The effect of sugarbeet root aphid (Pemphigus betae Doane) on sugarbeet yield and quality in Michigan

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Sugarbeet root aphids (Pemphigus betae Doane) had a significant impact on both yield and quality in areas of Michigan in 1995. This pest has continued to persist at differing levels in subsequent years. The objective of this presentation was to give a historical perspective of sugarbeet root aphids (SRA) impact in 1995, comparing the previous five-year period (1990 through 1994) in tons/A; sugar content; recoverable white sugar per acre (RWSA) and Gross ($/A). This comparison encompasses Michigan Sugar Company; Sebewaing factory district; Agriculturalist; and a five-grower average.

Prior to 1995, SRA were found sporadically; in very localized areas throughout the Saginaw Valley and Thumb sugarbeet-growing region which is dryland production. With areas planted to very susceptible varieties, coupled with ideal environmental conditions, SRA reached epidemic population numbers in 1995, especially hard hit was the northeastern Sebewaing factory district.

The SRA life stages and history in Michigan are similar to the Red River Valley. SRA initiate from wingless adults (apterae) which overwinter in the soil and give birth to live young. This first instar nymph looks for hosts including sugarbeet and common lambsquarters; and to a lesser extent, smartweed, dock, red beets, Swiss chard, spinach and alfalfa. To find hosts, the first instar crawls through soil or becomes airborne spreading on wind currents. Multiple generations can be produced in the growing season, especially under hot and dry conditions. Females are cream-colored and 1.5 to 2.5 mm in length. SRA can be readily seen feeding on sugarbeet roots protected by their white-colored waxy exudate. This waxy exudate can be found 20 cm deep in the soil. In response to cooler temperatures in the fall, both winged and unwinged adults are produced. Winged adults are "dead-end" in Michigan, since to complete their sexual phase, narrow-leaf cottonwood trees are required.

The damage from SRA begins with root feeding which interferes with the sugarbeet's ability to uptake moisture and nutrients. The earlier in the growing season SRA establishes itself on the crop, the greater impact potential on both yield and quality. SRA will move down the row faster than between rows; creating elliptical patterns of damage in fields. These elliptical patterns can run together devastating entire fields. In addition to SRA root feeding, the sugarbeets are more susceptible to other insect or disease stresses such as Cercospora leafspot, rhizoctonia, etc. The impact of severe SRA damage can also manifest in the sugarbeet's inability to store for extended periods of time in piles.

In comparing the previous five-years to 1995, Michigan Sugar Company, Sebewaing factory district; Agriculturalist; and five-grower average in tons/A decreased 13.6, 16.4, 19.3 and 22.7 percent, respectively. For the second preharvest samples taken in mid-September, this agriculturalist averaged 53.7 percent of samples exhibiting SRA waxy exudate on the roots. The five-grower

average was five of the "best" growers for this agriculturalist which were in one of the "worst" SRA damaged areas. These growers planted 49 to 429 acres over the total six years; the average acreage for five growers was 200 acres per grower. The same time frame comparison for Michigan Sugar Company, Sebewaing factory district; Agriculturalist; and five-grower average, sugar content declined 10.9, 15.7, 17.3 and 17.7 percent, respectively. In comparing the previous five-years to 1995, Michigan Sugar Company, Sebewaing factory district; Agriculturalist; and five-grower average in RWSA (incorporating both yield and quality) was lowered by 25.0, 32.1, 35.9 and 38.5 percent, respectively.

Assumptions for calculating gross ($/A) in grower value are $25/cwt for sugar; $6.90 per ton for byproducts value and grower split at 53.5 percent. Thus, in comparing the previous five-years to 1995, Michigan Sugar Company, Sebewaing factory district; Agriculturalist; and five-grower average in gross ($/A) in grower value was reduced by 23.9, 30.5, 34.3 and 37.0 percent, respectively. Actual gross loss in grower value for Michigan Sugar Company, Sebewaing factory district; Agriculturalist; and five-grower average was 164, 227, 251 and 311 $/A, respectively.

Conclusions from the 1995 SRA impact on Michigan Sugar Company in grower value was decreased tons/A, sugar content, RWSA and gross ($/A) by 13.6, 10.9, 25.0 and 23.9 percent, respectively. In addition, Michigan Sugar Company estimated their loss from the SRA in 1995 was greater than $8 million. The impact to the five-grower average in grower value in 1995 was staggering with losses in tons/A, sugar content, RWSA and gross ($/A) at 22.7, 17.7, 38.5 and 37.0 percent, respectively.

Management of SRA has three control alternatives consisting of cultural, biological and chemical. Cultural management of SRA includes resistant varieties. The Great Lakes sugarbeet growing region was fortunate to have variety Hilleshog E17 which has become the dominant variety. This variety has "good" SRA tolerance. Early season common lambsquarters weed control is critical to decreasing SRA in crop fields other than sugarbeets. Biological controls from natural predators are maggots from a chlorophid fly (Thaumatomyia glabra Miegen) and syrphid fly; and a ladybird beetle (Hippodamia convergens Guerin). Present insecticides applied at planting are not recommended for three reasons: sporadic nature and inability to predict SRA infestations; limited insecticide residual; and possibility of decreasing natural enemies resulting in higher SRA populations.

Three future needs related to SRA to be addressed involve life cycle determination in Michigan to more accurately predict occurrence. Secondly, development of triazimate, an insecticide having excellent selective SRA activity. Third, develop a variety tolerance rating standard, not only for Michigan, but for the entire sugarbeet industry.