POINDEXTER, S.[1], J. STEWART[2], L. HUBBELL[3], R. FOGG[4] and C. GUZA[5], [1]Michigan State University Extension Sugar Beet Educator / *Sugarbeet Advancement*; [2] Michigan Sugar Company, Director of Research; [3]Michigan Sugar Company, Research Agronomist; [4]Michigan Sugar Company, Chief Agronomist; [5]Michigan Sugar Company, Chief Agronomist, [1]MSU Extension, One Tuscola Street, Suite 100, Saginaw, MI 48607 and [2,3,4,5] Michigan Sugar Company, 2600 S. Euclid Avenue, Bay City, MI 48706. **Impact of Genetic Resistance to Sugarbeet Cyst Nematode on Yield and Quality of Sugarbeets.**

ABSTRACT

Sugarbeet Cyst Nematode can cause significant yield loss in many sugarbeet producing areas of the United States. Field trials were conducted to compare the yield of a Cyst Nematode resistant variety to conventional varieties. Studies were conducted in multiple locations throughout Michigan in fields known to be infested with Cyst Nematode. The resistant variety planted in the study was B-5534 N developed by BetaSeed. Compared to conventional varieties, sugarbeet yields were improved by an average of ten tons per acre in the fields with high levels of Cyst Nematode. In trials with no Cyst Nematode, the resistant and conventional varieties produced a similar yield. Soil sampled from sugarbeet roots of the resistant variety, contained a lower population of Cyst Nematode compared to soil sampled from roots of the conventional varieties suggesting, Cyst Nematode reproduction may have been affected by planting the resistant variety.

Objective

1.) To compare yield of Sugarbeet Cyst Nematode (SBCN) resistant variety B-5534 N to a susceptible sugarbeet variety in field conditions with high Cyst Nematode pressure.

2.) To compare yield of Sugarbeet Cyst Nematode resistant variety B-5534 N to susceptible sugarbeet varieties under no or low Cyst Nematode pressure

3.) To evaluate Sugarbeet Cyst Nematode populations on/or near roots of resistant and susceptible varieties late in the season.

Materials and Methods

Field sites were identified in 2005 and 2006 that had a history of Cyst Nematode and poor beet yields. Varieties utilized were B-5534 N; a new Cyst Nematode resistant variety compared most commonly to B-5833 R. Other susceptible varieties were also used less frequently. Trials were generally planted and harvested with grower equipment in strips across the field. Harvest strips were generally three to six replications. Quality samples and harvest weights were taken from individual strips and weighed by beet cart with scales or truck weights. In two trials, larger blocks were planted with separate grower contracts utilized for each variety. Small standard research trials were also established in non/low infested fields to compare yield of resistant and several of the most commonly planted susceptible varieties in Michigan. Sugarbeet Cyst Nematode soil/root samples were taken in early September to evaluate Cyst Nematode population differences between resistant and susceptible varieties. Soil was removed from the root of dug plants and submitted for laboratory analysis at Michigan State University.

Results and Discussion

In 2005 and 2006, 11 trials were planted with B-5534 N and to a susceptible check variety an analyzed for yield and quality under heavy Sugarbeet Cyst Nematode populations. Significant yield improvement in tonnage and recoverable sugar per acre occurred in every trial with the resistant variety. Overall, no significant differences were measured in sugar per ton, % sugar or clear juice purity when comparing the two varieties (see table one). The non significant differences in quality may be due to three factors: B-5534 N is a poorer quality beet when planted in non-nematode sites and Cercospora Leafspot was not adequately controlled on B-5534 N compared to the more Cercospora Leafspot resistant Michigan varieties (see table two and three). B-5534 N is a highly susceptible Cercospora Leafspot variety under Michigan conditions and in many grower fields Cercospora Leafspot control was poor compared to check varieties. Also, observations comparing B-5534 N and check varieties in 2006 indicated in some fields had notably higher levels of Rhizoctonia Crown Rot for B-5534 N. In the presence of heavy Sugarbeet Cyst Nematode, Cercospora Leafspot and moderate/high Rhizoctonia pressure tonnage was still significantly better than check varieties (see table four). In six trials, soil samples taken around the roots of beet plants indicated a reduction in total Cyst Nematode counts (eggs, juveniles and cysts) for the resistant variety as compared to the check (see table 5)

Conclusion

Sugarbeet Cyst Nematode is a major yield limiting factor to sugarbeets in a significant number of Michigan beet fields. Under heavy Cyst Nematode pressure, yield reductions due to Sugarbeet Cyst Nematode have been measured up to 17 tons per acre with an average loss of 9.6 tons (range 6-17 tons) in 11 trials. Unprofitable beet fields that have low yields because of Sugarbeet Cyst Nematode can be made profitable by utilizing a Sugarbeet Cyst Nematode resistant variety. B-5534 N is a variety that is not well suited for Michigan conditions because of its susceptibility to Cercospora Leafspot and Rhizoctonia Crown Rot and does not meet Michigan Sugar high quality requirements. When planted in Sugarbeet Cyst Nematode fields; B-5534 N tonnage is superior to conventional varieties and quality is equal to or better than traditional varieties. It is recommended when planting this variety in Michigan that additional fungicides be used to control Cercospora Leafspot and Rhizoctonia Crown Rot. There is no economical advantage of planting B-5534 N in the absence of Sugarbeet Cyst Nematode compared to our traditional best varieties. It appears from soil samples taken around the roots at the end of the season that Cyst Nematode populations are lower in B-5534 N than traditional varieties. Sampling would indicate up to a 26 times reduction in populations when combining cysts, eggs and juveniles. Because of apparent reduced reproduction it would suggest that this variety is not just tolerant but resistant to Sugarbeet Cyst Nematode. One trial conducted in 2006 (not shown) would suggest a combination of Oilseed Radish as previous crop coupled with B-5534 N under high pressure would produce further enhanced yields.

Severe Nematode Pressure
11 Trials / Michigan – 2005/06

TREATMENT	RWSA	T/A	RWST	% Sugar	% CJP
B-5534 Resistant	**6785**	**27.60**	**246**	**16.50**	**94.40**
Check Susceptible	**4327**	**18.0**	**241**	**16.00**	**94.70**
AVERAGE	5556	22.80	244	16.29	94.5
LSD (5%)	403	2.5	105	NS	NS

Table 1

Small Plot Nematode Variety Trials
Average of Four Trials - 2006

VARIETY	RWSA	RWST	% Suc	% CJP	T/A
Beta BK1643N	**9056**	**270.2**	**18.36**	**94.66**	**33.57**
Beta 5534N	**7994**	**246.9**	**17.28**	**93.43**	**32.51**
Crystal 963	**7987**	**266.9**	**18.33**	**94.14**	**29.89**
HM E-17	**7784**	**270.9**	**18.40**	**94.62**	**28.53**
SX Prompt	**7771**	**262.3**	**18.13**	**93.89**	**29.59**
HM 2761 RZ	**7589**	**257.6**	**17.77**	**94.05**	**29.43**
LSD (5%)	362	6.54	.30	.45	1.70

Table 2

SBA Non-Nematode Site

VARIETY	RWSA	T/A	RWST	% Sugar	% CJP
B-5833R	**8610**	**32.16**	**267**	**18.1**	**95.0**
B-5534N	**8128**	**32.17**	**253**	**17.5**	**94.0**
LSD (5%)	488	1.98	11	.9	.4

Table 3

Sugarbeet Cyst Nematode Variety Strip Trial
2005

VARIETY	RWSA	RWST	T/A	% Suc
Beta 5534 N	**6597**	**281.7**	**23.40**	**15.30**
Beta 5451	**3775**	**304.5**	**12.40**	**15.90**
Beta 5833 R	**3948**	**281.3**	**14.00**	**14.60**
HM 2763 RZ	**3442**	**293.0**	**11.80**	**15.30**
HM 7172 RZ	**4670**	**297.5**	**15.70**	**15.60**
Crystal 963	**4058**	**293.0**	**13.90**	**15.70**
Crystal 271	**4011**	**305.0**	**13.20**	**15.90**
LSD (5%)	484.4	NS	1.20	NS

Table 4

Total Nematode Count
Six Variety Trials 2006

VARIETY	TOTAL NEMATODE COUNT
Resistant	**309**
Susceptible	**8,082**

Comments: Counts are total of cysts, eggs and juveniles

Table 5