Important Facts about Western Corn Rootworm

Dr. Pat Porter recently attended a summit of industry and academic scientists on the western corn rootworm in St. Louis, Missouri. He shared his notes from the meeting which I thought was important to share in this newsletter. Many thanks to Dr. Porter for permission to use his written notes.

Economic Importance

Rootworms are listed as the most expensive pest in the world to control. This includes the cost of Bt rootworm traits, seed treatments, soil insecticides and beetle control. Feeding damage from rootworms causes a 15% loss in yield for each node of root injury based on the Iowa State rating scale or an average of 28 bushels lost per node destroyed. Bt rootworm corn gives an average 5% yield increase against susceptible rootworm larvae for a net economic impact of $9.71 to $48.9 per acre.

Evolutionary Perspective

Dr. Aaron Gassman, Iowa State Entomologist, commented to the group that rootworms have a very tight linkage with corn because it is their only real host and must adapt to changes in the corn system. Therefore, essentially there is no “refuge” of unselected rootworm larvae outside of corn. What happens in corn affects the whole local population. This goes for insecticides, rotations, Bt corn and other practices.

Resistance to Bt toxins

Resistance to Cry3Bb1 is now confirmed in Nebraska and there is cross resistance with mCry3a. And, a presentation on resistance to Cry34/35 at the Entomological Society of America annual meeting reported resistance was additive dominant with 88% survival of heterozygote rootworms having both a resistance allele and a susceptible allele (Rs). There was 100% survival of rootworms with homozygous resistance alleles (RR). This is bad news for the Texas High Plains where the predominate rootworm Bt trait in corn is Cry34/35 and for the Midwest where Cry34/35 is key to managing Cry3Bb1 resistance. Research shows there are no apparent fitness costs for resistance to Cry3Bb1. This means development is not delayed and there is no effect on longevity, body size, and fecundity (ability to reproduce).

Monsanto’s field failure recommendations

1. Best: Crop rotation
2. Next: Plant to SmartStax pyramid corn
3. If planting back to Cry3Bb1 only then use a
soil applied insecticide and spray adult beetles
4. Next: Plant another corn hybrid with another toxin like Cry34/35
5. Last: Plant to a non-Bt corn with soil applied insecticides

Monsanto stated that fields resistant to Cry3Bb1 do not need a soil applied insecticide the next year if they are planted to SmartStax (SSTX). They reported no difference in root injury rating with SSTX only (0.25 node damage) compared to SSTX + soil insecticide (0.20 node damage). And, stated that seed treatments, even at high rates, do not have much efficacy on moderate to high rootworm populations.

Promising Control Findings

Monsanto reported on a new biotechnology discovery of a non-protein transgenic that when ingested causes 99.98% mortality of rootworm larvae. This becomes a “high dose” toxin in the corn roots. The toxin is specific to western and southern corn rootworm and perhaps other rootworms. There is no activity to other taxa, including other beetles. This product will not be available commercially until the end of the decade.

Another promising control method reported on was the use of a parasitic nematode, *Steinernema feltiae*. Data showed the nematode killing corn rootworm larvae in first and especially second year corn fields inoculated when planted to alfalfa. These nematodes may not replace soil applied insecticides, but they offer a new approach to killing and managing rootworm infestations.