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The Role of Strip-Tillage in Sustainable Agriculture

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Growers around the world are recognizing the value of true stewardship and conservation tillage methods. Many have begun to reassess their approach to farming and acknowledge that sustainability of the land will be a significant factor for agriculture in the future.

In the next 10 years, the world's population will reach eight billion, and is expected to reach nine billion by 2050. Conservative estimates forecast growth in global food demand of at least 50 percent in the same period, even as global food production faces extraordinary challenges from rising temperatures, more severe floods and droughts and new pests and plant diseases. Experts conclude we must increase food production through higher plant productivity because we cannot count on adding more arable land.[1]

Conservation Tillage

One of the ways growing numbers of farmers around the world are helping ensure the sustainability of their land for future generations is through conservation tillage practices such as no-till and strip-till. Conservation tillage leaves a large percentage of crop residue on the soil surface during the soil erosion periods that occur pre-plant, at emergence and after harvest. This slows wind and water movement, which reduces soil erosion and helps retain moisture within the soil. No-till techniques seek to retain 100 percent of the ground cover by planting seeds into a narrow strip cut by a coulter wheel; strip-till techniques intensively till the soil in narrow rows to prepare a seedbed, but leave the soil in between the rows undisturbed.

Three Principles of Strip-Tillage

SEEDBED PREPARATION

For a quick start and robust germination, the use of strip-tillage maximizes existing soil moisture and increases water infiltration to create a warm, consistent seedbed with uniform seed-to-soil contact.

- Allows smooth planter operation for better performance
- Increases water infiltration and maximizes existing soil moisture

PRECISION NUTRIENT PLACEMENT

Modern strip-tillage machines can integrate dry, liquid or NH3 fertilizer systems and enable precise placement of multiple nutrients at variable depths for ideal uptake timing.

- Places multiple nutrients at variable, user-determined depths
- Targets absorption triangle for proper stage and use

ROOT-ZONE CONDITIONING

Strip-tillage creates an ideal environment throughout the growing cycle by shattering compaction in the root zone, eliminating subsoil voids and cavities and creating twice as many beneficial pores for improved below-ground development.

- Eliminates subsoil voids and creates beneficial pores
- Creates an ideal environment throughout the season
- Increases early root development during vital V1-V5 stage as well as late-stage development to improve yield results – specifically when the plant is determining kernel counts

Both techniques benefit farmers by reducing the number of times a farmer needs to cross the field, thereby saving fuel and labor and reducing the compaction of the soil. Although no-till techniques can still require multiple passes, advances in strip-till equipment have reduced the number of trips across the field to as few as one, in which each strip is tilled, cultivated and fertilized immediately before seeds are placed by an integrated planting system.

Enhanced Production

Although there may be a small increase in erosion risk, one of the benefits of strip-till versus no-till is improved production. Cool, moist soil conditions are exacerbated by no-till techniques and can delay crop germination in the spring. Strip-tillage removes residue in the seed row, uncovering dark earth to absorb the sun's energy and encourage much more rapid warming of the soil and therefore earlier and more robust germination.[II]

However, soil warmth is only one of a combination of factors important in improving yield that are addressed by modern strip-till equipment. Breaking up the soil in tilled rows allows an aerobic condition and creates an ideal seedbed, while eliminating compaction in the root zone improves conditions for early root development and creates an ideal environment throughout the growing season. Dry, liquid or NH3 fertilizer can be simultaneously applied only in these rows where the seed is being planted and at precisely determined depths to improve proximity of the fertilizer to the roots.

This precision in fertilizer placement creates new fertilizer options for producers that can have a positive effect on crop yield. According to AgProfessional.com, research in Kansas showed that when utilizing strip-till practices, producers can more effectively place nutrients directly below the seedbed to efficiently supply some of the crop's nutrient requirements, particularly nutrients with limited mobility such as phosphorus and potassium where precise placement can make nutrients more available to seeds. [III]

The research showed that producers using strip-tillage significantly increased corn yields compared to no-till at several locations. For example, the average corn yield increase of strip-till over no-till was 28 bushels per acre in Manhattan, Kan., in 2003. AgProfessional.com also cited work done by the Irrigation Research Foundation (IRF) in eastern Colorado from years comparing strip-tillage to conventional tillage:

"This work has shown a four-year average corn yield increase of 16 bushels per acre in strip-tillage compared to conventional tillage, with a range of increase from 11 to 24 bushels. Strip-till also produced deeper and more abundant roots to explore greater volumes of soil for water and nutrients. For example, 90 days after emergence (2002) total corn root length with strip-till was about three times that of conventional tillage and rooting depth was 12 inches greater. Water infiltration was also significantly increased in strip-till." [IV]

Soil Conservation Considerations

In an era of growing climate uncertainty, one thing most experts agree on is that water will take on increasing importance to future farmers. By leaving residue intact, both no-till and strip-till conserve considerably more moisture in the soil than conventional tillage systems. The crop residue absorbs the impact energy of raindrops and helps limit dispersal and crusting by impeding overland water flow and providing more time for the runoff to infiltrate through soil pores.

While strip-tilling may leave fields open to somewhat more soil erosion than no-till techniques, both are a dramatic improvement over conventional tillage. Research done by the University of Wisconsin Lancaster Agricultural Research Station involved placing passive runoff collectors in a field with both chiseled and strip-tillage on an 8 percent slope. The measured soil loss in a year that experienced substantial rainfall during the early part of the growing season prior to crop canopy closure was 4.67 tons of soil per acre in chisel, but only .28 tons of soil per acre in strip-tillage. [V]

Moving Toward Agricultural Sustainability

As agricultural growing conditions change around the world, producers will have to embrace new technologies to keep pace with increasing demand. Agronomists are already working with plant biologists as well as agricultural equipment engineers to develop new and more efficient ways to produce crops from the same amount of tillable land while maintaining the quality of the soil. Strip-till is the innovation that this generation of progressive farmers brought to the table. We're eager to see what comes next.

[I] Haga M., "Feeding a Growing World — Despite Climate Change," Crop Trust, www.croptrust.org/content/feeding-growing-world-despite-climate-change

[II] Godsey, C., Kochenower, R., Taylor, R., "Strip-till Considerations in Oklahoma," Oklahoma State University Cooperative Extension Service, PSS-2134, http://notill.okstate.edu/publications/factsheets/PSS-2134web.pdf

[III] "Strip tillage and fertilization for corn," AgProfessional.com http://www.agprofessional.com/resource-centers/strip-tillage/news/272421901.html

[IV] Ibid

[V] Wolkowski, R., Cox, T. and Leverish, R., "Strip-tillage: a conservation option for Wisconsin farmers," University of Wisconsin Cooperative Extension (A3883), http://corn.agronomy.wisc.edu Management/pdfs/A3883.pdf

About Randy Haarberg

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