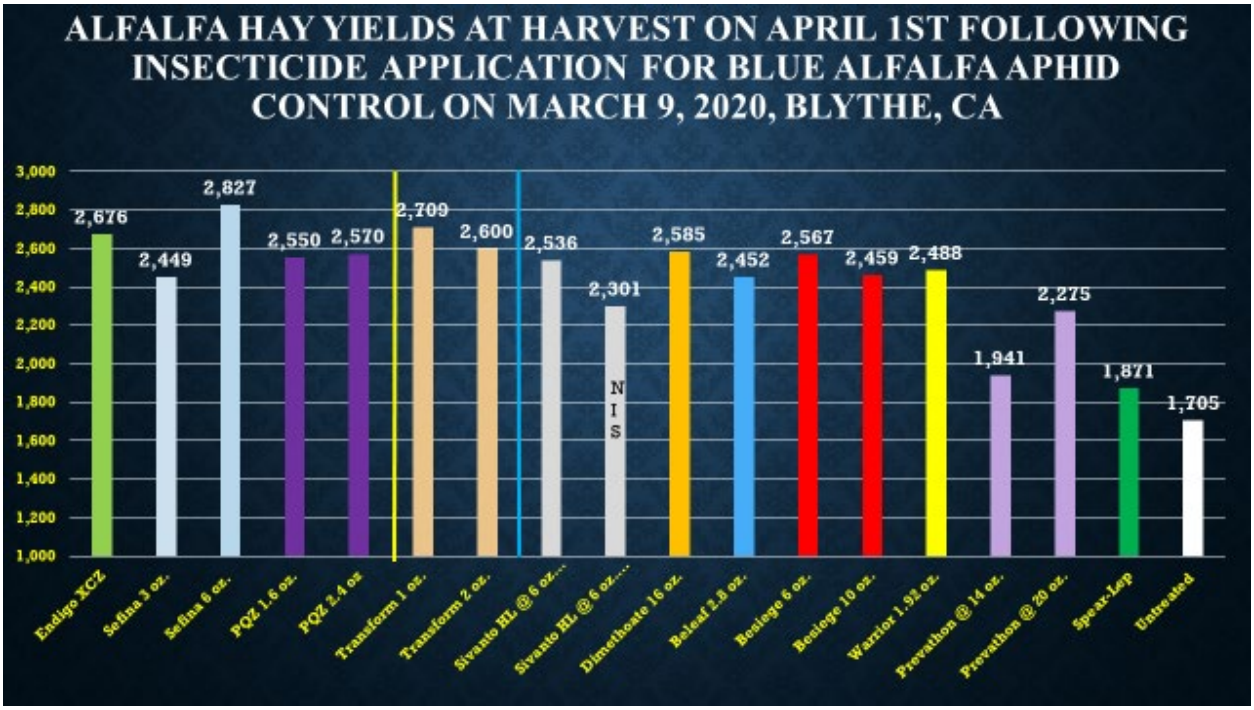
Low Deserts: In 2020 large migrations of winged blue alfalfa aphids were noted in early March from water traps collecting up to 550 winged aphids in two days (approximately 275/sq ft/day). In 2021 such migrations were not documented. The 2020 year allowed insecticide efficacy data to be collected that compared control of the winged vs. non-winged aphids and provided data on the feeding effects of the migrant aphids.

Data from 2020 trials indicate that distinct differences exist between insecticides for repulsion/quick knock down of migrating adult blue alfalfa aphids into plots, and these insecticides do not necessarily the same results for efficacy of stationary (non-winged) aphids. Insecticides that resulted in the fewest number of winged blue alfalfa aphids were Sefina® and Dimethoate.





Increased yields were associated with the treatments that had fewest winged blue alfalfa aphids although they had higher levels of non-winged aphids. This indicates that winged aphids because of their size may be injecting more toxin into plants than smaller aphids. This factor will need to be included in future aspects of economic thresholds. Highest yields were noted from alfalfa treated 6 oz./acre of Sefina® and 1.0 oz./acre of Transform® WG 0.5 or more tons/acre).



Biological controls in the low desert: Many years there are not sufficient biological controls for blue alfalfa aphid. Because of the lack of aphid hosts during the summers, parasitic wasps that attack blue alfalfa aphids are not present in the low desert. The few that are found must arrive in winged migrating aphids that were parasitized prior to arriving in the area.

Many ladybeetles, especially the convergent ladybeetle (*Hippodamia convergens*), prefers cooler temperatures. This species, while sometimes comprising almost 85% of the entire ladybeetles found in alfalfa in later winter, will often decrease rapidly when daily high temperatures reach and/or are above 85ºF for several days. It is not unusual to have 90ºF temperatures in February in the low desert.

In Arizona and other western states, aphids naturally infected by an entomopathogenic fungus (identified as *Zoophthora* sp. and *Isaria* sp.) have been observed in many alfalfa fields, with infection rates reaching 80% during 2016-2017 (Mostafa et al., 2019). Some fungi require 80% humidity levels for about 10 hours, which may be difficult to achieve naturally.

The commercial pathogenic fungus, PFR-97 20% WDG active = *Isaria fumosorosea)*, is labeled for application by several application methods including foliar as well as through irrigation, with the latter potentially providing the necessary humidity levels. Field testing of PFR-97 in Arizona resulted in alfalfa hay yields comparable to, and even greater, than many of the broad spectrum insecticides, with over 0.5 and 0.17 ton per acre increase in yield compared to the untreated control in 2017 and 2018, respectively (Mostafa et al., 2019).

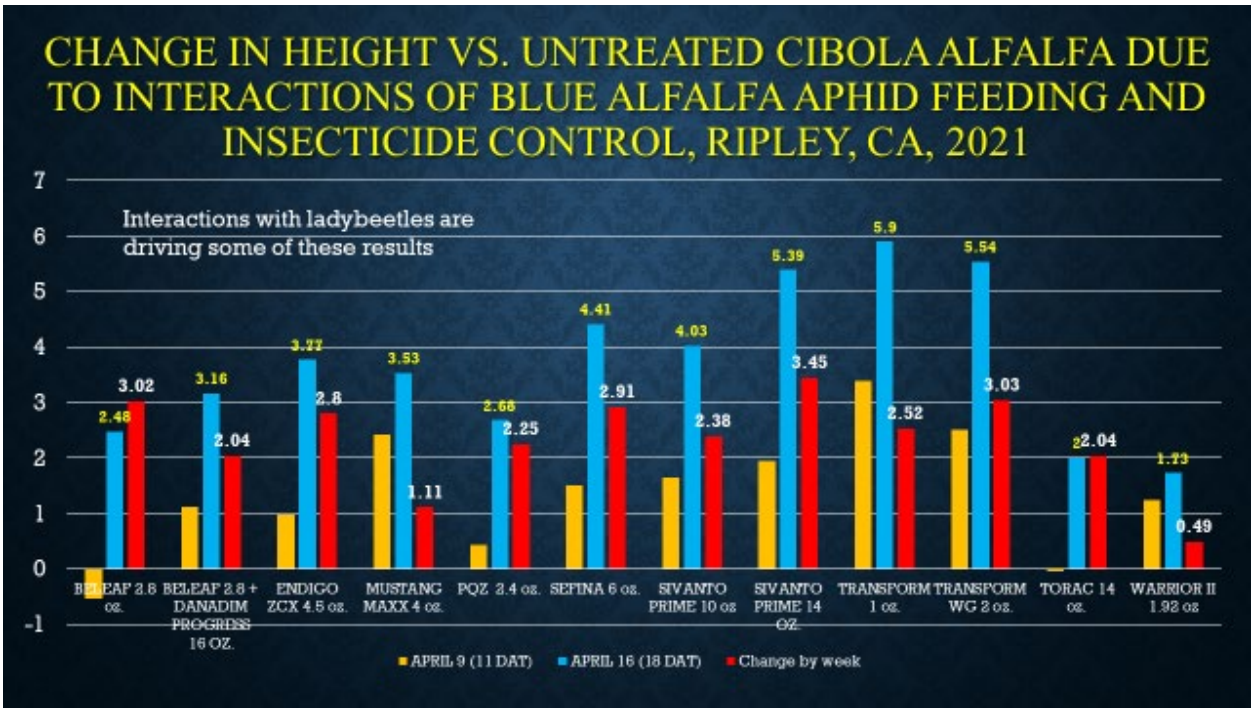
Central Valley of California/late planted fields in low desert

Unlike the low desert, ladybeetles and other beneficial insects are more prominent in the central valley, reducing dependency entirely upon insecticides for control. Disruption of beneficials by the broader spectrum insecticides (dimethoate, pyrethoids) have been noted to result in reduced yields by as much as 0.62 tons/acre compared to untreated alfalfa (Grettenberger et al., 2020). This was due to more aphids in untreated alfalfa than in certain broad spectrum insecticide treated plots due to the elimination/reduction of ladybeetles and demonstrates their value.

Similar results were also noted from a low desert trial in 2021. This situation was very unusual in that it was very late planted alfalfa (Dec.), blue alfalfa aphids were not numerous until late March, the field would endure almost 30 days of blue alfalfa feeding prior to harvest, and 7 spotted ladybeetles were very prevalent. In comparison to other local alfalfa at this time, this alfalfa was slower growing. While broad spectrum insecticides provided the quickest reduction in aphid numbers at 3 days post treatment, they also greatly reduced the numbers of ladybeetles.

Plant height measurements noted that untreated alfalfa was growing faster than most of the broad-spectrum treated alfalfa the latter half of the experiment, and that highest growth rates were documented from alfalfa treated with the higher rates of systemic insecticides (Sivanto® Prime, Transform® WG). The higher rates of these chemistries provided longer control of blue alfalfa aphids than lower rates. This resulted in higher alfalfa yields due to less stunting of alfalfa from blue alfalfa aphid feeding, but also resulted in lower quality due to lower leaf:stem

ratios than other treatments. The 14 oz./acre rate of Sivanto Prime had highest hay yields (2.64 tons), almost 0.6 tons/acre greater than untreated alfalfa (2.05 tons/acre).



Intermountain areas

The blue alfalfa aphid has developed into a major pest in the intermountain areas, and is reported to be seen though much of the area. In Utah, issues were at first isolated to the southern counties, but is now a problem throughout the region. Intermountain alfalfa is usually growing at a slower rate than low desert alfalfa in mid-March due to cooler temperatures, and due to this slower growth is more susceptible to damage by blue alfalfa aphid feeding. Yield losses of over 1.2 tons/acre have been reported in some instances in Utah (Ramirez, 2015).

Death of alfalfa plants can also occur from blue alfalfa aphid feeding, with reports from Utah, Nevada and California. Economic losses of $6 million/county have been estimated by Utah State University Extension personnel (J. Gale, pers. comm.). Intermountain alfalfa is also thought to be affected by blue alfalfa feeding not only in the spring, but also in the fall.

Control of blue alfalfa aphids in intermountain areas is challenging, as beneficial insects are not necessarily prevalent early in the year when aphids begin attacking alfalfa. Most insecticides that are systemic and available for usage in alfalfa are not fully systemic but just acropetally systemic (they move toward the growing tips, not downward toward the root system). This poses difficulty in obtaining desired levels of insecticide control when using these products as foliar applications, due to crop intercept relative to aphid location (which can often be on crowns of plants early in the spring in intermountain areas). The crop intercept can also provide

challenges when treating growing alfalfa, especially when alfalfa is 12+ inches in height, as alfalfa below the treated areas receives very little insecticide. Aphids are somewhat protected in these situations.

Table 1. Blue alfalfa aphid damage comparisons by geographic area

Geographic Area	Alfalfa Growth Rate	Damage from Blue Alfalfa Aphid Feeding
Low Desert *(already established alfalfa hay that is already growing and has been cut)*	**Fast**	Yield losses of 1,000 lbs. hay/acre
In-between	**Medium**	Longer period of growth. Yield losses on newly planted hay of 1,200 lbs./acre, could have been more if aphids had arrived earlier in the growth cycle.
Intermountain	**Slow**	Severe. Can result in plant death of large areas of field by feeding on plants in late winter/early spring; loss of 2,420 lbs./acre

Management and successful control of blue alfalfa aphids is affected by growing conditions at the various locations as there are wide differences across the west. Differences in available products for blue alfalfa aphid also create challenges, as Transform® WG is not available for usage on alfalfa hay in California.

Sefina® has recently been registered for usage in alfalfa hay. Sivanto® Prime has been the industry standard for several years but changes may be on the horizon. The US EPA is currently being sued, with the lawsuit asking the court to vacate registrations on the basis of non-compliance with the Endangered Species Act. Flupyradifurone (Sivanto®) is one product in the pending case.

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