Preliminary Weed Control Evaluations in Conservation Tillage Cotton in Arkansas: Problems and Plans

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INTRODUCTION

One of the major concerns of conservation tillage systems is weed control (Brown and Whitwell, 1985; McWhorter and Jordan, 1985 Webber et al., 1987; Witt, 1984). Traditionally, weed control in cotton includes preventive measures prior to weed establishment, the goal being to control all weeds regardless of the means required. Typically, a dinitroaniline herbicide is applied prior to planting and is incorporated into the soil. A single herbicide (or mixture) is then applied after planting (preemergence) and is followed by directed postemergence herbicides and cultivation as needed throughout the season. In a conservation tillage system, in which the crop is planted directly into crop stubble or a cover crop such as wheat, rye or legume or in which only minimum seedbed preparation is performed, a preplant-incorporated herbicide cannot be applied. Often this results in an increase in annual grass infestations, one of the disadvantages of reduced tillage systems (Brown and Whitwell, 1985; Kapusta, 1979; McWhorter and Jordan, 1985).

Cover crops are sometimes used with conservation tillage. They reduce erosion, usually increase soil moisture retention and add organic matter to the soil. Such crops must be destroyed prior to planting the primary crop, and they differ in their susceptibility to herbicide desiccation. Brown and Whitwell (1985) found that vetch was harder to manage in these systems than crimson clover or rye. Cotton stand and yield were reduced and maturity was delayed in plots in which vetch was not desiccated.

One of the questions about conservation tillage that arises is whether herbicide usage will be increased with such systems. Cultural control of weeds, which is the primary objective of tillage, will be reduced and probably replaced by chemical, preventive or biological control (Burnside, 1980). Although it is generally agreed that more herbicides will be needed as tillage is reduced, at least initially, some researchers feel that herbicide use will decline over time as the weed seed population near the soil surface is depleted (Burnside, 1980; Burnside et al., 1980). Reducing tillage may also necessitate higher herbicide rates because plant residues on the soil surface interfere with herbicide activity (Jones et al., 1968; Webber et al., 1987). Although herbicide usage in long-term conservation tillage production needs continuous evaluation, most researchers and farmers agree that an intensive, carefully managed herbicide program is needed to establish cotton in a conservation tillage system (Brown and Whitwell, 1985; McWhorter and Jordan, 1985).

Cotton is grown in several areas in Arkansas, but production is most prevalent on silty or sandy loam soils, although acreages of cotton on clay soils are increasing. Because the land does not need extensive preparation in the spring, conservation tillage practices may offer a tool for increasing cotton acreage in clay soils.

Research in several Southern states has provided a knowledge base for the development of conservation tillage weed control systems in the South. However, local and regional studies are needed to refine control measures based on sound weed ecology data for specific soils and weed problems. The objective of preliminary weed control research in Arkansas is to determine the feasibility of controlling weeds and maintaining cotton yield in conservation tillage systems.

DISCUSSION

The focus of this part of the paper will be on the problems encountered with experiments conducted in 1989 and 1990. The following section will briefly discuss experiments in progress and plans for future work.

Cover Crop Area, Clarkedale, Arkansas

Weed control experiments were conducted in 1989 and 1990 in an area planted to winter cover crops (rye, vetch and rye + vetch) and cotton each

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year since 1973. The soil is a Dubbs-Dundee complex. Each cover crop was treated with paraquat (Gramoxone Extra™) or paraquat plus oxyfluorfen (Goal™). Tillage practices prior to planting cotton consisted of conventional tillage, no tillage or minimum tillage (disk once prior to planting). Standard preemergence and post-directed herbicides were applied for season-long weed control.

Results from the experiments were inconclusive, but early observations indicate some of the problems that can be encountered in employing these systems. No effect of treatment on cover crops could be detected, although two applications of paraquat were needed both years to control vegetation. There were differences in cotton yield among treatments, but the differences were not consistent between years, In 1989, yields from no-till plots were equal to those from conventionally tilled plots. That year, 1989, the soil was moist at planting, so a conventional planter was satisfactory for placing seeds in the soil. In 1990, however, yield from no-till plots was significantly lower than that from conventional tillage. At planting in 1990, the soil was dry and hard on the surface, and a conventional planter was not able to break the surface and cover the cotton seeds adequately. These plots had to be re-planted. It is suspected that a no-till planter would have made a significant difference in cotton stand. In plots that had been disked one time in the week before planting, soil-to-seed contact was sufficient to obtain an adequate cotton stand that yielded almost as much as conventionally tilled plots.

The primary conclusion that could be drawn from the experiments was that obtaining a cotton stand in a no-till situation can be a problem if the planting equipment is not appropriate. However, if a cotton stand can be established, as it was in 1989, yields in no-till cotton can equal those of conventional production.

Conservation Tillage in a Johnsongrass Area, Clarkedale, Arkansas

An experiment was conducted in 1990 at Clarkedale on a Sharkey silty clay soil in an area with a heavy weed infestation that included seedling and rhizome johnsongrass, smartweed and morningglory species. The area had been planted to soybeans in 1989, but no herbicides had been applied. After soybeans were harvested in the fall, beds were rehipped. Approximately one month before cotton planting in 1990, preplant burndown treatments of glyphosate (Roundup?, paraquat and glufosinate (Ignite™) were applied to designated plots. Tops of the beds were leveled for cotton planting, and a preemergence herbicide was applied. Burndown herbicides were applied with the preemergence herbicides on plots that did not receive preplant treatments. A standard postemergence program, including quizalofop (Assure) for johnsongrass control, was followed.

As with the cover crop experiment, results were inconclusive: in this experiment; conclusions could not be drawn because cotton yield data were not obtained. Leveling the beds provided a planting surface adequate for planting with a conventional planter, and the resulting cotton stand was good. Two problems that prevented good cotton growth were soon evident, however. The first was lack of rainfall. Although the area received rainfall in the 12 weeks after cotton emergence, the amount each time was less than 1 to 2 cm. Because the experiment could not be irrigated, cotton growth was poor.

The second problem was one of weed control. It was observed that most weeds in plots that had a preplant treatment were controlled 80 to 100% at planting. In other plots, however, a heavy infestation of smartweed (Polygonurn spp.) was present. Although all preemergence treatments specified a burndown herbicide in the tank mixture, the smartweed was too large by that time (late May) to be adequately controlled. Additionally, with the slow growth of cotton, a height differential for proper application of post-directed herbicides was not obtained. Although the applications were finally made, they were not effective, and most plots had sufficient weeds present to be competitive with the cotton. The johnsongrass, however, was controlled with quizalofop.

It should be noted that a similar experiment was established in an area with a low weed population, also on a Sharkey clay. Every treatment in this experiment, however, had a preplant burndown added, which was applied approximately four weeks prior to planting. With the low initial weed pressure and irrigation to aid cotton growth after emergence, a height differential between cotton and the summer annual weeds was obtained, and control in most plots was good. (Because irrigation was limited, cotton yields were low and too inconsistent to accurately reflect differential treatment effects.)

One remedy for the problems in a heavily infested area, such as the johnsongrass area, is increased flexibility of the weed control program. Treatments in this experiment contained no options that would have allowed better control of smartweed. Conservation tillage production requires careful management and, apparently, a degree of flex-

ibility that was not available in this experiment. As Steve Crawford stated in an interview (Laws, 1990), "If you plant into a mess, things are just going to get worse. We don't have the technology in cotton to buy our way out of a jam like we do in soybeans." All plots should probably have been treated with a preplant burndown treatment, and most should have received another burndown application around the time of planting.

FUTURE RESEARCH

Experiments will be conducted at three Arkansas locations in 1991: Clarkedale (cover crop and johnsongrass areas), Marianna (two experiments on silt loam soil) and Fayetteville (an experiment to evaluate burndown of weeds, vetch and wheat followed by a season-long control program). In all these experiments, options for burndown of vegetation through the time of planting are a part of most treatments. One experiment will compare the effects of initiating preplant treatments (burndown plus residual) at approximately 10 to 12 weeks before planting, 4 to 6 weeks before planting and 0 to 7 days before planting.

Preliminary research in Arkansas will continue to focus on screening of burndown and residual herbicides at several rates and timings. The objective of the work essentially will be to define and verify sound weed control practices for conservation tillage practices in Arkansas. This must, of course, include various tillage practices, equipment, cover cropping systems and economic analysis. As the preliminary economic and weed control evaluations continue, other research will evaluate the effects of various conservation tillage systems on weed population dynamics.

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