

INSECT PESTS OF ECONOMIC IMPORTANCE ON ALFALFA IN THE IMPERIAL VALLEY--
EMPHASIS ON TREATMENT LEVELS FOR THE BLUE ALFALFA APHID

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Insect pests of alfalfa in the Imperial Valley were virtually unimportant until the invasion by the Egyptian alfalfa weevil almost thirty years ago. A few years later, the Valley hay growers will recall the nightmare of the fifties, the spotted alfalfa aphid. In 1954 with the build up of the aphid, fields of alfalfa turned black from honey dew, dried up from excessive feeding and mowers and balers were ground to a halt after being gummed up by honey dew. Then, in 1975, another aphid joined the existing aphid complex (pea aphid and spotted alfalfa aphid) which made insect pest management of alfalfa more complex than ever before. The aphid called the blue alfalfa aphid caused extensive damage when it was first discovered four years ago.

Other pests of economic importance on alfalfa which occur periodically in the Imperial Valley are the alfalfa caterpillar, the beet armyworm, the cutworms and the sowbugs.

THE EGYPTIAN ALFALFA WEEVIL--Hypera brunneipennis

The Egyptian alfalfa weevil is an increasingly serious pest of alfalfa in the Imperial Valley. There is only one generation of this weevil per year. However, some entomologists suspect that there may be more. Adult weevils begin leaving their overwintering sites in January to invade alfalfa fields. The females lay eggs in the stems of alfalfa plants. Larval populations reach peak infestations in March and virtually disappear towards the end of April.

The adults usually do not feed on the alfalfa to any significant degree but the weevil larvae damage the alfalfa by feeding on the terminal buds and upper leaves first and then gradually moving down the plants. Damage is usually confined to first cutting of alfalfa but sometimes persists into the second or third cuttings.

After the larvae begin to appear, fields should be checked at 2-4 day intervals. The University of California continues to recommend treatment when larval count reaches an average of 20 per sweep. On short alfalfa early in the season or on stubble following cutting which can not be checked with a sweep net, treatment is indicated when growth is retarded because of weevil feeding.

THE SPOTTED ALFALFA APHID--Therioaphis trifolii

The spotted alfalfa aphid, a small pale yellow or greyish aphid begins to appear in alfalfa fields as early as fall. In some years populations of this aphid develop rapidly on new plantings which require chemical treatments. This aphid excretes large amounts of honey dew and usually begins its infestation on the lower part of the plant.

The availability of resistant varieties along with activity of predators, fungus disease and introduced parasite (Trioxys utilis) has reduced this aphid to minor pest status. However, severe infestations may occur when these beneficial factors are not prevalent. Unchecked, heavy infestations of this aphid can retard growth, reduces feed value and may even kill plants.

Planting of resistant varieties has greatly helped in managing the spotted aphid. The use of Systox® is highly recommended to control this aphid. Systox® has demonstrated considerable selectivity being relatively nontoxic to some beneficial insects.

THE PEA APHID--Acyrtosiphon pisum

The pea aphid was a predominant aphid on alfalfa until the appearance of the blue aphid. Field observations show that the blue aphid out competes the pea aphid which has reduced its significance to somewhat minor status.

An introduced parasite of the pea aphid Aphidius smithi continues to be an effective biological control for this aphid in the Imperial Valley. In the presence of pea aphid mummies (parasitized aphids), caution should be exercised in treating for this aphid.

The Egyptian alfalfa weevil, the pea aphid, the spotted alfalfa aphid, and the blue aphid normally occurs at the same time in the Imperial Valley. Economic treatment levels are developed for individual pest species. When they occur together it makes pest management extremely complex. Because alfalfa is the Valley's reservoir for beneficial insects, good pest management of alfalfa is extremely important. Every precaution should be taken to preserve this beneficial complex.

THE ALFALFA CATERPILLAR: Colius eurytheme

Also known as the alfalfa butterfly, this insect has not been a very serious pest for some time. However, in some years the populations can be extremely heavy. The alfalfa butterfly reaches peak infestations in July and August in this valley.

The female alfalfa butterfly seeks out short (usually 6 inches or less) alfalfa upon which to lay her eggs. The small, white cigar-shaped eggs are laid singly on the upper surface of the leaves. Within 3 to 5 days the eggs hatch and the small velvety-green larvae begin feeding on the alfalfa leaves. When the worms are small the infury appears as small, circular holes in the alfalfa leaflets. As the worms grow larger whole leaves are eaten to the point that only bare stems may be left.

The larvae complete their development in ten days to two weeks and then pupate. The pupa of the alfalfa butterfly is called a chrysalis and is attached to the alfalfa stem. After about a week the chrysalis splits open and the adult butterfly emerges. Mating takes place soon after emergence and the females leave the field to find some short alfalfa where they can lay their eggs.

In summary, the eggs are laid on short alfalfa. The worms hatch and "grow up" with the alfalfa. About the time the alfalfa is ready to cut, the caterpillars have pupated and are emerging as adult butterflies. Large numbers of butterflies flying over short alfalfa then may be a forecast of a worm problem in that field within ten days. Large numbers of butterflies flying over tall alfalfa are no threat to that field as they have already done all the damage that they are going to do there. They will go somewhere else to lay their eggs.

Frequently large numbers of eggs are laid on alfalfa, but a damaging worm population does not develop. This situation usually results from the activity of parasites. One of these is Trichogramma, a very minute wasp which parasitizes the butterfly eggs. Newly laid butterfly eggs are pearly white and look like tiny cigars standing on end on the upper sides of the alfalfa leaves. Eggs which are ready to hatch are a greyish color. Parasitized eggs are shiny black. Watching the eggs for a few days following a flight of butterflies and observing the percentage of parasitized eggs is helpful in predicting a worm problem or the lack of one.

Another important parasite is Apanteles, a dark brown to black wasp about 1/4 inch long. This wasp stings the very small alfalfa caterpillar and lays an egg inside. The egg hatches and the wasp larva consumes the body contents of the caterpillar. A parasitized caterpillar dies before it reaches 1/2 inch in length. A parasitized caterpillar is recognized by being lighter than normal in color, somewhat shiny rather than velvety on the surface and swollen toward the rear. By pulling off the head of the caterpillar and squeezing out the body contents, the small shiny, white parasite larva can be seen.

Treatment for alfalfa caterpillar is indicated when the hay is more than one week from normal cutting time and the count averages 10 non-parasitized worms per sweep of the standard insect net. Treatments within a week of normal cutting will not pay as the tonnage gained will not be enough to offset the cost of the insecticide. It is better to cut such a field a little early, than to treat.

Very low dosages of Dylox® or Bacillus thuringiensis are effective on the alfalfa caterpillar and are easy on the beneficial insects.

THE BEET ARMY WORM--Spodoptera exigua

The beet armyworm sometimes occurs simultaneously with the alfalfa caterpillars. In this case, the use of Dylox® or Bacillus thuringiensis is not recommended. Methomyl has provided excellent control of the beet armyworm and will also control the alfalfa caterpillar, but it should be used when absolutely necessary.

The beet armyworm deposits its eggs in large masses which are covered with a white cottony material. The tiny caterpillar feeds on the terminal pests of the plant, making it easily accessible to insecticides. Treatments are usually recommended when counts of beet armyworm caterpillars reach 15 or more per sweep.

SOW

Sowbugs are generally considered non-economic except in greenhouses where plant roots and tender stems are frequently damaged. However, in some years sowbug damage to alfalfa seedlings in some fields has been severe.

The first recorded problem with sowbugs in Imperial County occurred in the fall of 1963. At that time all damaged alfalfa fields inspected followed about the same pattern. After the seed crop, the straw was worked into the soil. Where stands were weak, the fields were reseeded. These fields were dry for 6-8 weeks when over an inch of rain fell. After reseeding and irrigation, seedlings were attacked by sowbugs and completely eaten away. New shoots coming from the old alfalfa crowns were eaten off at or below ground level. Where a plant was bent over against the ground, it was almost completely destroyed.

Sevin® bait is quite effective in combating the sowbug problem.

CUTWORMS

The light streaks, bare patches, and grazed appearance in alfalfa fields which are not being grazed could be caused by cutworms. Unlike other pests of alfalfa which can be detected by sweeping fields with an insect net during daylight hours, cutworms feed at night. In the case of the variegated cutworm it hides beneath trash and in cracks in the soil during the day. From dusk to dawn the cutworms move up on the alfalfa plants where they feed voraciously on succulent new growth. Plants severely damaged have the appearance of having been grazed by cattle. When cutworms are abundant, they can strip a field of all green leaves within a short time and keep it stripped until they mature or are controlled.

Alfalfa fields should be checked for cutworms, especially those which have been watered back for the first time after cutting or pasturing. During the day, look for plants stripped of their leaves and then dig around these plants and look in cracks for the worms. A better method of determining cutworm populations is to sweep the fields at night when the worms are up feeding on the plants. A 5% Sevin® bait continues to be effective treatment for cutworms in alfalfa.

THE BLUE ALFALFA APHID - Acyrtosiphon Kondoi

In 1975, the new aphid was first noticed in the Imperial Valley when commercial pest control advisors observed less than satisfactory control of aphid populations with chemicals applied for pea aphid control or combinations of Egyptian alfalfa weevil and pea aphid control.

Field surveys indicated that an aphid of slightly different appearance than the familiar light green pea aphid was widespread throughout the Imperial Valley and that this smaller, blue-green aphid was inflicting damage to many alfalfa fields.

FIELD OBSERVATIONS:

The blue alfalfa aphid closely resembles the pea aphid. However, there are subtle differences. The blue alfalfa aphid is smaller, more blue-green, and has a waxy appearance, whereas the pea aphid is lighter green and more shiny. The winged and sometimes non-winged adult blue alfalfa aphids have a dark brownish thorax (body region just behind the head, or between the wings on the winged forms). The blue aphid moves faster than the pea aphid, produces more winged forms and clings to an insect net more than the pea aphid. The blue alfalfa aphid prefers to feed on the tender growing tips or on the elongating stem between the nodes, whereas the pea aphid is found up and down the stems and on the leaves.

It is not possible to distinguish the nymphs of the two aphids in mixed populations. Thus, a field estimation of some relative proportion of the 2 populations is important since the blue aphid is far more damaging than the pea aphid.

The feature of more winged forms and the blue aphid clinging to the sweep net can be used where both aphids occur in the same field. After taking 4-5 sweeps with an insect net many aphids will be clinging to the side of the net. The end of the net handle can then be abruptly hit with the palm of the hand or the net handle shaken and most of the pea aphids will fall to the bottom of the net.

DAMAGE:

The blue alfalfa aphid prefers to feed on the tender succulent parts of the alfalfa plant and the aphid colonies cluster on the terminal growth. As the populations increase they tend to congregate on the tender shoots and stems and beneath older leaves.

The first and second instar nymphs are not adequately sampled with a sweep net. When inspecting individual stems the sampler must pry open the small new leaves and search the space between the individual leaves. Many first and second instar aphids can often be found in these areas. A hand lens is usually needed in looking for the early instar nymphs.

When populations are heavy (20 or more per stem on new regrowth) there is a severe stunting of the stems which is characterized by smaller leaves and short internodes. Leaf curling, yellowing, and eventual leaf drop are also common symptoms in severely infested fields. Once the alfalfa is stunted this portion of the plant never seems to recover. There is strong evidence that a toxin is injected into the stems. Stems on the same plant without aphids grow normally while other stems with aphids are stunted. Stunting delays growth, reduces yield and lengthens the normal cutting cycle.

Reproduction of this aphid is markedly decreased as the alfalfa grows taller and more mature. Populations of 100 or more blue alfalfa aphids per stem on three-fourths grown alfalfa cause little damage while the same number on younger alfalfa will reduce yields 1/2 ton per acre.

RESISTANT VARIETIES

Alfalfa plant breeders with the USDA at Reno, Nevada, Tucson, Arizona and the University of California, Davis began to select plants resistant to the blue aphid when it first caused severe damage in the southwest. This work tied in with on-going projects being conducted to develop varieties resistant to the pea aphid.

A new variety was selected by picking out 93 plants from a severely damaged 20 acre field and seed was obtained in the summer, 1975. The various chemical and agronomic tests have been conducted and all meet standards for high quality alfalfa. The resulting variety is called CUF 101 since it is being developed through the cooperative efforts of the University of California, USDA, and farmers interested in the work. This variety is very resistant to the blue aphid.

Unfortunately, this is a non-dormant variety which will restrict its planting to the Yuma Valley, Arizona and the Imperial, Palo Verde and Coachella Valleys in southern California.

BIOLOGICAL CONTROL

The serious damage caused by the blue aphid in the spring of 1975 prompted an intensive effort from the UC, Biological Control Division to search for natural enemies that may attack it. Two parasites were obtained from Japan in an area somewhat similar to the coastal region of northern California. These did not respond when released in the field. A second survey was made into the Middle-East, Iraq, Iran, Turkey - since parts of this area are more climatically similar to the southwest desert areas of Arizona, California, and Nevada. Parasites were collected on other species of aphids closely related to the blue alfalfa aphid. These are still being evaluated for their effectiveness.

One encouraging aspect is that the parasite of the pea aphid, Aphidius smithi which was introduced from India into California and then into Arizona and Nevada in the early 1960's has gone over to attack the blue aphid.

CHEMICAL CONTROL

In 1975, the rapid reinfestation by the blue alfalfa aphid in treated fields was common and this gave an impression of poor knockdown. Our data show the blue aphid is very easy to kill with most materials used on alfalfa for aphid control.

Indeed, in 1976, we had two large scale field plots where the drift and fuming killed the aphids in untreated check plots. The treatments were applied by aircraft and the untreated plots ranged from 150 ft. wide in one test to 300 ft. wide in another test. The material was applied under ideal weather conditions.

ECONOMIC TREATMENT LEVELS:

Our data show that where there are no or very few lady beetles in the field a blue alfalfa aphid population of 10-12 aphids per stem on the new regrowth following cutting could seem to be heading for marked decrease in yield. In one test this amounted to 1/2 ton per acre.

Ten to twelve aphids are not necessarily damaging to alfalfa but populations increase rapidly and often reach 80 or more per stem in 10-12 days.

Alfalfa that is more than 1/2 grown (14-16 inches tall) can sustain 40-50 blue alfalfa aphids per stem with little or no loss in yield.

The key feature to economic treatment levels is whether the aphids are present on the new alfalfa regrowth, 3-6 inches tall.

The results of this trial conducted in 1976 are described on pages 68-70 in the proceedings for the Sixth California Alfalfa Symposium.

In 1977, a season long experiment was conducted to determine the effect of blue aphid feeding on several cuttings of alfalfa hay. This test was conducted on UC Cargo variety at the University of California Imperial Valley Field Station.

Four replications of treated and non-treated plots were used. Each plot was 120' x 60'.

Six ounces active ingredient of Pencap M were applied twice during the course of the experiment. The experiment was terminated after the third cutting. Below is a summary of results.

Mean No. Aphids/Stem

	<u>DATE</u>	<u>TREATED</u>	<u>NON-TREATED</u>
	Jan. 27	24	24
	Jan. 28	Sprayed	
	Jan. 31	0	22
	Feb. 3	0	11
	Feb. 8	0.1	80
	Feb. 11	0.2	155
	Feb. 17	0	17
FIRST CUTTING	Feb. 21	FIELD CUT - Yield reduction: 610 lbs/acre @ \$85.00/ Ton = \$25.91	
	Mar. 4	1.4	18
	Mar. 14	5	14
	Mar. 20	19	13
	Mar. 22	Sprayed	
	Mar. 28	1	26
	Apr. 1	1.1	13
	Apr. 5	5	30
SECOND CUTTING	Apr. 8	FIELD CUT - Yield reduction: 408 lbs/acre @ \$85.00/ Ton = \$17.34	
	Apr. 18	0.1	0.6
	Apr. 22	0.3	0.4
	Apr. 29	0.1	0
	May 13	FIELD CUT - No difference in yield between Treated and Non-treated plots.	

The results of our experiments strongly indicate that the most damaging stage of alfalfa to blue aphid is the regrowth after cutting. Early invasion of aphids on regrowth is damaging if not controlled. Invasion of aphid build-up after this period is far less damaging. In 1977, our results indicate that the blue aphid damage is persistent during the period of two cuttings (January - April), when increasing aphid infestations were prevalent. There was no difference in yields between the treated and non-treated in the third cutting in May. This indicated that the suspected toxin effect does not persist through the third cutting.