

Identify Soybean Germplasm for Resistance to Soybean Aphids

Project GREEN No.: GR02-095

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Project Justification/Statement of Challenge

Soybean is ranked second in production value among Michigan crops, with an annual production value between 334 and 463 million dollars. In 2000, a new invasive insect pest, the soybean aphid, was identified for the first time in the United States of America. In Southwest Michigan that year, heavy aphid infestation led to plant stunting and poor pod fill, and a yield reduction in unreplicated strip trials. In 2001, the aphid was recorded in all soybean fields in the state, although the heaviest damage was in eastern Michigan, particularly in the Thumb area. In a replicated trial on the MSU Saginaw Research Station, sprayed plots out-yielded unsprayed by 40%. Aphid feeding significantly reduced plant moisture, plant height, and most importantly, pod number. In 2003, over 600,000 soybean acres were sprayed for aphids in Michigan. Insecticide application also killed aphid predators and parasitoids, especially when the application was poorly timed. Clearly a more effective, long-term solution to soybean aphid is the use of aphid resistant soybean varieties. To develop aphid resistant varieties, sources of resistance must be identified.

Objectives

Identify sources of resistance to soybean aphids from soybean germplasm collected from northern China.

Results and Accomplishments

In 2002 and 2003, 2,147 soybean germplasm accessions, originally from northern China, were evaluated for aphid resistance in a greenhouse and in field cages. After two years of evaluation and confirmation, four accessions were found to be resistant to the soybean aphid (Table 1, Figure 1). Two of these accessions possessed antibiosis resistance, preventing the aphids from reproducing on the plants. The other two accessions possessed non-preference type of resistance. The result of this research is in press for publication in Crop Science and a patent application has been filed for the findings of this research. The soybean industry is in the process of licensing the patent.

Table 1: Damage Index (DI) based on three replications in 2004 for six putatively resistant accessions identified after two years of evaluation, and a susceptible check, three and four weeks after inoculation.

Accession ID	Damage Index (%)†	
	Three weeks after inoculation	Four weeks after inoculation
A-775	25 a‡	25 a
A-779	25 a	25 a
A-810	26 a	26 a
A-812	26 a	26 a
A-3036	75 b	79 b
A-3049	75 b	79 b
Williams 82§	83 c	100 c
Mean	47	51

† Damage index ranges from 0 to 100 with 0 as no damage and 100 as the most severe damage.

‡ Mean of three replications with a maximum of 10 plants in each replication. Means followed by the same letters are not significantly different by the least significant difference test ($P=0.05$).

§ William 82 is included as a susceptible check.

Impacts

The sources of resistance to soybean aphids identified in this research are currently used to develop commercial aphid resistant soybean varieties for Michigan. It is expected that soybean varieties with aphid resistance from these sources will be available in five years. Using the aphid resistant variety, Michigan soybean farmers will be able to save \$8-12 per acre in pesticide costs. Currently, Michigan has about 2 millions of acres planted with soybean annually. Therefore, the total pesticide costs can be reduced by up to \$24 million annually in the whole state. This will also reduce the pesticide load in Michigan by up to 90,000 gallons per year.



Difference in susceptibility to soybean aphids of a resistant soybean germplasm A-779 (on the left) and a susceptible check (on the right) four weeks after placing two aphids on each plant.

Summary

Sources of resistance to the soybean aphid, the most important insect pest of soybean in Michigan, have been identified in this research. Using aphid resistant varieties, Michigan can save up to \$24 millions annually in pesticide costs and reduce pesticide load by up to 90,000 gallons per year on the land.

Funding Partnerships

Michigan Soybean Promotion Committee: \$15,000