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Jon Tollefson
Iowa State University

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Jon Tollefson
Professor
Department of Entomology
Iowa State University

Western Corn Rootworm in Rotated Iowa Corn

At this meeting you have already heard that the northern corn rootworm can be a pest of rotated corn. The western corn rootworm also has been reported in rotated corn. In one of the workshops, Dr. Mike Gray, an invited speaker from the University of Illinois, will explain the adaptation of the western corn rootworm to corn grown in rotation. Recently the western corn rootworm has been reported in rotated Iowa corn as well. The Iowa Extension Crop Specialist from northeast Iowa, Brian Lang, was aware of a grower in Allamakee County that has had root lodging in his rotated corn for several years. During this past season, Brian placed traps in one of the grower's fields to capture beetles as they emerged from the soil. The presence of beetles in the traps would indicate that corn rootworm eggs were in the soil and larvae had survived on the crop of first-year corn. Over a three-week period Brian's traps averaged a total of 14 western corn rootworm and 1.5 northern corn rootworm beetles. The presence of adult northern corn rootworms could be explained by extended diapause as Marlin discussed. The adult western corn rootworms could mean that they also are capable of extended diapause or that the western is laying eggs in Iowa soybeans as they are east of us. During the next crop season we will be attempting to determine the extent and the reason for western corn rootworm survival in rotated Iowa corn.

Transgenic Corn with Rootworm Resistance

A new insect-management tactic that has caused considerable excitement, and some controversy, is the release of genetically engineered corn for European corn borer control. Monsanto and Pioneer have announced their development and intent to release transgenic varieties that contain resistance to the corn rootworm. This past season, 1999, several public scientists, including Iowa State University, had an opportunity to evaluate some early Monsanto releases.

This year there was only enough seed for cooperators to conduct a small-plot evaluation at a single location. The Iowa location was at the Northeast Research Center near Nashua. The experiment was planted into an area that had been a "trap crop" (delayed corn planting the previous season to encourage a corn rootworm infestation). Corn rootworm larval injury to the roots of four genetically engineered germplasms was compared to plots that had been treated with soil insecticides at planting and plots that were not treated. The experimental design was a randomized complete block with four replications. The experimental plots were three rows wide, 50 feet long, and had a single buffer row between plots. The corn that was planted in the check, buffer rows, and that treated with insecticide had the same pedigree as the corn that the resistance had been transferred into. The ability of the transgenic lines to resist corn rootworm larval injury was evaluated by comparing the rootworm larval injury in the transgenics with the injury in the untreated and insecticide treated rows.

The Iowa results are presented in Fig. 1. The injury is reported using the newer "node-injury" scale rather than the 1-6 Iowa root-injury rating. The node-injury scale offers an improvement in that it is linear throughout its range. In the node-injury scale, a one equals a node of roots pruned to within 1 and 1/2 inches of the plant stem. A proportion represents a percentage of a node removed. For example, a node-injury rating of 0.72 is equivalent to 72% of a node pruned to within 1 and 1/2 inches of the plant. Lines A-D represent four transgenic corn lines from Monsanto. Lines B-D provided root protection that was as good as the best soil insecticide.

Fig. 2 shows the results across all five Midwest University trials. The 1-6 root injury is used, with 1 = little injury and 6 = severe root lose. Averaged across locations, Line A was better than in Iowa and all four lines were comparable to the soil insecticides. Again Line D was the better transgenic; that is it suffered the least root injury.

A fifth line was released after the Iowa experiment and several other locations had been planted. Fig. 3 presents a comparison of Line E with A and D that were in all of the locations. Line E appears to be as good as Line D, and those two lines suffered the least root injury averaged across all trials during 1999.

In early evaluations, it appears that the transgenic varieties will be at least as good as soil insecticides in preventing corn rootworm larval injury. Because this benefit will come with no more effort than planting the seed, it is expected that transgenic rootworm resistant corn varieties will be widely planted when elite varieties become available. They will be especially attractive to corn growers that have been rotating, because they may not have equipment or experience to make soil insecticide applications. If they are as widely accepted as anticipated, it will be important to implement a resistance-management plan to avoid the loss of these new corn rootworm control tactics.

Figure 1. Corn rootworm larval injury (based on "node-injury scale") to transgenic resistant corn lines compared to soil insecticides and no treatment. Iowa, 1999.

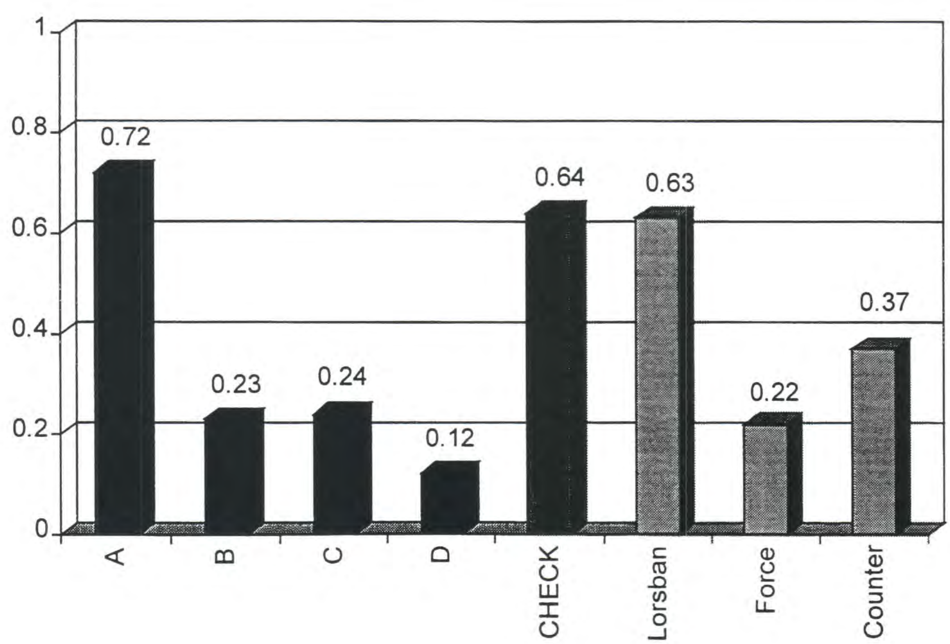

Figure 2. Corn rootworm larval injury (based on "1-6 root-injury scale) to transgenic resistant corn lines compared to soil insecticides and no treatment, averaged across 5 Midwest Universities. 1999.

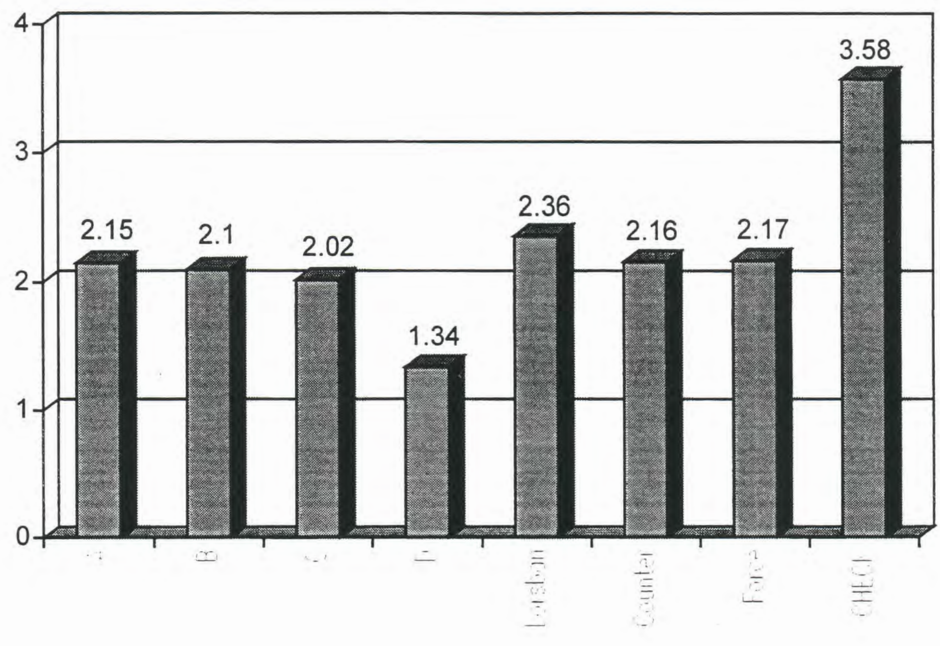

Figure 3. Corn rootworm larval injury (based on "1-6 root-injury scale) to transgenic resistant corn lines compared to soil insecticides and no treatment, averaged across 7 Monsanto locations. 1999.