Insecticide Seed Treatment (IST) Strategies For Increasing Field Corn And Soybean Yields In Conservation Tillage Production Systems

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Introduction

Southern crop production systems have become much more diversified in recent years and migrated from near monocultures of cotton, soybean, or rice. Variability in commodity prices and increases in production inputs has forced many producers to consider additional crops that are more profitable. This trend is likely to continue during the foreseeable future based upon annual fluctuations in profit margins for selected Southern row crops.

Numerous insect pests are capable of injuring field corn and soybean during seed germination and seedling establishment. The adoption of conservation tillage practices that limit tillage, increase post-harvest crop residue, and allow the establishment of native winter/spring vegetation has improved the intra-field soil environment for several of these pests. Greater pest diversity and higher survivorship increases potential injury to seeds and seedlings in field corn and soybean. For many years, field corn IPM strategies have included the use of a prophylactic, soil-applied insecticide treatment at the time of planting to reduce the impact of these pests. Those treatments are even more important in current production systems. Recently, the widespread adoption of MG IV soybean, early spring planting dates (March and April), and conservation tillage also has increased the potential of injury from soybean seed and seedling pests. At-planting treatments of soil-applied pesticides have been available for soybean for many years, but few benefits were observed when MG V/VI soybeans were planted in optimum soil environments. A coordinated Mid-Southern regional research project has documented considerable yield increases from the use of insecticides applied to soybean seed used in early- planted MG IV production systems.

This report will list common seed and seedling pests associated with field corn and soybean in the current Southern production systems. In addition, the use of IST's will be described as IPM tools in these crops.

Insect Pests Attacking Field Corn and Soybean Seedlings

Field corn is usually planted during February and March resulting in exposure of plants to soil and weather conditions that delay seedling development. Therefore, seed and seedlings are susceptible to insect pests for an extended period. Insect pest diversity and density in states along the Gulf Coast are usually much greater than that observed in northern corn production states. The most common soil and seedling insect pests of field corn in Louisiana include Southern corn rootworms, wireworms, cutworms, armyworms, seed corn maggots, sugarcane beetles, red imported fire ants, chinch bugs, and a complex of stink bugs (Pentatomidae).

Planting soybean during March and April increases the potential for early season environmental conditions that could delay seed germination and satisfactory stand establishment. This delay in plant development extends the period of susceptibility to those pests that attack seeds and seedlings. Furthermore, the adoption of conservation tillage practices increases those intra-field pest populations capable of injuring soybean during the early season. The most common soil and seedling insect pests of Louisiana soybean include Southern corn rootworms, cutworms, bean leaf beetles, armyworms, seed corn maggots, thrips, and three-cornered alfalfa hoppers.

At-Planting Chemical Control Strategies

Soil-applied insecticides used at the time of planting have been a critical input for opti-

mum grain production in Mid-South field corn. In recent years, most of the soil-applied products have been replaced by IST's represented in the neonicotinoid class (Cruiser, Gaucho, and Poncho). The results from IST rate definition tests for field corn pest management have consistently demonstrated that common commercial rates of these products are not sufficient for Louisiana's pest problems. The broad spectrum of common and emerging insect pests that attack field corn seed and seedlings are not consistently controlled with these treatments. Increasing IST rates or adding soil insecticides at reduced rates to the commercial IST has improved corn yields ≥15 bu/acre. Recently, one of the agrochemical industries (Bayer CropScience) has agreed to provide the optimum dose of Poncho to commercial seed companies. Therefore, no additional at-planting insecticides should be needed for most situations, with one noteworthy exception: cutworm management with pyrethroid applications.

Two of these IST's (Cruiser, Gaucho) have been recommended on other Louisiana field crops including soybean. Positive reports of insecticide efficacy and promising yield increases from other states have supported this insecticide use strategy, especially on early-planted soybeans. Results of the Mid-South regional IST screening trials have demonstrated seed yield increases of 0-18 bu/acre during the previous four years. Positive results for later-planted MG V/VI soybean (such as wheat/soybean double-cropping) are less consistent.

Current research projects have refined use rates for field corn pest management and validated IST performance in early season soybean production systems. Most national seed companies will include an IST on field corn or soybean cultivars sold during 2009.

Considerations for Pest Management with IST's in Conservation Tillage Systems

IST's are a logical extension of the use of transgenic traits allowing crops to express resistance to herbicides and tolerance to insect pests. There are similar benefits between the two plant protection tactics. In addition to direct improvements on grain yield and quality, the IST's improve planting efficiency and reduce non-target hazards associated with other soil-applied insecticide treatments. Several observations and recommendations for the use of IST's in field corn and soybean within conservation tillage systems are listed below.

- Conservation tillage production systems for Southern grain crops typically require more intensive IPM than conventional tillage systems.
- At-planting soil/seed insecticides are critical plant protection inputs in conservation tillage production systems for optimizing yields of field corn.
- Low rates of Cruiser 5F (0.25-0.64 mg AI/seed), Gaucho 600F (0.25-0.80 mg AI/seed), and Poncho 600F (0.25 mg AI/seed) are not sufficient for Louisiana's field corn pests.
- The LSU AgCenter's field corn IST results have provided justification for Bayer CropScience to offer Poncho 500 (0.5 mg AI/seed) on field corn seed in 2009, the optimum rate for Louisiana.
- Mid-South Trials on IST's (Cruiser and Gaucho) in early-planted soybean suggest seed yield increases for IST plots of 0-18 bu/acre above non-treated plots.
- Soybean seedling survival and plant development was rarely affected by the IST's, but insect pests (thrips, bean leaf beetles, three-cornered hoppers, and a bean-pea weevil [Sitona lineatus]) were significantly reduced compared to numbers on non-treated plants.
- Yield increases from IST's on MG V/VI soybean planted during May and June are less consistent and are, therefore, not recommended at this time.
- The IST's do not provide effective control of cutworms, and pyrethroid applications are necessary to reduce plant stand loss from these pests.

Summary

Chemical control strategies either as soil insecticides or ISTs' remain necessary crop protection inputs for field corn across the Mid-Southern Region. The shift to early-planted MG IV soybean production systems has also created a need for IST's to maintain adequate plant development and optimum yields. Recent communications with the agro-

chemical industries suggest that the dose of IST's offered to seed companies will provide sufficient control of the common pest populations in field corn and soybean. Although IST's are applied as preventative applications at the time of planting grain crops, the value of these specific treatments should not be underestimated as environmentally acceptable components of integrated pest management systems.

SOYBEAN PRESENTATIONS

Late Fall/Early Winter Herbicide Application: A New Approach To Managing Winter Weeds In Louisiana

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Many row crops in Louisiana are produced utilizing some type of conservation tillage system. Regardless of the system used, fields are allowed to remain undisturbed through the winter and spring until planting. In the absence of spring tillage, herbicide programs are required to successfully manage native winter vegetation prior to planting.

Control of weeds in the spring prior to planting has most often relied on programs including glyphosate or paraquat as the primary herbicide with tank mix partners such as 2,4-D, Goal, or Harmony Extra, among others, included to increase the spectrum of weeds controlled or to prevent future weed germination. In addition, paraquat applications at planting are often made following a glyphosate tank mix treatment to ensure weed free conditions for the emerging crop.

Although not directly related to herbicide effects or competition, winter weeds present in spring prior to planting may negatively affect crops by having the capacity to serve as possible hosts for insect and disease organisms.

The LSU AgCenter recommends that herbicides be applied 6 to 8 weeks prior to planting to remove winter vegetation eliminate problems with insects migrating from weeds to emerging crops. However, rain and wind often make it difficult to achieve this interval. Delays in spring herbicide applications not only lead to increased insect problems, but lead to reduced herbicide efficacy due to larger weeds and/or weed growth stages that decrease herbicide susceptibility.

Over reliance on widely used herbicides, such as glyphosate, has lead to increased incidence of weed resistance in other states. In Louisiana, weeds such as marestail, henbit, and ryegrass often require tank mixture of as many as 3 different herbicides once optimum herbicide application timing is missed. Even then these weeds are not always adequately controlled and cost is definitely increased. Furthermore, previous research by LSU AgCenter weed scientists has shown winter weeds to be very competitive in corn if not adequately controlled prior to planting.

Off-target drift is another problem with spring herbicide applications. Herbicides applied later in the spring on cotton and soybean fields can lead to situations of off-tar-