Chapter 5

Arthropod Pest Management

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The widespread adoption of conservation tillage systems for Louisiana crops has indirectly created changes in the pest spectrum and severity of problems in Louisiana's crops. Species diversity and population densities for a wide range of pest and beneficial arthropod complexes are influenced by a reduction in tillage, seeding of winter cover crops, double-cropping systems and delays in winter/spring vegetation management with herbicides.

The sub-tropical climate that is responsible for potentially high crop yields also provides a favorable environment for a variety of pests attacking those crops. Successful integrated pest management, abbreviated as IPM, in conservation tillage systems requires proper attention to the timeliness of all production practices, a formal field scouting protocol to identify problems and the proper selection and implementation of control strategies.

Preventive integrated pest management strategies coupled with early detection of problems and reactive treatments are essential components in profitable conservation tillage production systems.

The objective of this section is to identify pest issues in conservation tillage systems and briefly summarize the proper integration of selected IPM strategies in these systems.

Recognize potential pest problems

The most obvious effects of conservation tillage practices on arthropod pests will be changes in those pests that live in the soil or that use winter/spring native vegetation as hosts before moving to crops in seedling stages of development.

Tillage has been an effective means of physically disturbing the soil, which results in high mortality of any pest overwintering within the crop fields. In addition, tillage is very effective in completely terminating weedy vegetation in fields and thereby eliminating those plants as hosts for pests that may eventually migrate to crops.

Fields with heavy plant residue from a previous crop, green manure or winter cover crop, weedy spring/

Figure 5-1. In spite of effective herbicide use strategies, delaying herbicide applications can create serious insect pest management issues by forcing pests from dying weeds to crop plants.

winter vegetation or straw from a winter wheat crop (common in a double-cropping operations) should be considered at high risk for potential problems with arthropod pests (Figure 5-1). For example, all legume cover crops examined to date are more likely to produce economic infestations of cutworms in a subsequent cotton crop compared to nonlegume cover crops.

Conservation tillage practices improve soil quality and crop yield sustainability after each year. These same effects can improve habitat for arthropod pests and influence management strategies. Therefore, each crop season should be examined independently for potential pest problems.

Arthropod pest status and diversity

Conservation tillage practices are designed to increase post-harvest residue and native vegetation, unintentionally creating a favorable environment for insects within crop fields. There is considerable evidence supporting an increase in the diversity of yield-limiting pest populations in conservation tillage fields compared to fields receiving conventional tillage.

Most of the common pests in Louisiana crops will be found attacking the seed or young seedlings (Figure 5-2). Examples of these pests include slugs, red im-

Figure 5-2. If not detected early or managed with preventative strategies, numerous species of arthropod pests can cause direct injury and ultimate death to cotton seedling.

Figure 5-4. Red imported fire ants are both pests and beneficials in conservation tillage systems. They injure crop seeds, but also feed on other insect pests.

Figure 5-3. One of the most common insect pests that have been a consistent problem in conservation tillage systems is a complex of cutworms that severs seedling plants at the soil line.

Figure 5-5. Cotton aphids typically reach higher peak populations in conservation tillage fields than in conventionally-tilled fields.

ported fire ants, cutworms, armyworms, southern corn rootworms, seed corn maggots, wireworms, chinch bugs, sugarcane beetles, aphids, false chinch bugs, stink bugs and spider mites (Figures 5-3, 5-4, 5-5). In many instances, these pests are present in the field when the crop is planted.

Reduced tillage increases residue from previous crops (corn, sorghum and soybeans) and covers the soil surface, which, in turn, provides a favorable environment for insect populations by mediating soil moisture and temperature extremes. Poor field sanitation of volunteer plants and crop stubble following harvest during the fall also can provide a promising overwintering habitat for pest populations. These fields serve as refuges that may be capable of supporting pests whose subsequent generations eventually will migrate into adjacent crop fields.

Examples of these pests in corn are the southwestern corn borer and sugarcane borer. In cotton, the overwintering success of tobacco budworms and bollworms is directly affected by tillage practices, since these insects usually spend the winter in the soil of crop fields infested during the late fall.

In recent seasons, producers have relied on transgenic cotton and corn cultivars that express Bacillus thuringiensis, or Bt, traits to significantly reduce the effects of caterpillar pests such as those listed above. These integrated pest management tools have greatly reduced the yield-limiting effects of these pests, despite an increase in overwintering survival for pests in conservation tillage systems. In light of this success, cultivars expressing Bt traits should be the backbone of an IPM program in Louisiana crops.

Pre-plant pest management decisions

Arthropod pests may feed on numerous native host plants that make up the winter and spring weed complex in and around crop fields in Louisiana. The application of "burn down" herbicides, prior to planting, will terminate this weedy vegetation and destroy pests' food sources. This practice forces their emigration to nearby crop seedlings as a host for survival.

Destruction of winter vegetation well in advance of planting is the most effective cultural practice for reducing potential problems. Generally, if seedbeds are completely clean of living vegetation three weeks before planting, damage to crop seedlings may be minimized.

"Burn down" herbicide treatments need to be applied a minimum of six to eight weeks before planting, depending on the specific products, to successfully terminate winter vegetation by this time interval. Complete control of all weed species within the field and on the surrounding field borders is necessary to eliminate alternate host plants.

Fields should be scouted at the time of planting to ensure weed-free seedbeds. The presence of heavy plant residue or any green vegetation on the seedbeds following "burn down" applications may create a favorable environment for arthropod pests. Incomplete termination of some weed species may provide a refuge for insect pests until crop seedlings become available (Figure 5-6).

Even at planting, a herbicide application or modified tillage treatment is warranted to ensure a clean seedbed and remove alternate hosts. Additional weeds may emerge and become established following a successful pre-plant herbicide application if the treatment was applied too far in advance of planting or if the herbicide provided no residual control. Herbicides applied too late during the spring (close to the time of planting) may not completely kill the vegetation, and the pests can survive on decaying plant roots until crop seedlings become available.

At-planting pest management decisions

Fortunately, for many of the pest problems observed on seed and seedlings of Louisiana crops, pesticides can be applied at the time of planting to reduce the potential for crop injury. The use of soil insecticides to optimize yields has been more important in conservation tillage systems than in conventional production fields. These results are related to the fact that higher and more consistent initial pest populations occur in conservation tillage fields. Therefore, the potential for plant injury is higher and the value of these treatments is much higher in conservation tillage systems.

Insecticide-treated seed or soil-applied insecticides are standard treatments used to control seed and seedling pests. Regardless of the product(s) used, an at-planting treatment is essential for optimal seedling development. Producers should not reduce seeding rates below recommended levels when using at-planting insecticide

treatments. Lower than optimal plant populations cannot consistently tolerate injury from seedling insect pests and recover to produce maximum yields.

In addition, a second level of control frequently is recommended to ensure that a broader pest spectrum is controlled. A number of pyrethroid insecticides are labeled for use as preventive sprays during the planting operation. Producers should apply these treatments in a broadcast application or in a wide band across the seed furrow for maximum performance. Co-applications with "starter fertilizers" also are possible as long as the spray covers a band on the soil surface across the open seed furrow.

Many of the pests occur below the soil surface and feed on root tissue. Those pests may not be exposed to the insecticide treatment if only a small area of the seedbed is treated.

These applications become especially important if winter vegetation was not terminated well in advance of planting, if incomplete kill of winter weeds occurred, if any freshly emerged vegetation is observed on the seedbeds at the time of planting or if pests are observed in high numbers on plants in the field or along field borders.

Figure 5-6. Weeds such as henbit are promoting very early infestations of spider mites, tarnished plant bugs and corn earworms on crop seedlings. Complete spring vegetation destruction can reduce or even eliminate the impact of these pests.

Post-emergence and reactive pest management decisions

Generally, labeled rates of pesticide treatments used at the time of planting will not exhibit sufficient residual efficacy for crop seedlings to develop beyond the susceptible stages to all potential pests during the production season.

Foliar insecticide applications may be necessary at one to three weeks after emergence of cotton seedlings. For producers using herbicide-tolerant crops, the co-application of foliar insecticides with post-emergence herbicides is a cost-effective practice. This combination of treatments should be considered when summer weeds that can serve as alternate hosts for pests are present in the crop field.

Automatic pesticide applications should never be used, however, and all treatments should be based upon the detection of pests using a formal scouting protocol. Unnecessary pesticide sprays may not target the primary pest or may cause secondary pest infestations.

The ultimate goal is to maintain an optimum stand of healthy plants with the fewest inputs. Therefore, fields should be scouted regularly during the season and treated only as needed, based on pest infestations, field environment and changes in plant development.

Summary and recommendations

As conservation tillage systems continue to evolve, integrated pest management strategies will need to be refined to address emerging pest issues.

Conservation tillage production systems typically require more intensive pest management practices than conventionally tilled fields because soil arthropod populations are modified at all levels. Pest managers and producers should scout fields and identify those situations that may result in pest problems. These fields should be considered "high risk" and managed with preventive pest management methods.

An effective IPM strategy for arthropod pests should include weed-free seedbeds well in advance of planting, optimal application dates for agronomic practices and discriminate use of preventive and reactive chemical control strategies for pest problems.