Corn Rootworm Management

Corn rootworm (CRW) is the primary pest of corn in the major corn-growing areas of North America, causing more than one billion dollars in damage annually in control costs and yield reductions. Pioneer® brand Optimum® AcreMax® 1 (AM1), Optimum® AcreMax® Xtra (AMX) and Optimum® AcreMax® XTreme (AMXT) insect protection products with integrated refuge allow growers to reduce refuge requirements with a single product. These products deliver flexibility and convenience for insect refuge management by providing one mode of action for corn rootworm protection (Herculex® RW trait) in AM1 and AMX products and two modes of action for corn rootworm protection (Herculex® RW and Agrisure® RW traits) in AMXT products.

Study Description

On-Farm Trials

On-farm strip trials were conducted at 95 midwestern locations in 2013 to evaluate the efficacy and grain yield performance of AM1, AMX and AMXT products with and without the use of soil-applied insecticide. Trials were placed primarily in corn-on-corn fields in areas with a history of moderate to severe corn rootworm feeding.

Corn rootworm efficacy was measured by digging and washing 10 roots from each entry. All roots were assigned a CRW node injury scale (NIS) rating using the Iowa State 0-3 Node Injury Scale. Efficacy ratings reported here include both traited and non-traited plants within the 10 plants evaluated for integrated refuge entries. Corn rootworm pressure at each location was assessed by sampling roots from a check area with no CRW protection (no CRW trait, no insecticide).

Results reported here are combined for AM1 and AMX products, which have the same CRW protection trait and percent integrated refuge component. Entries were not identical across all on-farm trials; consequently, summary charts and tables shown here reflect data from the subset of locations at which the products and treatments were included.

Small-Plot Trials

Small-plot trials were conducted in 2012 and 2013 to evaluate the efficacy and grain yield performance of AMX and AMXT products under varying levels of corn rootworm feeding pressure.

Replicated trials were conducted at 12 locations in 2012 and at 9 locations in 2013. Eight hybrid platforms were evaluated in each year of testing, and trial locations extended from central Nebraska to central Indiana each year.

CRW efficacy was measured by digging and washing 10 consecutive plants from row 1 of each integrated refuge treatment and 5 consecutive plants in each base treatment. All roots were assigned a CRWNIS rating using the Iowa State 0-3 NIS scale. Efficacy ratings reported here include both traited and non-traited plants within the 10 plants evaluated for integrated refuge entries.

Results

Among 95 on-farm trial locations in 2013, high CRW pressure (defined as >1.5 on the Iowa State 0-3 NIS) was observed in 12 locations (Figure 1). Corn rootworm feeding was very intense at several of these locations. Four trials had CRW injury ratings between 2.0 and 2.5 (very high) in the unprotected check, and three had CRW injury greater than 2.5 (severe).

Corn rootworm feeding pressure was generally higher in 2012 small-plot testing locations compared to 2013. In 2012, 3 of 12 locations experienced high corn rootworm pressure (defined for these experiments as > 1.75 on the Iowa State 0-3 NIS), and 3 others experienced moderate feeding pressure (between 0.75 and 1.75 on the Iowa State 0-3 node injury scale). Conversely, in 2013, only three of nine testing locations had moderate feeding pressure, and none experienced high feeding pressure.

Performance of AM1 and AMX products was very consistent in 2013 on-farm trials, even under intense CRW pressure (Figure 2). Average CRW injury was significantly reduced relative to the unprotected check at all levels of CRW pressure. Average CRW injury in AM1 and AMX products was only 0.52 among the three locations with pressure greater than 2.5 in the check, indicating that these products continue to provide a high degree of protection under severe CRW pressure.

Small-plot trials evaluated performance of both AMX and AMXT products. Across three locations with high CRW pressure in 2012, average CRW feeding was 0.22 on AMX products and 0.13 on AMXT products compared to 2.02 in the unprotected check (Figure 3). Nearly identical results were observed in 2013.
on-farm trials that included both AMX and AMXT products. Average CRW feeding was 0.29 on AMX products and 0.08 on AMXT products compared to 2.06 in the unprotected check.

In both cases, CRW feeding was slightly lower on AMXT products than AMX products, although not to a statistically significant degree. Corn rootworm protection would be expected to be slightly greater with AMXT products due to the combined effects of trait efficacy (dual mode vs. single mode) and a lower percentage of refuge plants (5% vs. 10%).

The addition of a soil insecticide to AMX and AM1 products tended to result in a slight reduction in CRW feeding, although the effect was not statistically significant even under severe CRW pressure (Figure 2).

Corn yield tended to be slightly greater with the addition of a soil insecticide, with increases ranging from 2.9 to 3.8 bu/acre at locations with high, very high or severe CRW pressure (Figure 4). A slight increase in average yield was also observed with a soil insecticide application among sites with low to moderate CRW pressure, suggesting that yield improvements may be partially due to the control of insect pests other than corn rootworm.

Comparison of CRW feeding and yield performance between AM1/AMX products and non-CRW protected corn with an insecticide demonstrated the superior CRW protection provided by the Optimum® AcreMax® family of products (Table 1).
AMXT - Optimum® AcreMax® XTreme contains a single-bag integrated refuge solution for above- and below-ground insects. The major component contains the Agrisure® RW technology, the YieldGard® Corn Borer gene, and the Herculex® XTRA genes.

AMX - Optimum® AcreMax® Xtra Insect Protection system with YGCB, HXX, LL, RR2. Contains a single-bag integrated refuge solution for above- and below-ground insects. In EPA-designated cotton growing counties, a 20% separate refuge must be planted with Optimum AcreMax Xtra products.

AM1 - Contains the Optimum® AcreMax® 1 Insect Protection System with an integrated corn rootworm refuge solution includes HXX, LL, RR2. Optimum AcreMax 1 products contain the LibertyLink® gene and can be sprayed with Liberty® herbicide. The required corn borer refuge can be planted up to half a mile away.

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AMX - Optimum® AcreMax® Xtra Insect Protection system with YGCB, HXX, LL, RR2. Contains a single-bag integrated refuge solution for above- and below-ground insects. In EPA-designated cotton growing counties, a 20% separate refuge must be planted with Optimum AcreMax Xtra products.

AM1 - Contains the Optimum® AcreMax® 1 Insect Protection System with an integrated corn rootworm refuge solution includes HXX, LL, RR2. Optimum AcreMax 1 products contain the LibertyLink® gene and can be sprayed with Liberty® herbicide. The required corn borer refuge can be planted up to half a mile away.

AMXT - Optimum® AcreMax® XTreme contains a single-bag integrated refuge solution for above- and below-ground insects. The major component contains the Agrisure® RW technology, the YieldGard® Corn Borer gene, and the Herculex® XTRA genes.

AMX - Optimum® AcreMax® Xtra Insect Protection system with YGCB, HXX, LL, RR2. Contains a single-bag integrated refuge solution for above- and below-ground insects. In EPA-designated cotton growing counties, a 20% separate refuge must be planted with Optimum AcreMax Xtra products.

AM1 - Contains the Optimum® AcreMax® 1 Insect Protection System with an integrated corn rootworm refuge solution includes HXX, LL, RR2. Optimum AcreMax 1 products contain the LibertyLink® gene and can be sprayed with Liberty® herbicide. The required corn borer refuge can be planted up to half a mile away.

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