17th Annual National No-Till Conference

Indianapolis, Indiana

January 14th - 17th 2009

Efficient Fertilizer Placement In No-Till Systems

By Phil Needham

Needham Ag Technologies, LLC.
www.needhamag.com

With fertilizer prices at record levels, farmers need to be looking at more efficient methods of placing nutrients in the soil to maintain crop yields and control input costs. There are several efficiency boosting options being used within the USA and other countries around the world, already and most involve the use of conservation tillage practices in conjunction with fertilizer placement options. Such practices include strip-till, no-till and no-till with fertilizer placement. Following is a brief rundown of each of these practices and some newer technologies that have proven to help growers increase their bottom line.

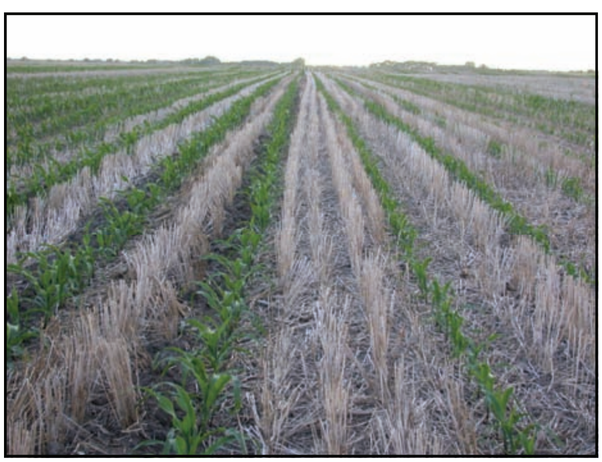
Cost-Effective No-Till.

Providing the producer's fields have above-average drainage, no-till frequently provides the most cost effective and efficient method of establishing a crop. Among the benefits of no-till are lower equipment costs, less labor, better soil conservation, and fewer spring passes across the field, which reduces soil compaction and helps increase yields indirectly. Providing a planter is properly equipped with appropriate attachments (such as row-cleaners, fertilizer placement options and a sound closing system) research shows that soil warming, early growth, total leaf area and final yields can equal or exceed those of strip-tillage or conventional tillage, especially in low rainfall areas.

Strip-Till Still Evolving.

There are many interpretations of strip-till and its final configuration is still evolving. Early strip-till units consisted of ripper shanks, which frequently caused depressed seed zones in the spring and numerous erosion problems on rolling ground. Most strip-till units today consist of discs that till a thin strip ahead of planting the following spring and these units appear to be the best option for most soils.

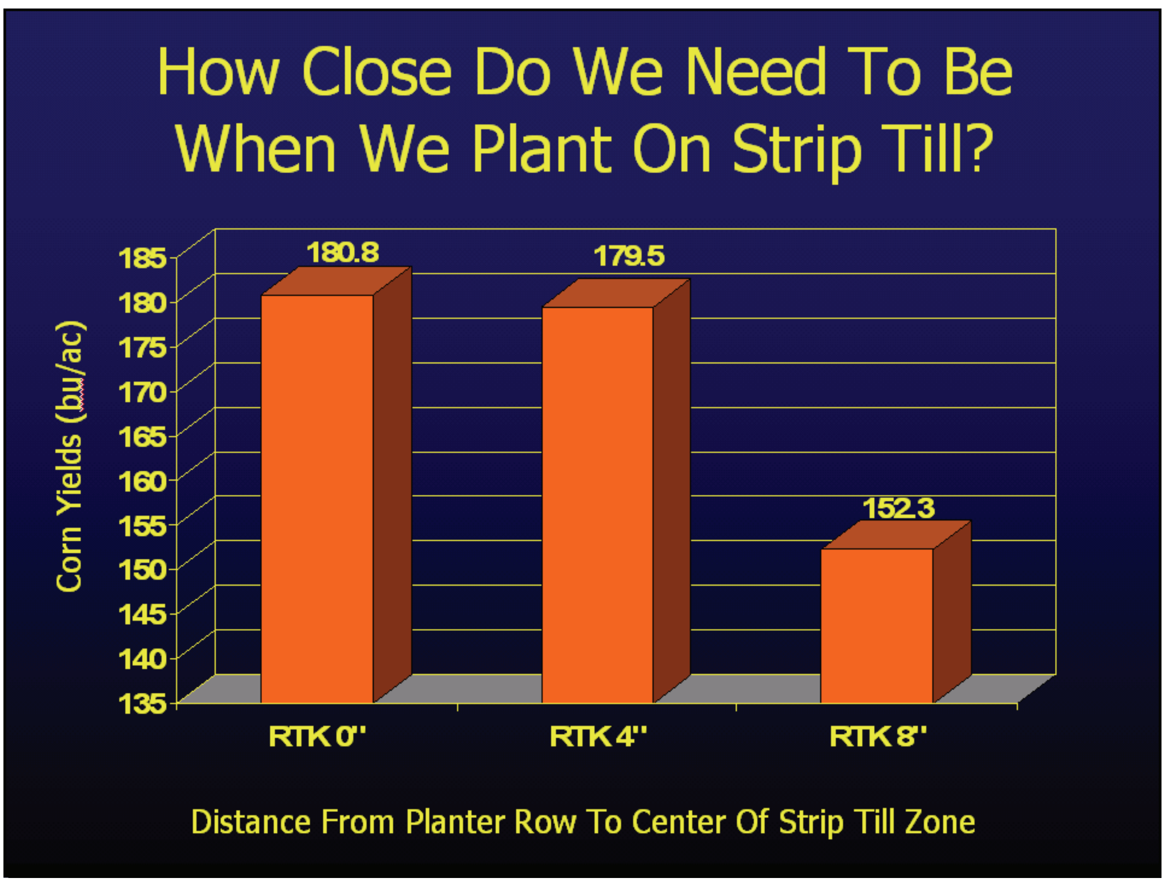
Improvements in GPS guidance have also helped the performance of strip-till by allowing the planter to return directly over the strip tilled zones. Growers need to be aware of where the yield benefits from strip till specifically come from. Many of them can be achieved with one pass using a planter if it’s correctly configured. Specific benefits to strip till will depend on soil type, drainage, previous crop, rainfall, location and many other factors. The illustration below is an image of a side by side - strip till vs. no-till corn trial conducted by a farmer in Nebraska. The strip till into wheat stubble provided a 15 bu/ac yield response, but in my opinion the no-till area to the right was never set up for success. No row cleaners were utilized, residue distribution with the combine was poor and no fertilizer was placed within, or alongside the row. All of those factors are very important for no-till, critical in fact. So if these additions could have been included within this comparison, I think the no-till would have performed as well as the strip-tilled regions at a significant lower cost.



The big challenges with regards to strip-till are the direct equipment expenses, labor plus the time required to complete the operation. For example, one producer that purchased the latest and greatest strip-till equipment never had time to run it before the land got too wet in the fall. This subject is ironic, because the regions which could stand to benefit the most from strip till (Minnesota, Eastern ND, Wisconsin and perhaps Northern Iowa) have the shortest growing seasons and some of the smallest time windows to fall strip till. While some producers have tried strip till in the spring with some success, it's very dependant on soil type and soil moisture. Soils with high clay content are generally not good for spring strip till, because the clods created by the strip till rig will need winter weathering to break them down to form a level strip to plant on.

Successful strip-till systems consist of a fertilizer placement system that can till a narrow raised strip, plus locate a band of fertilizer where the following corn (or soybean) row will be planted the following spring. However, research has shown that unless tractors are equipped with high-accuracy RTK auto-steer systems, the benefits of the tillage and fertilizer placement are quickly compromised and any benefits of strip-till yield deteriorate.

The graph below was taken from the **Irrigation Research Foundation (IRF)** Annual Report 2007, (page D3). The IRF was established in 1994 as a private, non profit organization located in Yuma, Colorado and they specialize in contract research. The graph represents average yields from two replications of each strip till pass. The offset of the corn planter was intentionally set to 0", 4" and 8" from the center of the strip till zone using a high accuracy RTK system on a John Deere tractor equipped with AutoTrac and the brand of strip-till rig was an Orthman. This trial suggests that if the planted row can stay within 4" of the center of the tilled strips, yield benefits can be maintained, however, if the planter wanders out as far as 8" significant yield loss can occur (28.5 bu/ac in this example).



No-Till with Fertilizer Placement.

The most efficient system that is just beginning to emerge in several areas of the country (most notably in the Dakotas) is a one-pass system I call "no-till with fertilizer placement." As different areas have various preferences with regard to the forms of fertilizer they utilize, specific configurations within these units can vary significantly. The goal is common to place nitrogen (N) in a band alongside the seed row at planting time. This saves a pass with the strip till rig and the placement is 100% accurate, even on rolling ground or when making slight turns. Such systems have proven to be very efficient from a labor and expense perspective, especially in medium to low rainfall areas and long-term no-till rotations.

This system is practical for many producers as they can either carry a tank on the tractor or planter, or even pull a trailed tank behind the planter. Most of these producers are applying 30-50% of the crops N requirements with the planter, then returning with a side-dress application of either liquid N or anhydrous ammonia. Such a strategy has been found to increase crop N uptake efficiency, reduce N losses maximize the bottom line.

Using a Commodity Cart.

Many growers are finding that a commodity cart is the best method of applying N + P + K with the planter in one pass. With all of the advances in yield mapping, soil type productivity values and site-specific soil sampling, the next opportunity to push this technology further is to couple it to variable rate application technology. Such strategies allows for the delivery of specific rates of N, P and K in accordance to yield potential within the different soils and topographies of a field.

The image above illustrates a grower who plants with a 16 row John Deere 1770 planter and pulls a John Deere 3 hopper commodity cart behind it. This commodity cart configuration offers huge flexibility to deliver N + P + K in a consistent band alongside the row. If growers want to use variable rate fertilizer, this highly efficient system adapts extremely well.

Note the use of weights on the wings to provide enough down force on the wing planter units. The tractor was fitted with AutoTrak, so the markers were removed.

The image above illustrates how a commodity cart was coupled to a 12 row john Deere 1770 planter. While most commodity carts are now available to match 30” rows and most planters can be equipped with frame or unit mounted fertilizer openers, the hoses, manifolds and dry boots. These will probably need to be fabricated at the dealership or on the farm, because they are not yet currently available as a bundle from the manufacturer.

A commodity cart may not appropriate for producers with rolling ground or smaller fields, so a more compact and cheaper option is to place liquid fertilizer tanks on the tractor. Such a configuration is illustrated above. This is a John Deere 1770NT with optional fertilizer frame. It is equipped with floating row cleaners to move residue and unit mounted fertilizer openers. This configuration applies liquid pop-up fertilizer in the row plus 20 gallons of 28% liquid nitrogen in a band 2 inches to the side of the seed row center. This system provides excellent early plant health, in preparation for a side-dress application to deliver the majority of the N around the 5-6 leaf stage. Such strategies can significantly increase fertilizer efficiencies, increase yields and lower production costs.

The Future……

With high fertilizer prices, producers should be encouraged to band their P & K fertilizer prior to planting or during the planting process. I also encourage producers to apply some of the N in, or next to the row to provide early season plant health. Research shows that availability is higher and rates of fertilizer can be reduced when fertilizer is banded. Banding fertilizer at planting is the most efficient and least labor-intensive option, but farmers will have to concentrate on the logistics of being able to supply the material to the planter. Most farmers are using hopper bottom semi's or straight trucks which can dump fertilizer directly into the commodity cart auger. The future is probably an auger wagon with 2-3 augers that can fill the commodity cart with 2-3 products simultaneously. One such example of this is illustrated below.

Finally, the balance of the corn nitrogen should be ideally side-dressed around the 5-6 leaf stage. This opens the door for many new technologies to sense crop health and deliver variable rate nitrogen prescriptions. While liquid nitrogen lends itself best to variable rate application, growers are starting to adapt anhydrous ammonia systems to utilize optical sensors such as Greenseeker. The images below illustrate how liquid N can be injected into the soil with an anhydrous toolbar and how liquid N can be injected into the soil with a Yetter toolbar on a John Deere sprayer. Liquid N can also be dribbled between the rows using drop nozzles. All of these systems utilized a Greenseeker to determine the N rates required within specific regions of the field.