CONSERVATION TILLAGE SYSTEMS FOR COTTON PRODUCTION

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All cotton planting in the United States for 2001 total 6,596,403 hectares up 5 percent from 2000. Growers planted 95,101 hectares of American-Pima cotton, up 38 percent from 2000. The largest increase came from growers in the Delta States and Texas. Insect resistant (Bollgard (BG)) varieties accounted for 13 percent of the 2001 cotton. 32 percent of the planted cotton was herbicide resistant (Roundup (RR)) and an additional 24 percent was stacked gene varieties (Bollgard plus Roundup (RRBG)). The total of all biotech varieties is 69 percent for 2001, up from 61 percent in 2000.

Conservation tillage (CT) cotton acreage is increasing rapidly since the introduction of Roundup Ready varieties in the U.S. Presently, 809,374.6 hectares of U.S. cotton are planted under some form of conservation tillage including strip till (ST), no-till (NT), stale seed bed or mulch till. Almost 607,030.9 hectares are planted in a strictly no-till situation, with zero tillage being performed since harvest of the previous crops. No-till cotton acres have more than doubled since the introduction of Roundup Ready Technology to producers in 1997. Prior to Roundup Ready cotton, weed control was a significant barrier to conservation tillage due to effectiveness of available herbicides.

There are certain areas and states that boasts large hectares and high percentage of CT and NT cotton. Over 50% of Tennessee’s cotton is grown by the no-till method. North Carolina, Georgia & Alabama have over 28% of their cotton produced in a reduced tillage situation.

BENEFITS OF CONSERVATION TILLAGE COTTON

REDUCED LABOR

Reduced-tillage cotton cuts labor costs because it can require as little as a single weed-control trip across the field, compared to six or more for conventional operations. A no-till cotton system can reduce labor by 28 to 50 percent, based on eight-row equipment and a 150-horsepower tractor. This means you can either farm more hectares using existing labor, or you can minimize your liability under worker-protection laws by reducing hired labor.

TIME SAVINGS

Cons-till can cut the time invested in preparing and planting a field by as much as sevenfold, 42 minutes per acre for conventional tillage versus only six minutes for total no-till.

On a 405 hectare farm, that adds up to savings of 600 hours or the equivalent of 60 extra 10-hour workdays each year that you can spend in other aspects of your farming operation or by enjoying leisure time with family. And since time really is money, when you pay labor by the hour, the time savings can truly contribute to dollar savings as well. Using our preceding example, that could mean savings of up to $4,200 (USD) per year, when based upon a $7 per hour labor expense.

Field accessibility is increased. Growers are able to take advantage of ‘windows of opportunity’ to perform the correct task (planting, spraying and pest management) at the correct time. Tillage is replaced by timing.

LOWER MACHINERY INVESTMENT
By reducing tillage, you also reduce the amount and size of equipment need, since con-till planters require only one-half the horsepower. Heavy tillage equipment and tractors can be reduced or eliminated altogether, free the dollars tied up in them for take-home profit or other uses. The three basic equipment needs are the conservation tillage planter and tractor, sprayer and harvest equipment.

LOWER MACHINERY OPERATING COAST

Fewer trips across the field result in less wear and tear on equipment. That means tractors last longer and repair costs drop drastically, saving up to $12 per hectare per year, money that can either contribute to increased return on investment (ROI) or be invested in other profit areas of your operation. Tractor hours are reduced as much as 60%. Fuel cost are reduced by 50% with conservation tillage.

GIVE THE MOST TO YOUR LAND-SOIL BENEFITS

The cumulative agronomic benefits of reduced tillage outlined below increase the productivity and value of your land, but they can be difficult to visualize. To do so, simply think of what vegetation in an undisturbed fence row looks like during periods of low rainfall-lush, green and growing. Then, picture what the crop in the tilled field right next to the fence row looks like-drought-stressed and struggling. Bottom line: reduced tillage results in healthy soil, which produces vigorous crops, which contribute to higher yields, which mean more money at harvest.

INCREASED SOIL ORGANIC MATTER

Long-term reduced-tillage plots, where no tillage was performed, showed an average of 0.1 percent per year increase in soil organic matter in the top 7 to 10 centimeters of the soil. Organic matter “recycles” soil nutrients and protects the crop against some pesticide damage, which contributes to overall yield potential.

DECREASED SOIL COMPACTION

By making fewer trips across a field, you reduce the weight or pressure on the soil, allowing more space between soil particles in underground root zones. Less compacted ground leads to healthier crops, particularly during periods of low rainfall.

IMPROVED SOIL TILTH

Reduced tillage decreases the cohesion of the soil, also called soil particulate aggregation. Small aggregates make it easier for water to move through the soil, allowing plants to use less energy in establishing roots. Intensive tillage compresses and shears soil aggregates, increasing the possibility of compaction, erosion and runoff.

BETTER INFILTRATION

Residue left on the soil surface “dams” water, nutrients and pesticides on the field, allowing them to soak into the soil where they can benefit the growing crop. This compliments improved soil structure in reduced-tillage fields, slowing associated runoff and nutrient loss.

LESS EVAPORATION

Because residue protects the soil surface from the sun’s heat, less water evaporates in the top 13 centimeters of water available for your growing crop in late season.

HOW TO BEGIN CONSERVATION TILLAGE COTTON
Conservation tillage cotton begins in the Fall with the harvest of the preceding crop to cotton. Rotations are good, but not necessary to the success of conservation tillage or no-till cotton. Conservation tillage monoculture cotton has been very successful and performed for 20 years in the same fields.

Normally immediately after cotton harvest, the stalks are cut or shredded no less than 15 to 20 centimeters in height. In areas that do not consistently receive freezing weather between crops herbicides or mechanical stalk puller are used to terminate re-growth or ratoon cotton. If you plan to follow a grain crop with conservation tillage cotton, add mechanical straw choppers and chaff spreaders to combines. All residue should be spread evenly in reduced tillage fields during or following harvest, especially following high-residue grain crops. Maze and sorghum stalks maybe left standing and not shreded.

In reduced tillage systems, herbicides replace tillage for weed control. Effective weed control can be accomplished even without Roundup Ready cotton but usually isn’t as economical.

Design herbicide rates and timing to match the weeds you have in your cotton fields. Start with quality spray equipment, including a post-direct and/or hooded sprayer, and maintain that equipment through out the season. The correct herbicide rate, applied at the right time using good spray equipment, is critical for effective weed control and crop safety in reduced-tillage cotton.

A clean field at planting, free of residual herbicides that may stress young cotton and stunt its growth, gives cotton an advantage in competing for moisture and nutrients. This advantage lasts throughout the season, for cleaner fields and higher yields in your con-till Roundup Ready cotton. For a clean start apply Roundup Ultra Max 14 to 28 days prior to planting.

Reduced-tillage cotton requires a good post-direct or hooded sprayer. Present Roundup Ready Technology allows for the cotton to be sprayed ‘over-the-top’ of the entire cotton plant from emergence through the 4th true stage. Equipment should be sturdy, well-maintained and ready to use. Check spray tips and screens, hoses, clamps, and pumps regularly for wear and replace them in needed. Also, check sprayers for adequate spray patterns and coverage.

It is very important the post-directed application, after the 4th true leaf stage, be directed under the leaves to minimize foliar contact with the cotton plant. To accomplish this, place nozzles in a low position to allow spray overlap in the row, while keeping the spray below the leaves.

For best results, follow these guidelines:
- Spray weeds when they are small—preferably less than 8 centimeters.
- Position the gauge mechanism on the post-direct rig close to the row rather than in row middles. Since row middles vary in height, gauging from the middles will vary the height of your spray. This increases the potential of foliar contact with Roundup Ultra Max, which could result in crop damage.
- Select spray nozzles, pressure and configuration that minimize spray mist. Lowering ground speed and reducing spray pressure are two ways to accomplish this.

Many con-till growers capitalize on each trip across the field by mounting multiple spray units on the tractor, so they can spray insecticides, fungicides, and plant growth regulators while applying herbicides. Timing is critical. If spraying is delayed, be sure the adjust herbicide rates and application methods as needed.

PLANTING EQUIPMENT

Proper planting equipment is key to successful con-till cotton. Use planters heavy enough to plant through residue and place the seed 3 to 6 centimeters with good seed-to-soil contact. While reduce- or no-tillage planters are available, converting most convention plants for use in con-till fields costs about $150 to $300 per row unit.

Here are some other recommendations for planting reduced-till cotton:
• Include heavy duty down-pressure springs that can be set for wet, medium and dry soil conditions on all reduced-till planters.
• Fit reduced-till planters with narrow wave or bubble coulters in front of offset double-disc openers, with solid or spoked/spaded closing wheels, particularly in high-residue or rocky fields.
• In average field conditions, run coulters 6 centimeters deeper than the double-disc openers. The dryer the soil conditions, the deeper the coulter settings and vice versa.
• Use residue managers to clear old residue. If using residue managers, set them to move residue only. If they are disturbing dirt, they are set too deep.
• Planting should be accomplished at normal speeds If planters or drills bounce excessively, slow down. You’re probably going too fast.

VARIETY SELECTION

Variety selection for conservation tillage differs little from more traditional tillage programs. Select only from those varieties with performance characteristics that are adapted for and fit your area and management practices. When choosing a variety, remember that cotton may emerge more slowly in con-till conditions, so early season vigor is important.

SOIL FERTILITY AND LIME

Cotton is very sensitive to soil fertility and pH levels. Con-till greatly reduces or eliminates the ability to incorporate fertilizer or lime. Therefore, it is a good idea to get fertility levels up and acidity levels down before starting to con-till a field.

Always fertilize on a field-by-field basis, as directed by soil testing. Phosphate, potash and ammonium nitrate may be surface applied in a reduced-tillage fields. But to prevent volatilization, urea (aqua) or UAN should be injected into the top 6 to 13 centimeters of soil with a coulter. Note that cotton seedlings are sensitive to ammonium-and anhydrous based fertilizers. These fertilizers should be injected away from the seed.

Use starter fertilizer in cooler soils to stimulate early cotton growth, if desired or if it’s a practice you would normally use in cotton production.

PLANTING DATE

Cotton seeds require a minimum soil temperature of 20 degrees Celsius for germination. Residue in reduced-tillage fields keep the soil slightly cooler, which means reduced-tillage fields may need to be planted later than clean-tilled fields. Fields with light residue warm as quickly as tilled fields, while fields with heavy residue may warm more slowly. Delay cotton planting until soil temperatures are at least 20 degrees Celsius and day time air temperatures are expected to remain above 20 degrees Celsius for two to three nights following planting.

According to a three-year study conducted at the University of Tennessee Milan Experiment Station in Milan, TN, reduced row spacing (76 cm vs. 96 cm vs. 101 cm) have no significant effect on average lint cotton yield in either reduced-tillage or conventionally tilled fields. However, narrow rows may overlap and shade row middles more quickly for added weed control and moisture conservation. Ultra narrow-row (UNR), 50 cm or less, cotton shows promise of benefiting both weed and insect control in cotton. However, harvest equipment, finger strippers, for UNR cotton is limited.

DISEASE AND INSECT PRESSURE

While greater disease and insect pressure may exist in high-residue environments, fungicides, and insecticides work essentially the same, regardless of tillage practices. Continue using fungicides in reduced-tillage cotton.

Kill cover crops and existing vegetation at least two to three weeks prior to planting and apply a labeled pyrethroid insecticide to prevent cutworms. Scout reduced-till cotton regularly and spray if pest populations reach local threshold levels.
CROP ROTATION

Crop rotation helps fight diseases and insects and also helps manage residue in reduced tillage. In general, rotate a low-residue broadleaf crop such as cotton with a high-residue grass crop such as corn, wheat or grain sorghum to obtain maximum benefit.

BARRIERS TO CONSERVATION TILLAGE COTTON

Why have U.S. Cotton growers continue to plow and till the soil when we have the technology to eliminate tillage? The reasons are many including the urge and need to prepare a “clean, firm seedbed” at the beginning of each season. Weed control, herbicide and fertilizer incorporation are other reasons cited. Tradition or performing the same tillage tasks as our forefathers performed them is another reason.

Why must growers change and why are they changing to no-till and conservation tillage? Economics and more profit potential are the driving factors. Wind and water soil erosion must be controlled to insure future long term production of land as well improve the “soil factory”. Growers must continue to meet environmental mandates and it is the moral obligation of farmers who want to be considered environmental caretakers.

Why have U.S. growers not changed their tillage habits? What are their barriers to conservation tillage? The number one reason is fear of failure when changing to a new method even though it is proven. Many believe that the no-till method “will not work on their particular soil type(s)”. Other reasons include not having the proper equipment and the perception of lower yields. Another is the fear of the soils compacting when not tilled regularly.

Every year economic considerations are leading more growers to convert to no-till and conservation tillage systems. After growers have tried a no-till or reduced-tillage system, they realize that there are many added costs associated with conventional tillage. Using a conventional tillage system requires significantly less trips across the field, which means an increase in time, labor, fuel and equipment costs. With reduced tillage systems, growers are saving money and improving moisture retention and soil quality, which eventually improves yields and makes fields easier to plant. Economic studies at several land grant universities are documenting that no-till can make a significant difference in the profitability of farms in regions as diverse as Mississippi and Texas. Other data is being collected from Monsanto Centers Of Excellence, test demonstration farms located in areas where conservation tillage cotton has a low adoption rate.

The Centers Of Excellence data collected over a three year period at 6 locations, AL, AR, LA, MS, SC, & TX showed that production costs were $86.48 (USD) less per hectare for no-till when compared to reduced tillage and conventional tillage. The no-till treatments yielded 14 kilograms per hectare more than the other tillage treatments. The no-till treatments increased profit by $140 (USD) per hectare. The most profitable cotton production system was the no-till Roundup Ready with Bollgard with Roundup only used for week control.

Conservation tillage cotton can be of great economic and profit benefit for the cotton producer, the soil and water quality benefits, our environment which we share with the general public benefits. Conservation tillage is a win-win-win for all involved.

CONSERVATION TILLAGE DEFINED

Conservation tillage is defined as any type of crop production system in which at least 30 percent residue remains on the soil surface after planting. Types of conservation tillage include:

- **No-Till**: No tillage performed at any time.
- **Ridge-Till**: Cultivation that creates “ridges” into which the seed is planted. Residue remains between ridges.
- **Mulch-Till**: No tillage following harvest, tillage prior to planting using chisels, field cultivators, discs, sweeps or blades.
• **Strip-Till**: An 15- to 25 cm wide strip of soil is tilled, into which the seed is planted. Residue outside of the tilled strip remains untouched.

• **Stale Seedbed**: Tillage in the fall following harvest to rework ground, reform beds and open the ground for winter moisture; no tillage in spring prior to planting.