



# Areawide Management of Corn Rootworms: Turning the First Corner

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The Corn Rootworm Areawide Pest Management (AWPM) Program is a coordinated effort that links a group of producers with crop consultants, applicators, and university and government researchers to manage the western corn rootworm, *Diabrotica virgifera virgifera* LeConte, over a large, well-defined area. The summer of 1997 marked the start of this four-year study located on the border of Illinois and Indiana. Similar projects, sponsored by the USDA, are being conducted in Iowa, Kansas, South Dakota, and Texas. A central component of all these areawide projects is the use of an insecticidal bait to manage rootworm populations.

## The Illinois-Indiana Study Site

A 16-square-mile area that includes parts of Iroquois County in Illinois and Benton and Newton counties in Indiana was selected as the AWPM study site. This location was selected primarily for two reasons: it is close to the institutions (University of Illinois and Purdue University) that are coordinating the study, and it is located in the heart of an area in which western corn rootworm adults have exhibited a dramatic change in behavior by laying eggs in soybean fields. This behavior has virtually eliminated the benefits of crop rotation as a rootworm management tactic in this area. In the past two years, an increasing number of growers in the affected area have resorted, understandably, to the use of soil insecticides to protect their corn crop.

The AWPM study enlists the partnership of 45 growers (only one grower could not participate) and about 12,000 acres of corn and soybeans. Nearly 10,000 of these acres (forming a jagged-sided square) were treated with the insecticidal bait Slam® (BASF Corp.) whenever densities of rootworm adults exceeded an economic threshold in corn or soybean fields. Slam consists of a feeding stimulant, inert carriers, and a low rate of carbaryl insecticide.

Cucurbitacin, a feeding stimulant derived from dried and ground roots of buffalo gourd, causes rootworm adults to stop “dead in their tracks” and to feed compulsively on Slam particles adhering to the surface of leaves. Because of the beetle’s voracious appetite for cucurbitacin, only a small dose of carbaryl is required to kill the insect. Other insects such as lady beetles, lacewings, honey bees, and European corn borers are “turned off” by the bitter taste of cucurbitacin, and are not affected by Slam. These features make Slam the favored candidate for use in an areawide pest management program.

Treatments were made to individual fields by aircraft. To determine the need and proper timing of insecticide treatment, agronomists from Midwest Consulting Service (MCS), Maple Park, Illinois, monitored corn and soybean fields weekly from the time adult rootworm beetles emerged until the population dwindled in late summer. Fourteen corn and 11 soybean fields, either adjoining or within 0.5 mile of the area to be treated with Slam, also were scouted for rootworm beetles, but they were not treated with an insecticide to kill adult rootworms.

In addition to scouting for rootworm beetles, MCS provided full-season scouting for weeds, plant diseases, and other insects to all growers participating in the AWPM program. This service was made available to participating growers at a discounted cost of \$2 per acre. Additional features of the scouting program included estimates of corn yield, sticky-trap and sweep-net sampling for insects in soybeans, and GPS boundary mapping of all fields in the study. An optional fertility testing program was made available through MCS.

The costs associated with the purchase and aerial application of insecticides used to control adult western corn rootworms were provided at no cost to the growers.

## The Year in Review

In general, growers in the areawide site practice both corn:soybean rotation and conservation tillage on all their acres. Within the 9,600 acres in the area to be treated with Slam were 94 cornfields (5,100 acres) and 73 soybean fields (4,500 acres). Seven growers had livestock and managed eight alfalfa fields within the study site. The 14 corn and 11 soybean fields that comprised the untreated fields along the borders of the areawide site totaled 1,700 acres.

Growers experienced the usual year of unusual weather in 1997. Favorable conditions in the spring allowed for early planting of both corn and soybeans. However, the cool temperatures that followed planting delayed germination and growth. A period of little to no precipitation during crop establishment was followed by a heavy rainfall that resulted in excessive ponding and loss of crops in some areas. Some of the drowned-out areas were replanted. Although hot and dry conditions prevailed during most of the corn pollination period, several timely rainfalls brought relief to the crops in the study site. Crops in surrounding counties continued to suffer environmental stress.

Sampling for adult western corn rootworms in corn and soybeans was conducted for 6 to 7 weeks, beginning July 21 and ending September 3. Populations of western corn rootworms (WCR) in corn were sampled by counting the number of beetles on two plants about 3 to 5 feet apart in each of 10 locations within the field. Insect populations were estimated in soybean fields with Pherocon AM yellow sticky cards and a sweep net. Sticky cards, distributed through the field in two rows of four cards, were positioned so that one-half of the card was above the soybean canopy. Sticky cards remained in the fields for one week, and then they were replaced with new cards. Four sets of 25 sweep-net samples were collected each week when sticky cards were replaced. Numbers of male and female western corn rootworms, northern corn rootworms, ladybug beetles, and lacewings were recorded each week for both sampling methods in soybeans.

The decision to treat for WCR beetles was based on economic thresholds that are well established in corn (0.5 beetle per plant in first-year corn, 0.7 beetle per plant in continuous corn, and at least 10 percent of the female beetles gravid) and was arbitrarily determined in soybean (2 beetles per sticky trap per day). Sampling for WCR in corn ended whenever 10 beetles were counted in first-year corn and 14 beetles were counted in continuous corn. The threshold for adult WCR in soybeans, as

it relates to the threat of economic injury caused by larvae in corn the following year, is not yet known. However, we assumed that the threshold we used in soybeans was low enough to prevent significant egg laying in these fields. Our experience with densities of western corn rootworms in soybeans in the past several years suggested that managing WCR with a threshold lower than 2 beetles per trap per day would be impractical. Our goal was to kill the majority of western corn rootworm beetles with Slam before they could leave cornfields and migrate to soybeans to lay eggs. With this strategy, we expected to treat no more than one-half of the soybean fields in the study site. Unfortunately, we learned that our expectations missed the mark by a long shot!

Densities of western corn rootworm beetles were extremely high in both corn and soybeans throughout east central Illinois and northern Indiana in 1997. Because of its central location within this "hot spot," the areawide study site was seemingly under constant bombardment of WCRs through the entire period of adult beetle activity. This increase in beetle numbers could have been predicted from the extensive larval damage observed in many first-year cornfields, most of which were treated at planting time with reduced or labeled rates of granular soil insecticides. Within the study site, soil and corn root sample taken from a first-year cornfield that had been treated with soil insecticide contained 20 larvae on a single root system. The prevalence of rootworm larval damage in insecticide-treated corn could be attributed to several factors including early planting, delayed egg-hatch, and/or an early-season downpour which may have hastened its degradation. In general, densities of western corn rootworms in the study area have increased during the last three or more years. Large numbers of rootworm adults have been observed in soybean fields.

WCR adults were first observed in cornfields in the areawide site on July 14. Densities increased quickly thereafter, and by July 28, rootworm beetle thresholds in two cornfields triggered a Slam treatment. In the three days following, 63 cornfields and 5 soybean fields were treated. Counts of rootworm adults in some of these cornfields ranged from 7 to 10 beetles per plant. The treatment rate for Slam was 3/8 lb formulation per acre in 3/4 gal water. Wind-brake® drift retardant was added to Slam at a rate of 12 oz/100 gal spray solution. Slam treatments during this time appeared to be efficacious in corn. Within 15 hours post-treatment, virtually all rootworm beetles were dead. However, because of our concern about the lack of residual toxicity in several corn and

soybean fields and the rapid increase in numbers of soybean fields with threshold levels of western corn rootworms within the first 8 to 9 days after treatments, we decided to increase the rate of Slam to 1/2 lb per acre on August 6. The first rainfall since Slam treatments began occurred on Monday, August 11. Wet and windy conditions lingered through the week and culminated in a 2.2-inch rainfall on August 16. The higher rate of Slam did not help reduce the number of fields that required treatment, so we returned to using the initial rate of Slam (3/8 lb) on August 19. From August 4 through 22, an equal number of corn and soybean fields were treated. By that time, 39, 50, and 5 cornfields, and 40, 21, and 6 soybean fields had been treated once, twice, and three times, respectively, using 5,900 total lbs of Slam. And it didn't stop there. The bulging beetle population coupled with an extended period of beetle emergence from the soil continued to wreak havoc with our ability to control this seemingly "unmanageable" pest. From August 28 to the final spray date on September 6, soybean fields located within the study area 1/2 mile or more from the edges of the areawide site were treated with Sevin XLR Plus® (Rhone-Poulenc Co.) at one-half the label rate (0.5 pint per acre). We resorted to this option for several reasons: (1) Sevin XLR Plus was used at 1/2 rate to save money and because it was late enough in the season when a long residual for beetle control was not needed; (2) most, if not all, growers will rotate their corn acres to soybeans next year (1998), so treating corn late in the year offered no benefit; and (3) fields no closer than 1/2 mile from the edge were treated to protect the central core of the study site. Densities of western corn rootworm adults increased to very high numbers late in the season (first 2 weeks in September) in soybeans as corn began to dry down. Rootworm beetle densities in many fields located within 1/2 mile of the study site edge reached threshold levels in late season, but they were not treated.

In summary, a continuous wave of WCR beetles in the areawide site made adult control with Slam a formidable and costly challenge. Final statistics reveal that 75 fields were treated once with Slam, 65 fields were treated twice, and 11 fields were treated three times. Twenty-eight fields were treated with Sevin XLR Plus, and five fields were treated with PennCap-M, provided by Elf Atochem, Inc. Three

soybean fields were not treated. One cornfield within the areawide site was treated with PennCap-M® to control first-generation European corn borer before WCR beetles emerged. The two aerial applicators selected for this project, Joe Zumwalt (Zumwalt Aviation, Sheldon, Illinois) and Scott Schertz (Schertz Aerial Service, Inc., Hudson, Illinois), collectively logged more than 15,700 acres of beetle-control flights. Their response time in treating fields within 12 to 24 hours of notification was outstanding. Undoubtedly, the successes of the first year of this study have to be judged by the growers' willingness to participate in the study and the establishment of a strong infrastructure—composed of crop consultants, aerial applicators, and an agchem dealership—that is poised to carry this program into the future.

### **What's Ahead?**

The effectiveness of Slam for managing the rootworm population in the areawide site will be determined, in part, by evaluating corn roots for rootworm larval injury in 1998. All growers who plan to use a soil insecticide in the areawide site will be asked to leave at least two untreated rows or strips in each cornfield. A comparison of root ratings in fields that were treated with Slam with those that were not treated with Slam will provide meaningful information about the ability of Slam to prevent gravid females from laying most of their eggs in soybeans and will help determine the accuracy of the rootworm threshold we used in soybeans in this study.

The ultimate qualification in determining if areawide management for corn rootworms has a future in this area of the Midwest is if it puts dollars into the farmers' pockets. If growers continue to experience shortcomings with the use of soil insecticides as they did in 1997, an adult rootworm management program will attract more attention in the future. The data generated in the areawide management program over the next three to four years should enable us to determine the feasibility of expanding this type of management tactic to other areas where rootworms are causing damage to first-year cornfields. Although the first year of this project was a costly venture, we expect that there will be fewer larvae and fewer beetles to treat next year and in the years to come. However, in 1997, we learned not to underestimate the power of an insect.