IMPACT OF ALFALFA ON BIOLOGICAL CONTROL OF COTTON INSECT PESTS IN NEW MEXICO

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Abstract

Alfalfa can be a source of beneficial arthropods for other crops. Field trials were conducted on an experiment station and a commercial farm to evaluate the impact of hay on predation in adjacent cotton using cotton bollworm eggs from a laboratory colony. Eggs were placed in transects to measure the impact on distance to hay and time of year in both trials. Eggs were removed after 48 hours and examined for evidence of predation.

Predation was often significantly higher in alfalfa compared to cotton. In an experiment station trial, mean predation in alfalfa was 78% compared to 48-58% in cotton. The primary predators were ladybug adults, nabids and various spiders. At very high predation rates, there was little difference in predation rates between adjacent alfalfa and cotton fields with 85-97% predation in alfalfa and up to 300 feet into cotton. However, there was significantly less predation 1000 feet into the cotton field with 67% predation on one date suggesting that close proximity may have the highest impact. After cutting and cooler weather, predation rates declined in the commercial field with a mean 65% predation in alfalfa but only 28% predation in the commercial cotton field. September also produced lower predation rates in the experiment station trial with 35% predation compared to 53-77% predation in July and August.

Introduction

Crops growing in close proximity to cotton may exert important effects on insects pests of cotton by increasing the population of predators or parasitoids in the area. In California, 20 ft strips of alfalfa for every 300-500 feet of cotton serves as an effective source of natural enemies of insect pests of cotton (Stern et al. 1969). Whitcomb and Bell (1964) noted that predators increased in cotton after alfalfa fields were cut in Arkansas.

In New Mexico, alfalfa is likely an important source of predators for cotton. This study was initiated to start to understand the role of alfalfa in providing predators to cotton in New Mexico. Bollworm eggs were attached to plants in the field then examined in the lab for evidence of predation to determine the impact of distance from alfalfa, direction and time of year.

Two field trials were conducted over two years on a commercial farm and a University experiment station. At the experiment station, the degree of predation was evaluated by setting up four transects from alfalfa into cotton in each of 4 directions, a total of 16 transects. Each transect had eggs placed 10 feet into the alfalfa stand and 10, 30, and 80 feet into the block of cotton. Field to lab bioassays were conducted five times over the season to determine the degree of predation. Approximately 50 eggs from a laboratory colony were attached to each plant at each location. Eggs were approximately 12 hours old when they were placed in the field. Eggs were removed from the field after 48 hours then examined under a dissection microscope to determine rate of predation. Predators were sampled directly, with 50 sweeps per sample.

In the commercial field, eggs were also placed in transects but on one side only where cotton was adjacent to alfalfa. There were 12 transects in the field. Eggs were placed in alfalfa 10 and 30 feet from cotton and placed in cotton 10, 30, 100, 300 and 1000 feet from alfalfa. Eggs were left in the field 48 hours then brought back to the laboratory for examination.

Results

In the experiment station plots, predation was significantly higher in alfalfa compared to cotton with an average 78% predation of eggs over the season compared to 48-58% predation in cotton (Figure 1). Predation was not reduced over the relatively short distances into cotton (10, 30 and 80 feet) at the experiment station. It was thought that prevailing winds from the west might impact the rate of predation, but here was not difference in predation on the east, west, north or south sides of the cotton field (Figure 2).

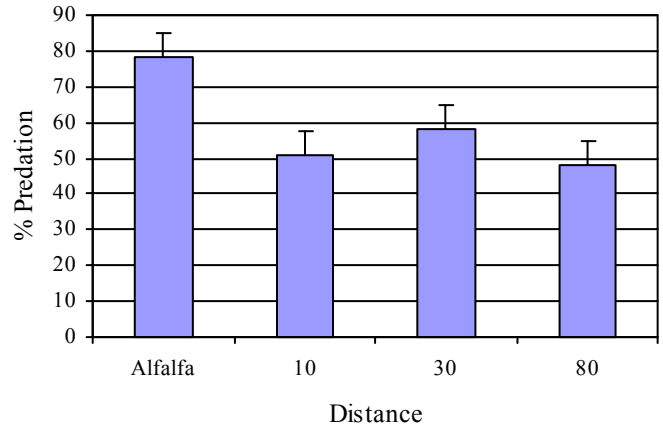

Figure 1. Impact of distance from alfalfa on predation of cotton bollworm eggs attached to plants

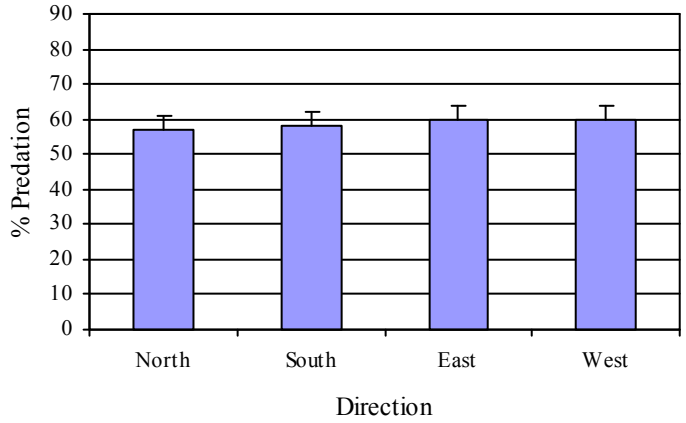

Figure 2. Impact of direction from alfalfa to cotton on predation of cotton bollworm eggs attached to plants.

Time of year did, as expected, have some impact on rate of predation with significantly less predation in September with only 35% predation of eggs compared to 53-77% predation from July 18 to August 27 (Figure 3).

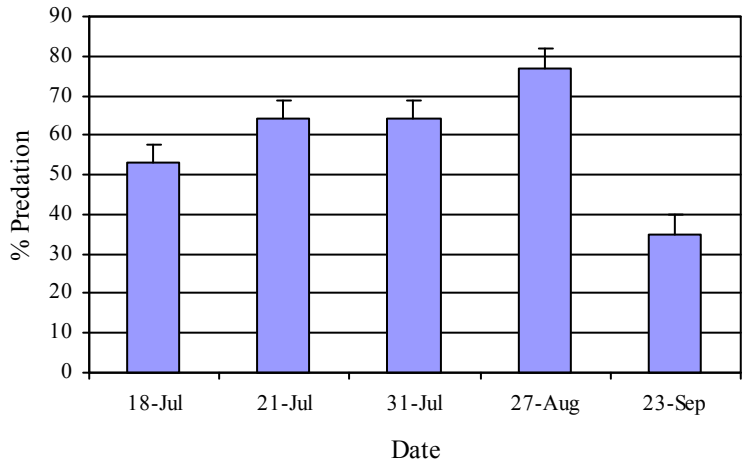

Figure 3. Impact of time of year on predation of cotton bollworm eggs attached to alfalfa and cotton plants.

Total number of predators was consistent with predation rates with the peak predation and predator numbers on August 27, and the lowest predation rate and mean number of predators on September 22. (Figure 4).

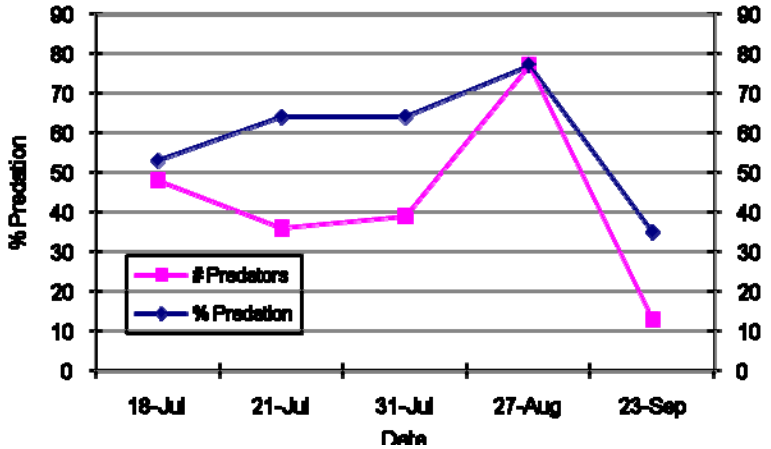

Figure 4. Predation rate and mean number of predators in over time in adjacent cotton and alfalfa.

Nabids were the most commonly collected predator on all but the last date of collection (Figure 5). Ladybug adults were the second most common predator through July. In August and September, spider collections increased dramatically and were 85% of all arthropods collected. Big eyed bugs represented 6-14% of predators in July-August. Assassin bugs appeared in significant numbers briefly in August. Collops beetles ranged from 2-10% of predators July 21- August 27. Ladybug larvae were less than 5% of predators collected on any date. No green lacewing larvae were collected although they are a very common predator in New Mexico.

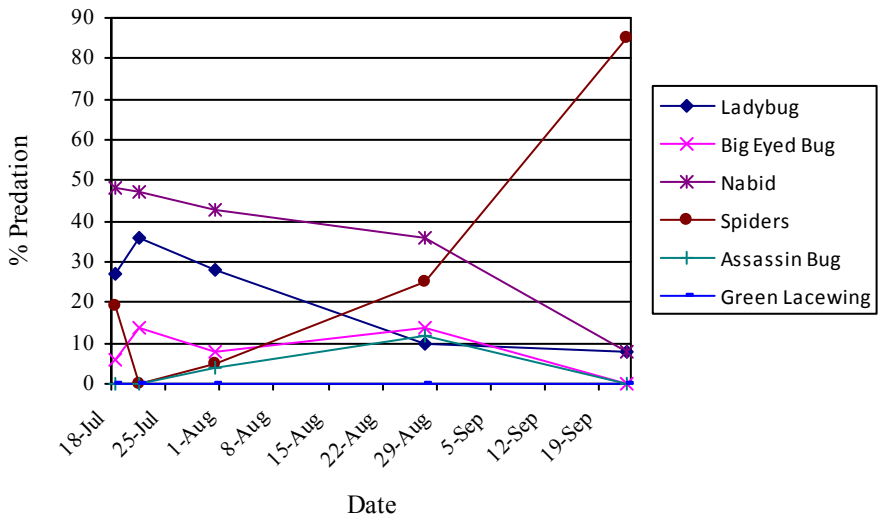

Figure 5. Arthropod predators collected as a percent of the total collected.

Predation rates were very high in both cotton and alfalfa August 31 and September 4 with 85-97% predation 10-300 feet into cotton. The only significant reduction in predation on those dates were 69% predation 1000 feet into cotton on September 4. After the hay was cut and weather was cooler predation rates were significantly lower in all cotton transects. While alfalfa still had 73-78% predation, eggs placed only 10 feet into cotton on September 10 had 27% predation (Figure 6).

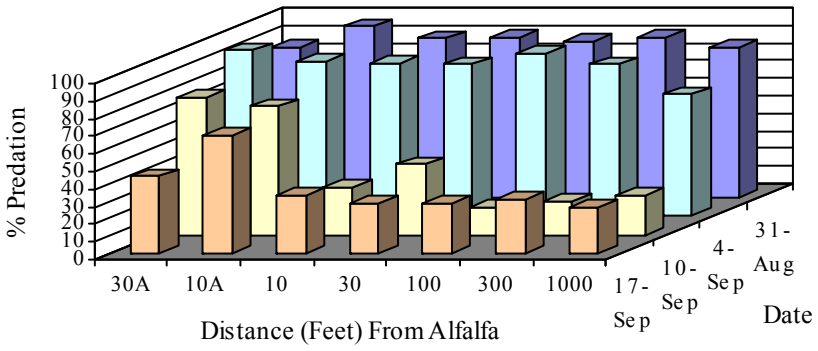

Figure 6. Predation in cotton impactd by date and distance to alfalfa.

Acknowledgement

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