CONSERVATION TILLAGE

Conservation tillage practices are employed on about 50 percent of the Georgia cotton acreage. In Georgia, conservation tillage and strip tillage are essentially synonymous. Incentives for such systems include reduced trips over the field, reduced labor and equipment costs, and soil and water conservation. After several years in reduced tillage, a slight buildup in overall organic matter often occurs, with significant increases in the upper half inch at the soil surface.

Success in conservation tillage requires a commitment to "make it work." Not surprisingly, there are pockets in the state of devotion to this methodology and adoption of the technology seems to grow more rapidly in these areas. Farmers gain confidence from watching successes on neighboring farms, and thus, are willing to attempt a significant change in production practices. Successful conversion to conservation tillage is rarely piecemeal, it requires a total change in equipment and management. Required equipment includes a strip till unit, sprayer, and hooded sprayer or high residue cultivator.

Historically, the greatest challenges of reduced tillage systems have been stand establishment and weed control. Strip tillage implements have eased the complications of obtaining a stand by creating an environment similar to conventional seedbed preparation. For reduced tillage systems, burndown herbicides replace preplant tillage as the means of eliminating vegetation. The increased reliance on herbicides requires careful selection of products and rates as well as timely application.

Strip Till Equipment

Strip till equipment includes tillage implements which provide a narrow zone of tillage in the crop drill. These implements remove weed or cover crop debris, subsoil under the row, and provide a reasonable seedbed for planting cotton. Several brands are available, and possible options include variations in coulters and rear closing/mixing tools.

General Problems

Conservation tillage systems are not without problems. Success demands careful planning and management. In most situations, growers should begin a year in advance in preparations for changes to conservation tillage. Planting into residues or untilled surfaces requires use of specialized equipment and increased reliance on agrichemicals. Inclusion of cover crops may increase management and expense. In addition, cover crops may drain needed moisture in a dry year or retain excess moisture in a wet spring. Reduction in tillage may cause changes in pest complexes, for example, proliferation of certain perennial weeds. Weed control is further complicated by the inherent inability to incorporate dinitroaniline herbicides, which provide the backbone of annual grass and small seeded broadleaf control in conventional systems.

Soils

The presence of covers often results in slightly cooler soil temperatures, which may delay planting and/or increase seedling disease. Reduced tillage generally improves soil moisture, although the presence of covers may deplete soil moisture in a dry spring or conversely, retain excessive surface moisture in a wet spring. Either situation may delay or hinder cotton stand establishment. Though few trials have documented advantages of particular cultivars in conservation tillage, potential stresses of cool temperatures suggest the need for planting cultivars with good early season vigor.

Long term reduced tillage may cause compaction in some soils, but in others, soil tilth may increase. Significant increases in organic matter require continuous conservation tillage for

at least 3 to 5 years. Shallow fall disking or chisel plowing smooths field surfaces, providing a level seedbed for subsequent spring planting of cotton. Long term use of controlled traffic patterns may eliminate the need for subsoiling every year.

Cover Crops

Use of seeded covers increases cost and management but with benefits of added surface residues, soil and water conservation, wind protection, and possibly grazing, seed production, or N fixation. For compliance purposes, surface litter must provide 30 percent cover of the soil immediately after planting to qualify as "conservation tillage." Cover establishment can be accomplished by aerial seeding, spreading with fertilizer, or standard drill seeding in the fall. Cover crop establishment methods which do not include fall tillage, favor establishment of wind-dispersed, cool season weeds such as horseweed. In crops such as soybeans or cotton, aerial seeding prior to leaf drop aids in cover crop establishment. Seeding rates can be lower than used for forage or grain production; however, many growers suggest that full seeding rates are needed to gain competitive advantage over weeds. In some situations, fallow or natural weed cover may be an economical alternative, provided they develop a sufficient winter cover.

Generally, small grain cover crops are easier to deal with than legumes. With high fertility, however, small grains may produce excessive growth, thus increasing problems with strip tillage and planting equipment and requiring slightly higher N rates (in cotton). In lower portions of the state, double crop wheat works in some years, although later planted cotton is at risk to early frost. Among the small grains, rye is probably the most adaptable. It is easiest to kill, easy to establish, and provides aggressive fall growth. In some instances, rye may provide too much vegetative growth and thus wheat may be a better choice. Ryegrass is extremely difficult to eliminate in the spring with burndown herbicides and should not be planted as a cover.

Though they may offset need for fertilizer N by about 30 lb/A, legumes pose several challenges. Legumes are often difficult to kill with burndown herbicides, and the release of ammonia during decomposition of green matter may injure cotton seedlings unless the cover is killed 2 weeks or more prior to planting. Legumes are also a host for cutworms and nematodes, the latter of which is a serious concern as increases in cotton acreage limit rotation. Most legume/conservation tillage systems have involved hairy vetch and crimson clover. In southern extremes and with early seeding varieties, crimson clover may work well in a reseeding program; in other words, clover may mature and produce seed prior to the time cotton should be planted.

Cover crops or weeds should be terminated with burndown herbicides 2 to 3 weeks before seeding cotton. Partial or strip killing of covers is usually not effective because of the competitive effects of the cover on the young cotton crop. Application accuracy of burn down sprays is facilitated by foam markers, light bars, or guidance systems. Termination of cover crops should be timed to limit excessive growth. This is of special concern with aggressive covers such as rye. Though research is not very precise on the matter, rye should be terminated before it reaches 3 to 4 ft tall, other small grains before they exceed 2 to 3 ft. The key is to desiccate the cover to prevent excesses in dry matter production and complications with strip tillage and soil/seed contact at planting.

Fertility

Because of limited opportunity to correct problems, a move into conservation tillage should begin only after establishing proper pH and fertility. Surface applications of lime and fertilizer are adequate for maintaining nutrient levels in reduced till systems. Starter fertilizers may have greater utility in conservation tillage because of cooler or compacted soils and the inability to thoroughly mix fertilizer amendments. Nitrogen fertility must be integrated with cover crop management--increase N rates for small grains, decrease for legumes--and petiole testing may be even more valuable in conservation tillage than in conventional tillage systems.

Strip Tillage/Planting

Achieving an adequate crop stand is foundational for successful cotton production. In conservation systems, strip tillage and planting equipment must effectively operate in surface litter and narrow, tilled zones to place cotton seed in firm contact with moist soil at a desired depth. Fortunately, manufacturers and farmer-innovators have developed numerous implements for planting in reduced tillage situations.

Strip tillage and planting may be performed in the same or separate operations, with advantages for either approach. If both are performed in the same pass, there are fewer tracking problems and obvious savings in equipment and labor. Delaying planting 10 days or more after strip tillage reduces problems associated with litter decomposition and allows for moisture recharge of the tilled seedbed.

Rain or timely irrigation overcomes poor planting technique and poor soil/seed contact. Planting in a depression should be avoided because of potential problems with preemergence herbicide injury, postemergence weed control, and harvest. Standard strip tillage practices are not readily suited to establishment of raised beds and smooth row shoulders. However, a few growers have had success with fall bedding followed by cover seeding in order to create beds for the subsequent planting of cotton.

Insect Management

Insect management in conventional and reduced tillage systems is similar for most insect pests. However, differences do exists, most notably is the increased risk of cutworms in reduced tillage systems, especially if a legume cover crop is used. To reduce the risk of cutworm attack cover crops or winter weeds should be **controlled at least three weeks prior to planting**. No green vegetation should be present at planting, as it may serve as a reservoir host for various insects which may infest cotton. If the risk of cutworm infestation is high (i.e. green vegetation present, legumes cover crop, etc.), consider banding a cutworm insecticide such as a pyrethroid behind the planter as a preventive treatment. Increased infestations of false chinch bugs are sometimes observed in reduced tillage systems when a timely burndown herbicide was not applied. Grasshoppers are also more common in reduced tillage systems. We tend to observe fewer thrips in conservation tillage systems, but a thrips management program will still be needed. As fields remain in conservation tillage for several years, fire ants (beneficial) tend to increase.

Disease Management

Cooler temperatures and decaying vegetation contribute to increased potential for seedling disease in conservation tillage. Delaying planting or separating strip tillage and planting typically results in warmer, more favorable conditions and thus may aid in stand establishment in reduced till systems.

The interaction of covers with nematodes is not fully understood, but the preference of nematodes for certain legumes raises questions about their long term use in conservation tillage cotton. This is especially true for clovers and vetches.

Burndown in No-Till or Strip-Till Cotton

Cover crops (or heavy stands of winter weeds) should be killed at least 2 to 3 weeks before planting. This will avoid soil moisture depletion by the cover crop or weeds, allow the soil to warm quicker, and allow time to apply additional burndown herbicides, if needed, to kill streaks that may have been missed during the original application. Recommended burndown herbicides and application rates for small grain cover crops are outlined in Appendix VI.

If no-tilling or strip-tilling into natural cover (i.e., winter weeds), the need for an early burndown treatment will depend on the weed species present and the size of the weeds. An early burndown is normally advantageous, especially if ryegrass, cutleaf eveningprimrose, horseweed, wild mustard, wild radish, or curly dock is present.

Cutleaf eveningprimrose has been one of the most common and most difficult weeds to kill in strip-till or no-till fields. The most effective and economical option for cutleaf eveningprimrose is application of 2,4-D alone or mixed with glyphosate at least 30 days before planting. **The ideal and most effective time to apply 2,4-D is late February or early March.** At this time, the suggested rate of application of 2,4-D to control cutleaf eveningprimrose is 0.18 to 0.24 lb a.e. per acre (6 to 8 fluid ounces of a 3.8 pound per gallon formulation). Use 0.48 pound a.e. per acre (1 pint of a 3.8 pound per gallon formulation) for other weeds such as wild radish and use 0.95 lb a.e. per acre (1.5 to 2.0 pints of a 3.8 pound per gallon formulation) for horseweed.

For growers who do not want to put 2,4-D in their sprays, Ignite or a combination of glyphosate plus Valor are options. If applying Valor, review the label for tank clean out procedures after EACH day of use.

Extensive research has shown little to no benefit from application of Aim, ET, Goal, Harmony Extra, Harmony GT, or Resource to cutleaf eveningprimrose.

Early control of cutleaf eveningprimrose and other weeds is recommended. However, after cutleaf eveningprimrose has begun blooming, good control can be obtained with a combination of Gramoxone plus Direx. This combination also is effective on most other winter weeds. Ignite 280 is also effective on cutleaf eveningprimrose under warm conditions but may provide poor control under cool conditions. Also, Ignite will not control immature wild radish.

Wild radish can also be control by 2,4-D at 1.5 pt/A (of a 3.8 pound per gallon formulation) when applied alone or with 1.0 to 1.5 pt/A when mixed with Roundup. For growers not willing to use 2,4-D, radish can be controlled very effectively by glyphosate plus Harmony Extra or Express when applied at least 14 days prior to planting cotton. Once radish is fully matured (i.e. pod set), Ignite, glyphosate plus Valor, or Gramoxone plus diuron can also be used to provide good to excellent control.

Before applying any herbicide prior to cotton planting review the table below and the respective product labels for uses and plant back restrictions.

Plant back restrictions and comments for cotton burndown herbicides.

Burndown Herbicide Choice	Time Interval Before Planting	Special Comments
glyphosate	anytime prior to planting	
glyphosate + 2,4-D or 2,4-D alone	unknown for many brands of 2,4-D; 30 days for Barrage HF and Salvo 5 at proper rates	label suggest cotton can be planted after 2,4-D has dissipated from the soil
glyphosate + Harmony Extra or glyphosate + Express	at least 14 days	
glyphosate + Valor	strip-till production: 14 days for 1 oz/A and 21 days for 1.5 to 2 oz/A. no-till: 30 days.	one inch of rain needed after application but before planting
glyphosate + pendimethalin	apply within 15 days of planting	
glyphosate + Goal	at least 30 days	need 3 rainfalls each at least 0.25 inch
Gramoxone	any time prior to planting	
Gramoxone + 2,4-D	unknown for many brands of 2,4-D; 30 days for Barrage HF and Salvo 5 at proper rates	label suggest cotton can be planted after 2,4-D has dissipated from the soil
Gramoxone + Direx	15 to 45 days	
Gramoxone + Harmony Extra	at least 14 days	
Gramoxone + Goal	at least 30 days	need 3 rainfalls each at least 0.25 inch