

Blue alfalfa aphid: Economic threshold levels in southern California

Raj Sharma □ Vern Stern

A deceptively low count on new regrowth may signal a population buildup and potential crop loss.

The blue alfalfa aphid (BAA), *Acyrtosiphon kondoi* was first collected from alfalfa near Bakersfield in April, 1974. The following spring the new invader from the Orient was found damaging alfalfa in the Imperial and San Joaquin valleys.

High numbers of BAA now occur in the Imperial, Palo Verde, and Coachella valleys in January, February, and March, and disappear when temperatures reach 75° to 80° F. Peak populations occur later in cooler areas.

The BAA buildup in the southern desert valleys occurs before lady beetles leave their overwintering aggregation sites. There are no effective native parasites and the fungus disease is inadequate because of low winter rainfall. In the absence of natural enemies the southern growers have no recourse but to treat the aphid-infested fields.

The BAA is far more damaging to alfalfa than is the pea aphid. It feeds in colonies on the upper succulent parts of the alfalfa. When populations reach about 20 or more per stem on new regrowth, the stems are stunted and have small leaves and short internodes. A toxin is apparently injected into the stems which causes the abnormal growth. Leaf curling, yellowing, and leaf drop are also common symptoms. Once the alfalfa is stunted, it never seems to recover during the normal cutting period. In badly stunted alfalfa, the best procedures are to eliminate the aphids, cut the field, and wait for new regrowth for the next cutting.

The BAA is easy to kill with the materials registered for use on alfalfa for aphid control.

Economic threshold studies

Test No. 1. On February 3, 1976, Penn-cap M (= microencapsulated methyl parathion) at 6 ounces active ingredient per acre was applied by aircraft in the Imperial Valley on 4- to 5-inch alfalfa. There were 3 treated plots and 3 checks. Each plot was 300 x 600 feet. The aphid population was essentially 100 percent BAA.

All samples were taken by counting the BAA on 25 stems in each of the 6 plots. Five days after treatment the aphids had decreased slightly from the pretreatment count because of drift into the 2 center checks. There was 100 percent kill in the treated plots (figure 1). The BAA in the West check plot, on the edge of the field, had increased to 37 per stem. The alfalfa showed evidence of stunting. Thus, we separated the field into West check plot, center checks, and treated plots.

By February 16, the West check, 2 center checks, and 3 treated plots had an average of 86, 51 and 4 BAA per stem, respectively. The alfalfa was 10 to 12 inches tall in the center checks and treated plots. The West check was yellowish green and 6 inches tall.

On February 24 the aphids had increased to 103 per stem in the 2 center checks, 18

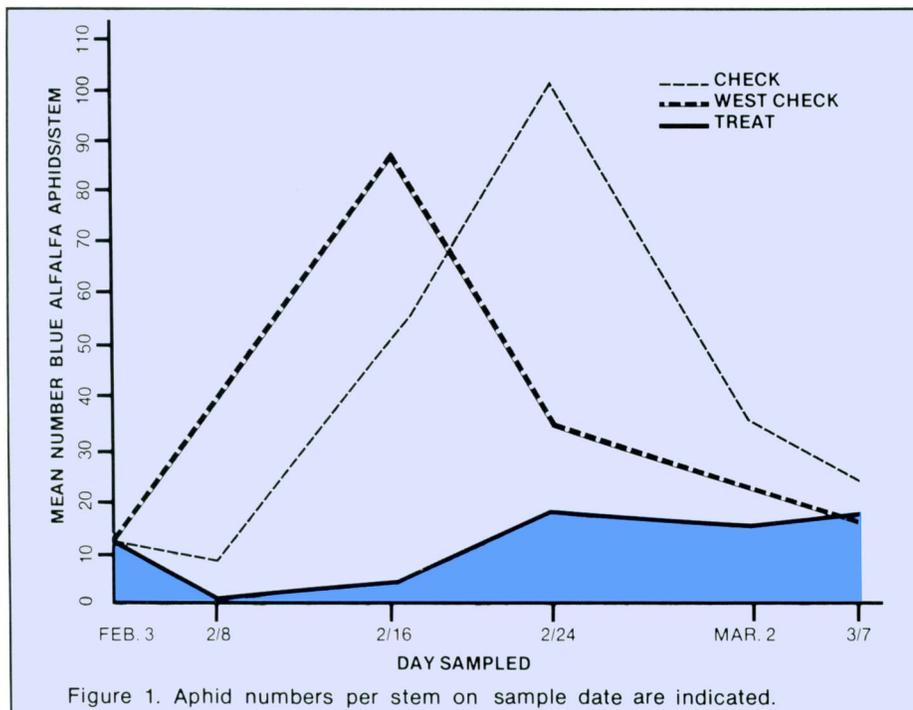


Figure 1. Aphid numbers per stem on sample date are indicated.

TABLE 1.— Analysis of Alfalfa Hay Yield and Loss Resulting from Blue Alfalfa Aphid Peaks at Different Times in the Growth Cycle (See Figure 1).

Treatment	Mean no. lbs green alfalfa sample*	Percent water loss	Percent protein†	Yield lb/A	Pound loss/A	Loss at \$80/ton
West check	17.31	74.5	22.4 a	1536	992	\$39.68
Center checks	28.27 a	75.3	20.8 a	2436	92	3.68**
Penncap M 6 oz/A	35.41 b	79.5	21.3 a	2528	—	—

* Four 50 x 2.5-foot samples per replication.

† Vertical values followed by the same letter are not statistically different at the 0.05 level.

** This apparent loss could not be substantiated statistically.

TABLE 2. Alfalfa Yield Reduction from the Blue Alfalfa Aphid on 3 Successive Cuttings in the Same Treated and Check Plots, Imperial Valley, 1977.

Sample Date	Mean no. BAA/stem Treat	Check
First Cutting		
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
Feb. 21	Field Cut	—
Yield Loss:	—	610 lb/A
Second Cutting		
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
Apr. 8	Field Cut	—
Yield Loss:	—	408 lb/A
Third Cutting		
Apr. 18	0.1	0.6
Apr. 22	0.3	0.4
Apr. 29	0.1	0.0
May 13	Field Cut	—
No difference in yield between treatments.		

per stem in the treated plots, and had decreased to 35 per stem in the West check. This decrease was because of winged aphids leaving the plot combined with reduced reproduction on the deformed plants.

The BAA had decreased in the 2 center checks along with a further decline in the West check by March 2. This is typical as the alfalfa matures in BAA-infested fields. The center checks showed a distinct off-green color, but the alfalfa height was the same as the treated plots. The alfalfa in the West check had ceased growth.

Yields were obtained on March 10 by cutting four separate 50 x 2.5-foot samples in all 6 plots with a small self-propelled swather. The green weights were immediately recorded for each sample (table 1). Alfalfa sub-samples were dried in the 6 plots to obtain dry weight yield. There was no significant difference between dry weights in the center checks and treated plots and no difference in the percentage of protein among the 3 types of plots.

The alfalfa loss in the West check was 992 pounds per acre. Alfalfa was selling for \$80 per ton in 1976, so the loss amounted to \$39.68 per acre.

There was no difference in the alfalfa height at harvest time between the 2 center checks and the 3 treated plots. The center checks did have a distinct off-green color and leaf drop was evident. However, the apparent yield loss of 92 pounds per acre or \$3.68 per acre could not be substantiated statistically.

It should be noted that yield loss in the West check at a peak of 86 BAA per stem was very severe in comparison with the center checks with a peak of 103 BAA per stem. The yield loss difference was due to the time of attack in relation to the alfalfa growth (figure 1). This test and our observations in other fields show the most severe stunting occurs when aphids attack the young regrowth. Once the alfalfa is well along in growth in a cutting cycle, it can

tolerate much higher BAA with less effect on yield.

Test No. 2. This 1977 study was also conducted in the Imperial Valley on second-year alfalfa. There were 4 replications of each treated and check plot. Each replication was 60 x 120 feet. Penncap M was applied by handsprayer at 6 ounces active ingredient per acre and a finished spray of 10 gallons per acre. Twenty-five alfalfa stems were sampled per replication to estimate the BAA population.

On January 27 the regrowth alfalfa was 8 inches tall with 24 BAA per stem. Four plots were treated on January 28 (table 2). The untreated plots reached 155 aphids per stem on February 11. The alfalfa was off-color and stunted but not as bad as the West check in the 1976 test.

Yield samples were taken on February 21 by cutting two 50 x 2.5-foot swaths in each replication with a self-propelled mower. The green and dry weights of alfalfa were obtained as described in Test No. 1. There was no difference in the percentage of protein between treatments. Yield reduction in the untreated plots was 610 pounds per acre. Alfalfa in 1977 was \$85 per ton for a loss of \$25.93 per acre.

The study was carried into the second cutting on the same treated and check plots. The aphids remained low in the plots treated on January 28 until March 20 when they increased to 19 per stem. These plots were treated March 22.

There was a mean average of 19 aphids per stem on the 6 sampling dates during the second cutting period in the check plots. There was a noticeable stunting and off-color of the alfalfa in the check plots when they were cut on April 8, but not as severe as the first cutting.

Yield samples were taken in the same manner as on the first cutting. There was no difference in percentage of protein between treatments. Yield reduction in the check plots was 408 pounds per acre or \$17.34 per acre.

The study continued into the third cutting on the same treated and check plots to determine whether there would be a yield loss from the BAA toxin injected into the alfalfa on the first 2 cuttings. The aphid population was very low in both treatments during the growth period. Yield samples were taken on May 13. There was no difference in percentage of protein or yield between plots treated on the first and second cutting and the check plots.

Conclusions

When there are no natural enemies in the field, a BAA population of 10 to 12 per stem on the new regrowth in January, February, and March is a signal for potential crop loss. Ten to 12 aphids per stem are not damaging to alfalfa, but BAA populations generally increase rapidly in the absence of natural enemies and damage to new regrowth appears to start at about 20 aphids per stem.

When the aphids build up on alfalfa that is more than half grown, the plants can withstand 40 to 50 or more BAA 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 less than 6 inches tall and temperatures are below 75° F.

Raj Sharma is Entomology Farm Advisor, Cooperative Extension, Imperial County, and Vern Stern is Professor of Entomology, U.C., Riverside.