What is Residue Management and Conservation Tillage?

Residue Management is managing the amount, orientation and distribution of crop and other plant residue on the soil surface throughout the year. It includes all soil disturbing activities like tillage, nutrient applications and harvesting of residue. Residue management systems can be designated to accomplish multiple purposes including:

- Reduced sheet and rill erosion
- Maintain or increase soil organic matter
- Increase moisture available for plant use
- Cost savings from reduced fuel usage
- Reduce soil particulate emissions and CO₂ losses
- Provide food and escape cover for wildlife

Two important definitions to remember when talking about residue management activities include Soil Condition Index (SCI) and Soil Tillage Intensity Rating (STIR). Both are used in the RUSLE2 program and are defined as:

**SCI** – a numerical value calculated using RUSLE2. SCI predicts the effects of management systems on soil organic matter content. Soil organic matter level is a primary indicator of soil condition. It affects soil characteristics and processes such as cation exchange, aggregate stability, water holding capacity, and soil biological activity. Soil condition is the degree to which a soil maintains the ability to accept, store and release water, nutrients, and energy, to promote and sustain root growth, soil biological and chemical processes, resist erosion, compaction, and other management impacts.

**STIR** - a numerical value calculated using RUSLE2 that is based on factors determined by crop management decisions being implemented for a particular field. The specific components of the STIR value include the operational speed of tillage equipment, tillage type, depth of tillage operation, and the percent of soil surface area disturbed. Values may range from 0-200, with lower scores indicating less soil disturbance.

Conservation tillage is any tillage system that leaves at least 30% crop residue cover after planting or during a residue management period. There are four types of residue tillage regimes that manage residue for sustainable agricultural production:

- Residue Management, No Till/StripTill
- Residue Management, Ridge Till
- Residue Management, Mulch Till
- Residue Management, Seasonal

All four of these residue management systems have been proven to improve soil condition over traditional tillage methods. There are several distinct differences between these practices, however.

**Residue Management, No Till/Strip Till**

This is the ‘Cadillac’ of residue management strategies. This system disturbs the least amount of residue because crops are either planted directly into previous year’s residue or small strips or slots. Key points of No Till/Strip Till include:

- A minimum of 30% cover must be maintained year-round over the entire field
- No full width tillage can be performed. Allowances can be made to level ruts or perform deep tillage to alleviate hard pans.
The STIR, as calculated by the RUSLE2 program, cannot exceed 30 under any circumstances.

This practice can be planned in row-crops, but no provisions exist for re-hipping rows.

Residue cannot be burned under any circumstances.

This system is not applicable to sugarcane production systems.

Weed control is almost exclusively achieved with herbicides.

Residue Management, Ridge Till

The ridge till system of managing residue is most appropriate when producers want the flexibility to rebuild rows if necessary. The term ‘ridge’ in this system refers to hipped rows in a row-crop farming system. The furrows are the dips between rows. Key points of Ridge Till are:

- All residue (minimum 30%) shall be uniformly distributed over the entire field following crop harvest.
- The tops of the ridges can be cleaned during planting, but the residue must be maintained in furrows until the ridges are rebuilt by cultivation. Ideally, cultivation to re-hip rows will be delayed for as late as possible during the growing season. At a minimum, rows cannot be re-hipped until at least 10 days after planting (except for sugarcane).
- Seedbed preparation, planting, fertilizer applications, and cultivation shall not exceed a STIR rating of 40 and the Soil Condition Index (SCI) should be positive. These two parameters must be calculated using the RUSLE2 program.
- Residue shall not be burned, except as noted for sugarcane.
- Weed control is achieved with a combination of cultivation and herbicides.

Sugarcane

1. No soil disturbing activities shall occur from harvest of the final ratoon crop until planting of the next sugarcane crop. During the fallow period, volunteer sugarcane and weeds shall be controlled by preplant herbicides (burndowns and/or residuals) recommended by the LSU Agricultural Center. If soybeans or other warm season annuals are grown during the fallow period, seedbed preparation for planting warm season annuals is limited to one pass of a rotary tiller or similar implement along the top of the row to destroy sugarcane stubble and flatten the row top enough to accommodate planter units. No other soil disturbing activities are allowed until planting operations for sugarcane commence as described in the next item.

2. Planting (including hipping, opening, planting, covering and packing) shall be accomplished within 21 days of the initial soil disturbing activity.

3. Planting shall be accomplished within dates recommended for sugarcane by the LSU Agricultural Center.

4. Ridge height following planting shall be a minimum of 10 inches.

5. Row cleaning, herbicide incorporation, and fertilizer placement shall disturb no more than 24 inches across the top of the row.

6. Following harvest, crops residue may be left undisturbed, moved to the furrows with a row cleaner or similar implement which does not disturb more than 24 inches across the top of the row or bury the residue, or burned. If burned, burning shall be conducted according to Louisiana’s Smoke Management Guidelines for Harvesting Sugarcane. Sugarcane may be burned pre or post harvest but not both. No burning shall be conducted after the final harvest in the rotation.

7. Weed control shall be accomplished with a combination of herbicides and cultivation.

8. Cultivation for weed control and rebuilding of ridges is limited to 2 passes (in addition to off-bar operation) and shall be accomplished with implements that maintain residue in the surface layer (within top 3 inches).

Residue Management, Mulch Till

This is the residue management regime that insures that 30% cover will remain on the soil surface year-round. Full width tillage is allowed, as long as it meets the minimum criteria below. Important points to remember include:

- As with No Till planting, planters used in Mulch Till systems need to be able to cut through and place seeds in a minimum of 30% cover.
Seedbed preparation, planting, fertilizer applications, and cultivation shall not exceed a STIR rating of 30 and the Soil Condition Index (SCI) should be positive. These two parameters must be calculated using the RUSLE2 program.

Full-width tillage is allowed, but the maximum STIR rating will usually restrict producers to few tillage passes or equipment that minimizes burial of surface litter (such as plows with sweeps).

Residue cannot be burned under any circumstances.

This system is not applicable to sugarcane production systems.

Weed control is achieved with a combination of cultivation and herbicides.

Residue Management, Seasonal

This is the residue management regime that insures that 30% cover will remain on the soil surface during a specified period. In Louisiana, this period typically begins immediately after harvest and ends at seedbed preparation for the next crop. Important points to remember include:

- The Residue Management, Seasonal specification lists the earliest date ground preparation activities can begin for common crops. When planting crops on Highly Erodible Cropland, additional criteria apply.
- Full width tillage activities can performed any time of the year, as long as 30% of the residue is visible and measurable immediately following soil disturbing activities.
- Stale seedbed planting is a system that requires re-hipping rows immediately following harvest but does not require any pre-plant tillage in the spring. This system is acceptable as long as no more than one pass with a hipper, bedder, disk-hiller, or middle-buster or similar implement is used following harvest of a non-fragile high-residue crop. This operation cannot take place after November 1, and if 30% residue is not present by December 15, a cover crop must be planted.
- If fall tillage is performed on rice, levees must be closed until 30% cover (volunteer vegetation) is present or seedbed preparation activities begin in the spring.
- Residue cannot be burned under any circumstances.

The earliest dates for beginning seedbed preparation on non-highly erodible cropland are:

- Rice January 15
- Corn February 15
- Grain Sorghum February 15
- Cotton February 15
- Soybeans February 15
- Sugarcane February 15
- Oats September 1
- Wheat September 1
- Rye September 1
- Ryegrass September 1

For all four residue management options, carefully read all practice standards and specifications.

Planning and Implementation of Residue Management

Residue management will be planned, with the producer, using past farm records and the RUSLE2 program. All cultural operations from past farming operations will be input into the RUSLE2 model. This will set the ‘baseline’ measurement of surface residue, STIR, and SCI throughout the year. Improvements to cultural operations are then to be input into RUSLE2 to determine if all criteria for residue management system chosen are met. Once the producer and the NRCS conservation planner agree on the plan of cultural operations, this chronological list of planned cultural practices, along with the ‘baseline’, will be printed out and become part of the conservation plan. The Profile option in RUSLE2 (and not the Worksheet or Plan option) must be used to generate RUSLE2 reports. The report NRCS Profile with SCI STIR Fuel UseLandscape0806.pro.dot must be selected, as it provides a list of all cultural activities used to generate the SCI and STIR.

Follow-up activities to assure that planned residue management and tillage operations meet the minimum criteria will be conducted. At a minimum, residue cover will be reviewed once per year using the line-transect method. Depending on the crops grown and the Residue Management system planned, these times will differ. For most crops, however, transects should
be completed immediately following planting activities or, for Residue Management-Seasonal, just prior to the first soil disturbing activity at the end of the practice. Conservation planners must use good judgment in determining when to conduct transects for practice certification. If any questions should arise, the State Conservation Agronomist should be contacted for assistance.

**Estimating Residue Cover**

The line-transect method is the preferred way to quantify the amount of cover a producer has on his or her field. To conduct this test, field personnel will need a 50’ or 100’ measuring tape or similar measuring device with at least 100 marks spaced 6” to 12” apart.

**Step 1** Find a representative area of the field.

**Step 2** Stretch the tape or line diagonally across crop rows and anchor at both ends.

**Step 3** Count the residue at the point of each mark of the tape or line. Make sure that the same side of the tape or line is used when counting residue. Count only those marks that have residue exactly under them. Only count residue that is wider than 3/32”, as anything smaller will not fully dissipate the energy of a raindrop. If you are unsure, do not count the intersection.

**Step 4** Determine the percent cover. When 100 points on a tape are counted, the number of marks over residue gives a direct measurement of the percentage of cover in the field. A count of 32 would equal 32% residue cover.

**Step 5** Repeat this procedure in each field under review.