FIELD DYNAMICS OF SUGAR BEET ROOT APHID POPULATIONS AND FACTORS INFLUENCING POPULATIONS

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ABSTRACT

The sugar beet root aphid is commonly seen throughout all of the sugar beet growing areas near the Rocky Mountain region. A better understanding of the population dynamics of the aphid and the factors that affect it are needed to better manage this serious insect pest. The objectives of this study were to determine the seasonal population buildup of root aphids in sugar beet fields in the region and identify major factors that may influence root aphid survival.

Root aphid populations were monitored in sugar beet fields planted to a root aphid susceptible variety in Nebraska and Montana from 2000-2002. Results indicate root aphid populations increase slowly through late July and early August with much more rapid increase in late August, peaking from mid-September to early October. The influence of various levels of irrigation and irrigation timing on aphid populations and on aphid yield impact was evaluated. Data indicate that even under well-irrigated conditions root aphids have a significant impact, but that irrigation timing influences the overall impact. Increasing irrigation does reduce aphid populations, but does not eliminate them under the conditions tested.

INTRODUCTION

Sugar beet root aphids are a regular problem in sugar beets grown in the region near the Rocky Mountains. When aphid populations are present on susceptible varieties, they significantly reduce sugar yields.

Sugar beet root aphids have a complicated life cycle that includes an over wintering generation on narrowleaf cottonwood trees. These trees are found throughout the Rocky Mountains along rivers and dry creek beds at elevations above 1200-1500 m above sea level. In the spring, the over wintering eggs hatch, and the aphids seek expanding cottonwood leaves. Within a gall formed by the leaf, a female aphid produces a colony of winged aphids (summer migrants) that when mature, leave the cottonwood trees and fly to and infest sugar beet fields in late June and July. Aphid populations then build up in beet fields through the rest of the season.

Little is known about this progression of aphid build up in the field nor the effects of various management practices on aphid populations late in the season. This information is important to improved management of this insect as late season

management may reduce the impact of the aphid on sugar yields.

MATERIALS AND METHODS

Seasonal Population Dynamics: Root aphid populations were monitored in sugar beet fields planted to a root aphid susceptible variety in both Nebraska and Montana from 2000-2002. Beginning in late July or early August, samples were taken in these fields and monitored approximately weekly for root aphids to determine the aphid infestation levels and aphid population densities in these fields. Sampling consisted of taking five beets in each of ten sites in the field. Each beet was inspected for root aphids, and the root was rated for the presence of aphids on a 0-5 damage rating scale.

Impact of late season irrigation: Treatments were arranged in a split-plot within a randomized complete block design and replicated six times. All plots were planted on April 15 to Beta 6863, a root aphid susceptible variety. Four row plots of Beta 6863 were used with two rows of Monohikari (aphid resistant) between each plot. Individual subplots were 25 feet long with small alleys between the plots. All plots were watered identically via combined sprinkler and furrow irrigation procedures until 15 August. Beginning on 15 August the following main plot treatments were initiated:

1. No additional watering after 15 August.
2. No additional watering after 1 September.
3. No additional watering after 15 September.
5. Continued watering according to crop needs throughout September.

Each main plot was divided into two subplots for aphid infested and non-infested treatments. In late June and early July, three infestations of colony-reared aphids were added to the aphid infested plots to supplement the natural infestations. No-aphid plots were treated with Aphistar (triazimate, Rohm and Haas Co.) in mid August to eliminate any aphid infestation. Thus, the yield results for all infested plots were compared to paired plots that did not support aphids. Plots were sampled for root aphid presence on 20-23 September and maintained until harvest in early October. Root and sugar yields were obtained for all plots.

RESULTS

Seasonal Population Dynamics: Sugar beet root aphid rating data from several of the seasonal sampling fields are shown in Figure 1. The data show that peak aphid populations occur in September or even as late as October. Fields that have ratings above a rating of about '1' on 15 August resulted in a peak populations occurring in the first half of September. Those fields that had lower populations on 15 August increased more slowly and did not develop their peak populations until late September or early October. In 2002 an interesting development occurred in the Mitchell N field (Nebraska). Populations increased rapidly in early August in the Mitchell N field but then declined dramatically even as the Mitchell S field gradually increased through August and September to

peak in early October. The unique aspect of the drop in the aphid population in the Mitchell N field was an associated increase in the presence of a predatory fly maggot that became very numerous in these declining colonies. We have observed these predatory fly maggots in numerous aphid colonies throughout the region, most often on heavily infested sugar beets; however, this is the earliest decline that we have seen of the aphids. This species of predatory fly, Thaumatomyia glabra, has been reported from root aphid colonies in the past.

The Montana fields sampled had peak root ratings in late September or early October. This was generally later than in the Nebraska fields. This may be the result of generally lower populations that needed more time to build up or later seasonal development due to later establishment. Later establishment would result from aphids leaving their primary host, narrowleaf cottonwood, later in the season due to higher elevations or a more northern latitude.

Impact of late season irrigation: The results of these trials are shown in Figure 2. We were able to establish very high aphid infestations in the infested plots and very low aphid levels in the non-infested plots. We saw little impact of varying irrigation on aphid infestations. Withholding late season irrigation depressed yields for all treatments, but the aphid infested plots showed much more dramatic reduction in sugar yield when irrigation was stopped in August. This relationship will need further delineating.

CONCLUSION

Sugar beet root aphid populations are low in most fields during mid-season, but they can increase dramatically through August and into September.

Higher populations in mid August tend to peak by mid September. Lower populations in mid August tend to continue to increase until October.

Natural predators are an important factor in limiting the development of aphid populations in some fields.

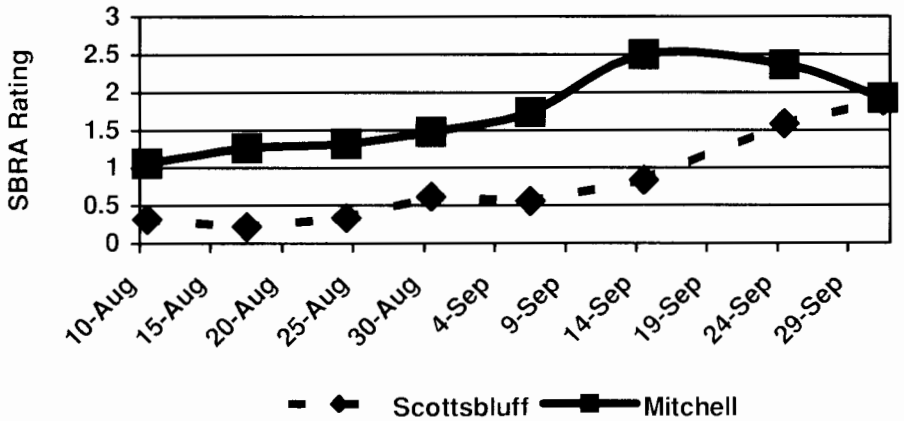
Optimum management of late season irrigation during late August and September, while aphids are most numerous and actively increasing, may help to decrease the damage potential that the aphids have during this late season period.

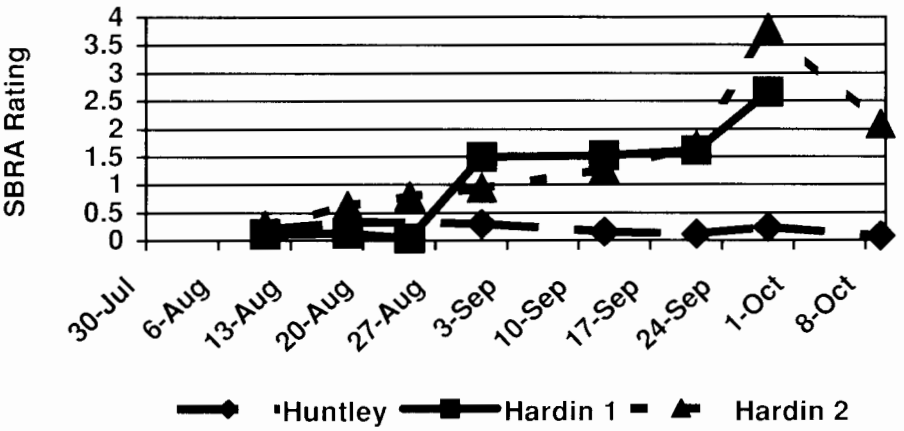
Varying late season irrigation had very little effect on the late season aphid populations.

Late season irrigation does reduce the overall impact of aphids on yield.

Late season irrigation may provide a useful management tool with susceptible varieties t0 reduce aphid impact.

Figure 1. Sugar beet root aphid seasonal population presence on susceptible varieties.





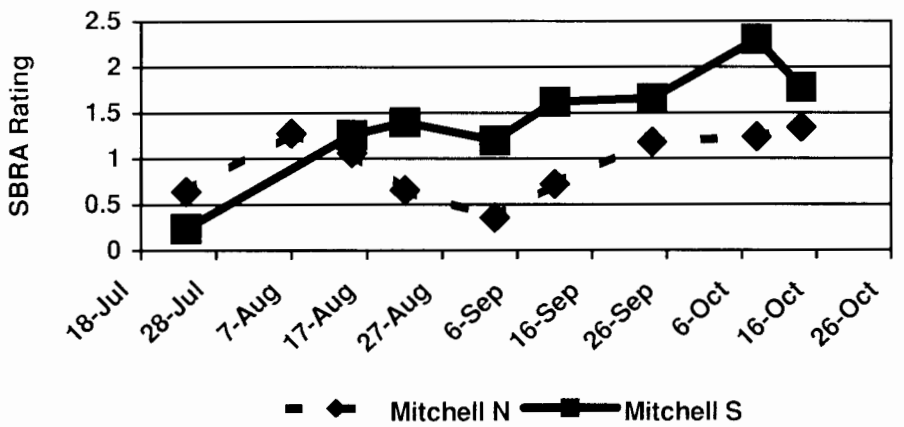


Figure 2. Impact of late season irrigation on sugar beet root aphid population and impact on yield, Scottsbluff, NE 2002.