Development of Alternative Control Strategies for the Sugarbeet Root Maggot

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Sugarbeet root maggot (*Tetanops myopaeformis* von Röder) is a major insect pest of sugarbeet (*Beta vulgaris* L.) throughout much of North America (Campbell et al., 1998). The primary control method has been the use of insecticides to reduce larval populations in sugarbeet fields. The almost exclusive use of two organophosphate insecticides (chlorpyrifos and terbufos) is conducive to the development of insecticide resistant root maggot. Possible alternatives to these insecticides include the use of biological control agents and the development of germplasm with host plant resistance.

Two resistant germplasm lines, F1015 and F1016, have been developed and released by ARS and North Dakota State University (Campbell et al.,2000a). Four experimental hybrids were produced by Bill Niehaus of American Crystal Sugar using elite parental lines as the female parent and F1015 as the pollen parent. In 1998-99 trials with and without chlorpyrifos (Lorsban), the four experimental hybrids without insecticide produced between 133 and 584 pounds recoverable sugar per acre less than the same hybrids with chlorpyrifos applied at planting (Table 1). In contrast, not applying chlorpyrifos to a widely grown commercial hybrid reduced recoverable sugar yield by 1096 pounds per acre.

Among the biological control agents that we have evaluated for root maggot control, the entomopathogenic fungus *Metarhizium anisopliae* (Metschnikoff) Sorokin appears to be the most promising (Campbell et al., 2000b). Under moderate to light root maggot infestations (1995-1999), the highest yielding *Metarhizium* treatment produced 24.8 tons per acre, compared with 24.9 tons per acre from the chlorpyrifos treatment and 22.7 tons when no insecticide was used. Current research with *Metarhizium* focuses on the development of commercially useful application techniques and evaluations in diverse environments.

Imidacloprid applied as a seed treatment has provided some control of the root maggot under light infestation levels, but provided minimal control under the heavy maggot pressure encountered in 2000. Other research has suggested a synergistic effect when imidacloprid and *Metarhizium* were used together. This, and other combinations of insecticides, biological control agents, and host plant resistance, will be explored in future research.

Literature Cited

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Table 1. Yield of four experimental sugarbeet hybrids with F1015 as a pollinator, a commercial hybrid, and F1015, St. Thomas, North Dakota, 1998 and 1999.

Hybrid or line/ insecticide	Root yield			Sugar			Recoverable sugar		
	1998	1999	Mean	1998	1999	Mean	1998	1999	Mean
	- Tons / acre-			--- % ---			- - lb/acre - -		
Exp - A									
Lorsban	20.4	22.2	21.3	14.4	15.1	14.8	5074	5835	5455
None	19.6	19.7	19.7	14.5	14.3	14.4	4837	4868	4871
Mean	20.0	21.0	20.5	14.5	14.7	14.6	4974	5351	5165
Exp - B									
Lorsban	17.5	19.7	18.6	14.2	14.2	14.2	4267	4807	4537
None	17.8	20.1	18.9	13.9	13.5	13.7	4186	4631	4409
Mean	17.6	19.9	18.8	14.1	13.8	14.0	4227	4719	4473
Exp - C									
Lorsban	14.9	17.6	16.3	15.0	14.5	14.7	3815	4428	4122
None	14.9	18.2	16.5	14.9	13.7	14.2	3809	4169	3989
Mean	14.9	17.9	16.4	14.9	14.1	14.5	3812	4298	4056
Exp - D									
Lorsban	18.3	19.9	19.1	14.7	14.5	14.6	4686	5044	4865
None	16.9	20.4	18.7	14.8	14.3	14.5	4379	5085	4732
Mean	17.6	20.2	18.9	14.7	14.4	14.6	4532	5065	4790
F1015									
Lorsban	16.4	19.0	17.7	13.5	13.6	13.6	3706	4433	4069
None	15.2	19.2	17.2	13.4	13.2	13.3	3395	4297	3846
Mean	15.8	19.1	17.4	13.5	13.4	13.4	3550	4356	3958
Commercial Hybrid									
Lorsban	19.6	21.8	20.7	15.9	16.2	16.1	5601	6297	5949
None	16.2	18.4	17.3	15.5	16.2	15.8	4398	5308	4853
Mean	17.9	20.1	19.0	15.7	16.2	16.0	5000	5802	5401
Mean									
Lorsban	17.8	20.1	19.0	14.6	14.7	14.7	4525	5140	4833
None	16.8	19.3	18.0	14.5	14.2	14.3	4173	4726	4450
Mean	17.3	19.7	18.5	14.6	14.4	14.5	4350	4933	4642