CR-1213
0582

OSU Current Report

Cooperative Extension Service • Division of Agriculture • Oklahoma State University

UNDERSTANDING "LO-TILL"* PLANTERS

By Willard Downs
Assistant Professor
Extension Agricultural Engineering

The idea of reducing tillage between harvest and planting is not new to many Oklahoma farmers. "Stubble mulching" was widely practiced after the dust bowl. Current minimum tillage programs are based on using chemicals to eliminate all or most fallow season tillage operations.

Perhaps the most important benefit from reduced tillage is conservation of soil moisture (see Table 1). Improvements in water storage will depend on the amount of stubble present, its orientation, weeds present, etc., but the results of all studies on moisture conservation indicate significant improvement with reduced tillage. Wind and water erosion of soil is also significantly reduced.

Table 1. Soil water storage during fallow as influenced by straw mulch rates at 4 Great Plains locations.

Location	No. of Years Tested	Tons of mulch per acre			
		0	1	2	3
		----Inches of water stored-----			
Bushland, TX	3	2.8	3.9	3.9	4.2
Akron, CO	6	5.3	5.9	6.5	7.3
North Platte, NB	7	6.5	7.6	8.5	9.2
Sidney, MT	4	2.1	2.7	3.7	4.0
Average soil water		4.2	5.0	5.7	6.2
Water gain by mulching		---	.8	1.5	2.0

Minimum tillage equipment and practices can be used to get double or second crops in the ground immediately after harvest of the first crop to take advantage of residual soil moisture. The additional soil moisture available is often enough to get the crop going even during dry parts of the year. Lo-Till planters can also be used to seed directly into sod. This idea is being practiced today in parts of Oklahoma.

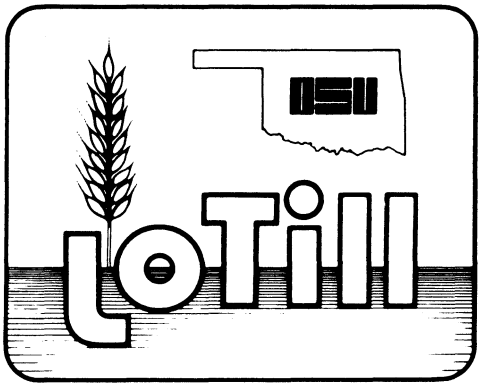
*Lo-Till is a term adopted by the O.S.U. Extension Service to represent minimum tillage programs in Oklahoma.

Minimum tillage results in reduced fuel consumption, less labor, fewer passes across the field and reduced field compaction. A smaller complement of machines is required, reducing capital requirements. Table 2 compares the inputs for minimum till programs based on Bladex and Surflan to conventional practices.

Table 2. Inputs for Lo-Till program using Surflan and Bladex for weed control compared to conventional practices.

	PER ACRE CHANGES FROM CONVENTIONAL				
	FUEL (gal)	LABOR (hrs)	NITROGEN (lbs)	HERBICIDE ($/ac)	REPAIR ($/ac)
Surflan	-4.28	-1.04	+20	10.50	-2.76
Bladex	-3.54	- .86	+20	9.00	-2.50

Conclusive information on crop yields, total cost, and long term insect and disease problems is not yet available. Research in this area is currently underway at many universities, including Oklahoma State University. In most cases where minimum tillage concepts have been properly applied, yields have compared favorably with conventional systems. This is particularly true in areas where water is the limiting factor. Most researchers believe the total costs per acre will be about the same for both conventional and conservation tillage methods at current fuel prices.



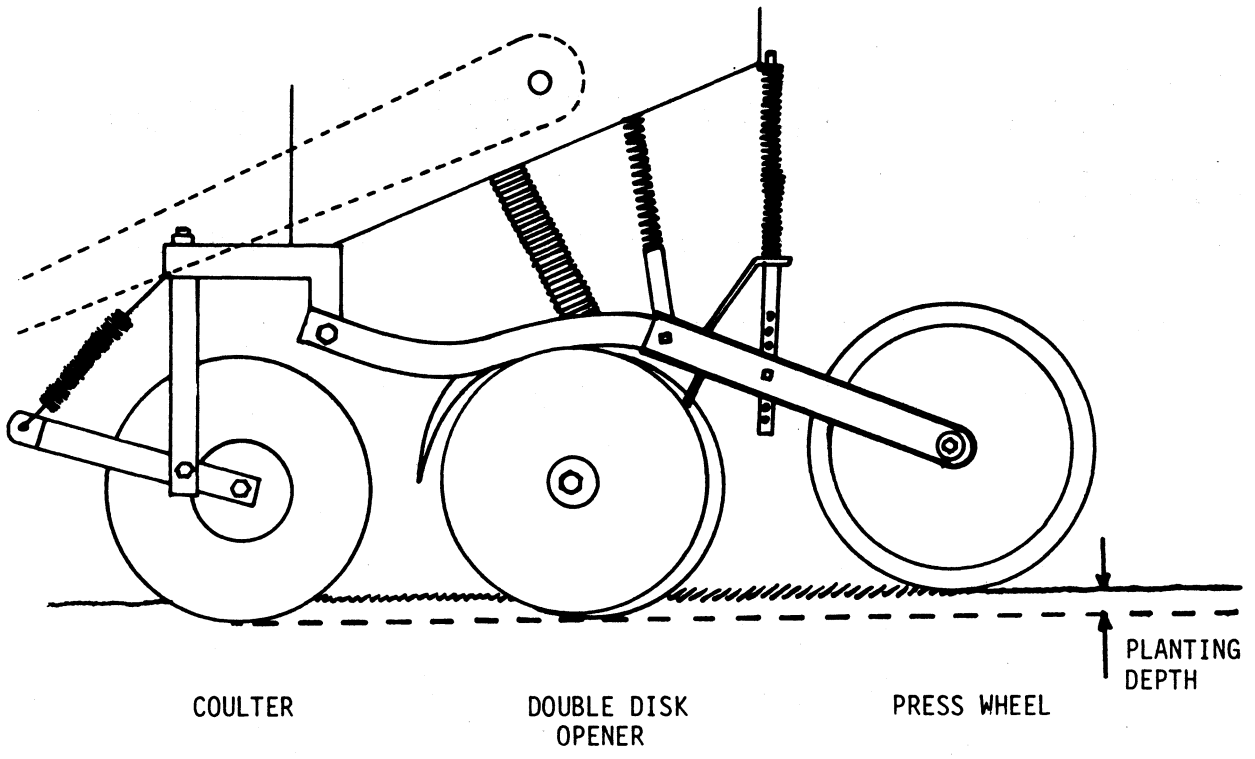


Figure 1. Lo-Till Planter

PLANTING EQUIPMENT

From the equipment standpoint, most attention must be focused on the planter. A Lo-Till planter must operate in rough, trashy conditions, and provide whatever tillage or ground preparation is necessary while planting the seed accurately and applying fertilizer and/or herbicides. Figure 1 shows the configuration of a typical Lo-Till planter.

Coulters. Most Lo-Till planters use coulters to cut through trash and stubble and prepare the surface for the seed opener. Coulters may range from one to two inches in width in a ripple design. Narrow coulters work best in wet or sticky conditions, while wider coulters do a better job in sandy, dry soils. The trend seems to be towards narrow coulters which cut cleanly through trash while disturbing as little soil as possible. Recent studies have shown more variability in seed placement when wide coulters were used. The best choice of coulter width will depend on field conditions. Coulters should be simply mounted so that they may be changed as necessary to suit field conditions. Considerable weight on the coulters is necessary for clean cutting. As much as 400 pounds per coulter may be required. Each coulter should be independently mounted and adjustable.

Openers. The four common types of furrow openers are the single disk, double disk, runner or shoe type, and the chisel. The double disk opener is currently most popular. It provides good self cleaning action, helps cut through trash and disturbs a minimum amount of soil.

Seed Metering and Delivery. Row crop planters usually have plates, finger pick-up, or air metering systems. Air systems may have some advantages in Lo-Till row crop planting. "Doubling" (placement of more than one seed in the same spot) is often less frequent with air systems. Drills normally have some form of fluted feed cup. Some small grain planters also use air metering and delivery.

Depth Control. Good depth control is especially important with a Lo-Till planter because of surface trash and roughness. The most accurate depth control device is probably a depth band attached to the disk opener. If the soil is too wet or cloddy however, the depth band may be unable to accurately control seed placement depth. Small gauge wheels mounted independently with each planting unit will provide good depth control and may work better in wet conditions. The press wheel following the planting unit can also provide good depth control. When gauge wheels or press wheels are providing depth control, they should be coupled as closely as possible to the seed placement unit to minimize variations in seed depth due to surface irregularities.

Covering. Adequate seed covering is normally provided by the action of the seed openers and press wheels. An additional covering disk is occasionally used.

Firming of the Soil Over the Seed. Soil firming is a critical part of Lo-till planting because of the variability in the nature and texture of the soil surface. Many types of press wheels are in use. The most common include (see Figure 2):

(1) Smooth wheels with a single or double rib
(2) Smooth wheels (wide variation in diameter and width)
(3) Concave
(4) Double, angled wheels

PRESS WHEELS & FIRMING WHEELS

FIGURE 2

As with the coulter, the choice of which press wheel to use is very dependent on field conditions. For loose, dry soil conditions, it is necessary to firm the soil directly over the top of the seed. In this case, a center ribbed press wheel or a relatively narrow smooth wheel would be the best choice. If the soil is wet and sticky, the press wheel should exert pressure on the sides of the seed furrow without compacting the top of the furrow, or emergence may be adversely affected. The double rib and the double, angled press wheels provide pressure to the lip of the furrow, firming the soil around the seed, without compacting soil directly above the seed. Press wheels should be simply mounted so that they may be changed or adjusted to suit field conditions. Independent suspension is important in compensating for ground irregularities.

No One Configuration Best. It is likely that no one planter configuration will be best for all field conditions, even on the same farm. The choice and adjustment of coulters and press wheels is especially critical to Lo-Till planting.

Important Considerations When Selecting a Planter. Several important considerations should be made when selecting a planter. Each run on the drill or row on the planter should be independently mounted and adjustable. This should include the coulter, opener and placement unit, and press wheel. High trash clearance (18 to 24 inches) is desirable. Interchangeable coulters and press wheels are a must for operation in changing field conditions. Check to see that the change can be made easily and quickly, and that the manufacturer has the coulters and press wheels which you might need. If the unit has depth bands which must be removed for operation in wet conditions, what provisions remain for effective depth control? Can the planter frame carry any additional weight which might be necessary in dry conditions, and can the weight be added quickly and easily? The planter should have adequate bin flexibility so that fertilizers, herbicides, etc. can be applied during the planting operation.

Can An Existing Planter be Adapted for Lo-Till Use? Any drill or planter can serve in a Lo-Till program provided it performs satisfactorily. If the existing planting unit has acceptable opening and placement units, coulters can be added. This would normally require a third toolbar for mounted planters. Addition of coulters to a frame-mounted drill may be more difficult. Press wheels may already be adequate, or possibly added as needed. If possible, each run should be independently attached and supported. The original planter frame and mountings may require strengthening to carry the extra coulters plus any additional weight which must be added.

PLANTER OPERATION

Modern planters have been designed to operate at ground speeds of 6 to 7 mph. A drill or planter operating in Lo-Till conditions should be operated at a much slower speed. At speeds above 4-1/2 mph, seeding accuracy may be seriously affected. Figure 3 shows the reduction in germination as a result of seed placement variability with increased travel speed. Germination rate is also affected by placement depth, and accurate depth control is more difficult at higher ground speeds. Variability due to speed will probably be more serious for row crop operations than for drilled crops.

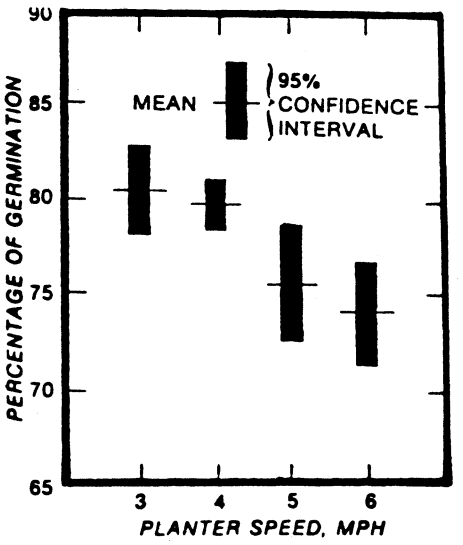


Figure 3

Surface residue should be dry, with firm soil underneath, if coulters are to cut cleanly through trash. In wet conditions, residue may be forced into the mud, making proper furrow opening impossible. Wet soil may also stick to the coulter resulting in plugging. Narrow coulters would offer an advantage in these conditions. If the soil beneath the residue is too loose, it may be difficult to cut through the residue. Wide coulters would be a better choice for these conditions.

Press wheels should be selected to fit existing field conditions. Wider press wheels designed to provide firming directly over the seed would be the choice for dry or loose field conditions. Press wheels providing pressure to the lip of the furrow would be the best starting configuration in wet conditions.

Although planting depth will depend on many things, a good starting point would be to aim for 1-1/2 to 2 inches in coarse, dry soils and 1 to 1-1/2 inches in fine, moist soils. It is desirable to have about one inch of firm soil directly over the seed. It may be necessary to plant at greater depths if soil moisture is limited.

PRE-PLANTING PRACTICES

Even distribution of surface residue over the field is essential to the Lo-Till concept. Proper application of chemicals for weed control is difficult when straw is unevenly spread. Provisions should be made during harvest to evenly spread the residue. It may be necessary to use a shredder or other tool as a pre-planting operation.

TYPICAL PLANTING SYSTEMS

Four most commonly used rediced tillage planting systems are briefly described below:

Till Plant Systems. A strip tillage system in which sweeps or disks cut and remove residue, growing vegetation, and a layer of soil over the old row just ahead of a surface planter in a once-over operation. Typical of the system is the "Buffalo Till Planter". Such equipment has also been successfully used to plant row crops in native sod or irrigated grass. Advantages of the system are low machinery investment, reduced fuel costs, and excellent moisture conservation. Disadvantages include problems in adjusting trash sweeps to proper depth. If herbicides are used, only one cultivation is usually necessary. Large amounts of long, flat stubble can be a problem.

Adequate weed control is also an important factor. Weeds use significant amounts of valuable soil moisture and can affect planting. If adequate chemical control of weeds has not been achieved, it may be necessary to perform a sweep operation prior to planting.

The reports of Oklahoma researchers indicate that for wheatland operation, straw should be cut low and spread evenly over the surface to give maximum mulching effect. However, in row crop operations where the average residue stalk diameter is much greater, it may be difficult to cut through large amounts of flat residue. Some experimentation may be necessary to determine how much of the residue should be left standing. In areas where winter and spring winds cause problems with drifting snow or soil erosion, it may be desirable to leave more standing stubble. The standing stubble should be disturbed as little as possible. If more than one sweep pass is required for weed control, it would be wise to perform the second pass at a right angle to the first. The objective is to avoid a situation where the entire soil-mulch layer becomes loose enough to become a problem during the planting or for erosion and blowing to become a factor.

Tri-Level Bedder (Orthman). Sixty inch beds are formed by a V-shaped bedder. The bedder forms a ridge, two ledges, and a furrow. Seed is planted on the ledges and one irrigation furrow is formed for each two crops rows. This system requires less skilled and precise operation than other till plant systems. The system does a good job of incorporating crop residues, and irrigation is facilitated by the large furrows. The use of the bed splitter permits pre-irrigation whenever desired. Two or three operations may be required for planting if the bed splitter is used, and more fuel is required than for till plant systems.

Disk-Surface Plant. Seedbed preparation is by double disking and harrowing. Crop residue is thoroughly incorporated. Power requirements are reduced in comparision to the mold board plow, but moisture loss is greater than with other reduced tillage systems. Water and wind erosion are also more severe.

No Till, Slit Planting or Slot Planting. Examples could be in continuous wheat cropping, fallow season wheat cropping, or planting small grains or row crops directly into native sod. Row crops can be seeded into summer fallowed wheatland with this system and double crops are often seeded with this system. As many machine passes as possible are eliminated by the use of a chemical weed control program, and the new crop is planted directly into the stubble. In Oklahoma, this system seems to be most successful when chemical and mechanical weed control methods are used together. When adequate weed control is achieved and field conditions are acceptable, it may be possible to eliminate mechanical tillage entirely. More often, one or two mechanical sweep passes will be used, with chemicals providing the rest of the weed control.

SUMMARY

The recent development of new herbicides and chemical weed control programs, coupled with equipment developments have made the application of Lo-Till planting practices a potentially attractive alternative in Oklahoma. Studies are underway to solve current and long term cultural problems. Good equipment selection and application is essential to success with Lo-Till. The most significant advantages of Lo-Till practices seem to be in moisture and soil conservation. Equipment inventories and labor requirements may also be reduced, but the overall cost of the Lo-Till system seems to be about the same as with conventional systems (mainly due to chemical costs).

This fact sheet was intended to deal primarily with the mechanical aspects of Lo-Till planting systems. Questions on chemical and cultural practices should be referred to Extension Agronomists, Entomologists, Plant Pathologists and etc. The development of the Lo-Till concept has been established as an Extension Service priority and is supported by a grant from the Oklahoma Wheat Commission.

Oklahoma State Cooperative Extension Service does not discriminate because of race, color, or national origin in its programs and activities, and is an equal opportunity employer. Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Charles B. Browning, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Dean of the Division of Agriculture and has been prepared and distributed at a cost of $385.00 for 8,775 copies. 0582 PD