Agronomic Update

GOLD COUNTRY SEED®

Conservation Tillage Practices

- A key component of a sustainable agricultural production system is proper soil management.
- Maintaining an effective, adequate amount of residue is critical in a conservation tillage system.
- Managing soil erosion, maintaining adequate organic matter, nutrient supply, and soil moisture for crop production are major factors to consider in a conservative tillage practice.
- Depending on the field situation, conservation tillage systems have advantages and disadvantages that need to be assessed.

Advantages:

- Depending on tillage method, 60 to 90 percent residue remains on the soil surface to help reduce erosion. Residue can protect soil particles from rain and wind erosion.
- Conserves soil moisture by reducing evaporation at the soil surface.
- Improves soil health and reduces runoff by increasing organic matter, which helps to improve soil structure and increase water infiltration.
- Requires less labor and fuel and reduces soil compaction due to fewer tillage passes across the field.
- Firmer soil conditions during harvest.
- Potentially less air pollution from dust and diesel emissions.
- Residue provides food and cover for wildlife.

Disadvantages:

- Slow soil warming in the spring, especially on poorly drained soils.
- Requires planter modification or a no-till planter.
- Increased dependence on herbicides for weed management.
- Scouting is required because insect, disease, and weed problems may be different compared to pests that are found in conventional tillage systems.

Conservation Tillage Systems

No-till. In this system, crop residue on the soil surface is not disturbed and should remain on the soil surface from harvest to seeding and from the latter to harvest. This practice helps reduce soil erosion, especially on highly erodible soils, and allows for adequate stand establishment. Soil is only disturbed when a narrow band is created by a coulter, seed furrow opener, row cleaner, or other attachments to the planters or drills for planting or drilling operations. No-till planters and drills should be able to cut the crop residue and penetrate the undisturbed soil. About 60 to 70 percent of residue after planting is generally required to manage erosion and conserve soil moisture, depending on soil types, field conditions, and residue source. [2]

The disadvantages of the system include dependency on herbicides for weed management, requires a no-till planter or planter modification, planting may be delayed due to wet, cool soil temperatures, and problems with different insect, disease, and weed species.

Strip-till. Usually used in fields that are poorly drained or fields with very little slope. This system is mostly beneficial in cold, wet spring conditions. Typically, strip-till is similar to no –till except that narrow strips are tilled while the rest of the field is left untilled. The system is implemented in fall in conjunction with anhydrous ammonium application. Strip-till can help warm up the seedbed earlier than a no-till system.

Ridge-till (ridge-plant or till-plant). Specialized planters and cultivators must be used to maintain the permanent ridges created for planting a row crop. The ridge tops are cleared of the previous crop residue at planting, to allow for the new crop to be planted on the ridges. After harvest, crop residue is left undisturbed on the soil surface until planting time. Maintenance of the ridges is essential and requires modified or specialized equipment for a successful ridge tillage system.

Mulch-till. Any conservation tillage system, except no-till and ridge-till, is called mulch-till. Deep tillage might be performed and crop residues are mixed with the soil. Different implements must be used to perform mulch-till. The tillage tools that are used must leave at least 30 percent of the residue on the soil surface.

Selecting the best tillage system for a specific situation requires the consideration of several factors:

Weed Management

Weed management in conservation tillage systems depends more on herbicides. Pre-emergence or post-emergence herbicides applied on the surface should be used to manage weeds in a no-till production system.

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Conservation Tillage Practices

Timing of herbicide application and enhancing crop competition can be effective in managing weeds in a no-till system.

Use paraquat or a Roundup® brand agricultural herbicide to manage small annual weeds. Roundup is effective at controlling perennial weeds because it translocates in the plant unlike paraquat. Paraquat or a Roundup brand agricultural herbicide can be tank mixed with atrazine to help manage perennial grasses, like Tall Fescue, in corn or grain sorghum fields. A Roundup brand agricultural herbicide can be tank mix with 2,4-D or dicamba for improved control of difficult to control broadleaves like marestail.

Several of the pre-emergence herbicides used to manage weeds in a conventional tilled system can also be used for no-till fields, but labels should always be checked for products that can be used in no-till fields. Keep in mind that no-till fields require the upper end of the product rate ranges to help ensure enough active ingredient is available to go through crop residue and effectively manage weeds. **Always read the label for information on proper application techniques.** Visit *http://www.roundupreadyplus.com/* for recommendations and the latest information on weed management.

Organic Matter (OM)

The soil OM amount and distribution change with the tillage practice. No-till is considered the most effective system for increasing OM. The slow decomposition of the undisturbed crop residue left on the soil surface helps increase OM in the upper few inches after several years. In addition, no-till can improve root biomass, microbial diversity, and help increase earthworm populations. The OM level of strip-till and ridge-till systems is between that of a moldboard plow and a no-till system.

Fertilizer Management

Tillage systems affect fertilizer management as the immobile elements of phosphorus (P), potassium (K), and limestone move slowly in most soils unless they are physically mixed during tillage operations. Soil fertility levels for conservation tillage at deeper depths may be reduced, which requires fertility management, based on soil test results.

Soil pH and Liming. In a no-till system, nitrogen (N) fertilizers applied to the surface reduce soil pH in the top two to three inches. Soil test samples for pH should be taken in the upper two inches, while nutrient samples should be collected from depths of six to seven inches. Lime should be applied, based on soil test recommendations to correct soil pH to the appropriate levels for crop growth and development. Keep in mind that over-liming or liming just before planting should be avoided in fields where triazine herbicides are used. High pH can increase the activity of these herbicides and potentially result in crop injury. If only the top two to three inches of the soil is acidic, half of the recommended lime should be applied.

Nitrogen. Liquid N or anhydrous ammonia should be injected into the soil to prevent N volatilization losses, using coulters in front of the injector knives. The same rates of N for conventional tillage are recommended for a no-till system when injecting into four to eight inches below the soil surface. If surface application of N is needed in a conservation tillage system, utilize a nitrification inhibitor to reduce N loss. Research has shown that injecting resulted in higher corn yields in a no-till system than surface N applications, either broadcast or surface banding.[1]

Phosphorus and Potassium. If soil test shows low P and K, injecting both nutrients with the planter or manure applicators is highly recommended.

Summary

- Conservation tillage is a system with a minimal amount of soil disturbance for a proper environment for seed germination and root growth.
- There is no one best system because of several variables, depending on the intensity of a tillage practice.
- Selecting one of the conservative tillage systems requires consideration of soil erosion and compaction prevention, fertilizer management and placement, weed management, organic matter retention, insect and disease control, and labor and energy cost.

Sources:

[1] Howard, D.D. and D.D. Tyler. 1989. Nitrogen source, rate, and application method for no-tillage corn. Soil Sci. Soc. Am. J. 53:1573-1577; [2] Buchholz, D.D. et al. 1993. No-till planting systems. University of Missouri Extension, G4080. http://extension.missouri.edu (verified 8/29/14);

Other resources used: Al-Kaisi, M.M. and M. Licht. 2005. Tillage management and soil organic matter. Iowa State University. https://store.extension.iastate.edu/ (verified 9/1/14); Al-Kaisi, M.M. et al. 2009. Considerations in selecting no-till. Iowa State University. https://store.extension.iastate.edu/ (verified 9/1/14); Conservation tillage. 2014. Conservation practices-Minnesota conservation funding guide. Minnesota Department of Agriculture. http://www.mda.state.mn.us/ (verified 8/30/14); Dickey, E.C. et al. 1986. Tillage systems for row crop production. NebGuide G80-535.Cooperative Extension Service, University of Nebraska–Lincoln; Simmons, F.W. 2002. Soil management and tillage. University of Illinois Extension. Illinois Agronomy Handbook, 23rd Edition; Sprague, G.F. and J.W. Dudley. 1988. Tillage practices and cultivation. In: Corn and corn improvement. Agronomy No. 18, 3rd edition. ASA, CSSA, and SSSA; Stoskopf, N.C. 1981. Cropping practices in an agro-ecosystem. In: Understanding crop production. Reston Publishing Company, Inc., Reston, Virginia.
