1983

G83-684 Row Crop Planters: Equipment Adjustments and Performance in Conservation Tillage

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G83-684
(Revised September 1989)

NebGuide

Published by Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln

Row Crop Planters: Equipment Adjustments and Performance in Conservation Tillage

This NebGuide discusses planters used in conservation tillage systems and gives recommendations for improving planter performance.

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The planter's primary job is to place seed where it will germinate and grow. Proper seed spacing minimizes competition for the light, nutrients and soil moisture essential for crop growth.

Several factors influence planter performance, including adjustments and correct operation. Field conditions also are important.

Traditionally, producers used tillage equipment that created a well-tilled, residue-free seedbed for planting. Many producers now are adopting conservation tillage methods that have fewer tillage operations and leave a protective residue cover on the soil surface (*Figure 1*).

Figure 1. No-till planter working in heavy residue.

Although effective in reducing erosion, these practices have increased concern about seed placement and general planter performance.

Tillage systems currently available range from the

traditional moldboard plow to conservation tillage methods such as no-till. No-till systems disturb only a narrow strip of soil, leaving most of the residue on the soil surface. This offers the best erosion control.

Other conservation tillage systems for corn, grain sorghum and wheat residues can include chisel, disk, rotary-till and ridge plant methods, provided at least 30 percent of the soil surface is covered with residue after planting. However, only no-till consistently leaves more than a 30 percent cover in soybean residue, because of its fragile nature. Tillage systems are discussed in NebGuide G80-535, *Tillage Systems for Row Crop Production* and G91-1046, *Conservation Tillage and Planting Systems*.

Planter Equipment

Many brands of planters can be used for conservation tillage. Many of these do not require any modification. Planter performance is influenced by planter features and attachments, as well as proper machine adjustment and operation. While options are available for adapting planters to a wide variety of soil and residue conditions, major features are largely dependent on the brand of planter.

Seed Furrow Openers

Commonly available seed furrow openers are illustrated in *Figure 2*. The major function of seed furrow openers is to create a well-defined groove in the soil where the seed can be placed at the proper depth. Research indicates no difference in seed spacing uniformity exists among the various openers.

Although a runner can create a cleaner seed furrow, the double-disk opener can cut through residue and reduce potential clogging problems. The double-disk opener also has better depth control under conservation tillage conditions because, unlike a runner, it does not have a tendency to float up and over residue. The staggered double-disk opener is a modification of the double-disk seed furrow opener. With this design, the leading edge of one disk is slightly in front of the other. The leading disk cuts the residue and soil and the trailing disk helps open the seed furrow.

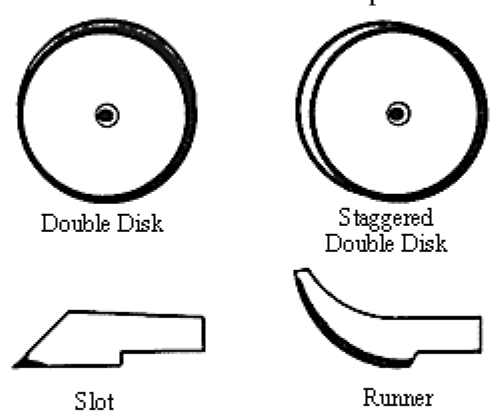

Figure 2. Types of seed furrow openers

A variation of a runner opener is a slot shoe opener which slides under the residue and lifts it out of the seed furrow. The slot shoe opener requires a coulter in front to avoid clogging problems from residue wrapping around the opener when used in no-till.

The planter's capability to cut residue depends on the amount and condition of the residue. For example, planters with disk seed furrow openers can cut fragile soybean residue and penetrate the mellow soil surface without a coulter, provided the residue was uniformly spread behind the combine.

On older planters, the disks may need sharpening or adjusting to properly cut the residue. As the disks wear, a gap develops and allows residue and soil to wedge between the disks. If this occurs, remove spacer washers behind the disks and adjust to maintain about two inches of blade contact on the leading edge of the double-disk seed furrow openers. When properly adjusted and maintained, double-disk seed furrow openers without coulters also can cut dryland corn or grain sorghum residue, especially if the stalks were shredded or heavily grazed.

Coulters

More abundant or unevenly distributed residue usually requires coulters in front of the double-disk seed furrow openers. Runner seed furrow openers also need coulters to cut residue so the runner doesn't ride up over the residue, causing poor seed placement and germination. The leading disk of the staggered double-disk seed furrow opener can act as the coulter. This design can eliminate the need for a coulter to cut residue, even in heavy residue conditions.

The primary function of a coulter is to cut the residue, not till the soil. The seed furrow opener performs the tillage necessary for seed-to-soil contact. The coulter should be operated at slightly less than the seed placement depth. This prevents loosening soil beneath where the seed will be placed, and avoids forming air pockets which may dry out the soil.

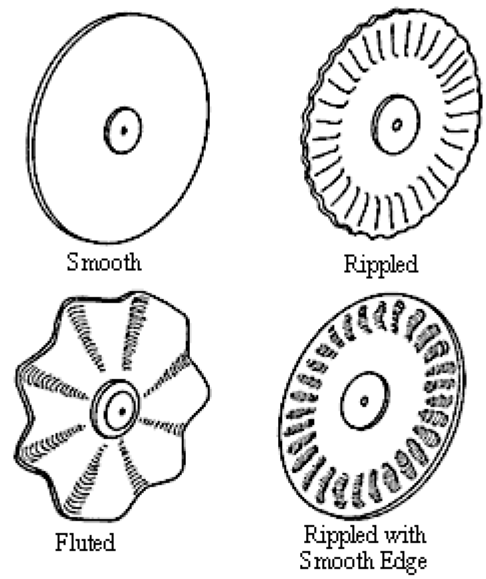

Figure 3. Types of coulters

Smooth, rippled, rippled with a smooth edge or fluted rolling coulters are common choices to add in front of the planter units to cut residue (*Figure 3*). In general, wider ripples or flutes on the coulter increase tillage action, but require more weight for penetration. As much as 400 to 600 pounds per coulter may be required for some no-till applications.

To prevent "throwing" excessive amounts of soil or herbicide away from the row, keep ground speeds below four mph when using fluted coulters. Rippled coulters perform less tillage with less weight while allowing for higher planter speeds. Rippled coulters with a smooth edge or smooth coulters are preferred to cutting residue. Conventional disk rolling equipment can be used to maintain a sharp cutting edge on these coulters.

Most equipment manufacturers offer coulters as an option. These coulters may be mounted to the toolbar or the planting unit. Older planters may need an additional toolbar to mount the coulters on.

Coulter operating depth in relation to seeding depth is more consistent when the coulter is mounted to the planting unit. Coulters should be mounted close to the seed furrow openers to avoid tracking errors on slopes and curves.

Row Cleaning Devices

Double-disk furrowers, row cleaners, sweeps or horizontally mounted disks may be used in front of the planting unit to push clods and residue away from the row (*Figure 4*). These devices are necessary in ridge plant systems to remove weed seed from the ridge top during planting (See NebGuide *G88-876, Ridge Plant Systems: Equipment*). In addition, these devices have been used in conventional tillage to remove clods and dry soil from the row to allow planting into moist soil.

Row cleaning attachments are not necessary in most no-till applications, especially if coulters or double-disk seed furrow openers are used to cut the residue.

Row cleaning devices often are misused when planting, creating a deep furrow, similar to that of a lister. The main function of row cleaning devices is to remove residue and weed seed from the soil surface for easy planting and not to till a deep furrow. Runoff can concentrate in the furrows, washing out seeds and plants and causing gully erosion. In level fields water may pond in the furrows, causing the soil to crust, making seedling emergence difficult.

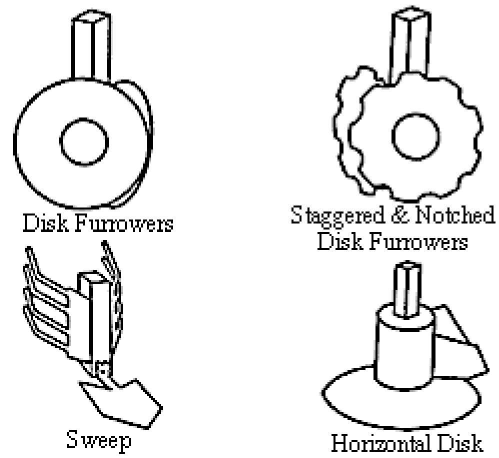

Figure 4. Types of row cleaning devices

Because of these problems, as well as the cost of row cleaning devices, they may not be desirable unless the planter is to be used as a ridge-planter. Unfortunately, when the furrowing devices are used to move residue, clods, or soil, any previously applied herbicide also may be moved out of the row area, leaving an untreated seedbed. A band application of herbicide behind the planting unit solves this problem.

Seed Covering

Good seed-to-soil contact is essential for germination and seedling emergence. Depending on the planter and options selected, a seed covering device, press wheel or a combination of these are used to provide the necessary seed-to-soil contact. While older planters relied on the natural tumbling of loose soil to cover the seed, planters used in conservation tillage must have some method of moving soil back into the seed furrow.

Commonly used seed covering devices include disks and knives. The knife coverer is less expensive, but may plug in residue covered fields. The disk coverers will either cut or roll over the residue, reducing plugging problems.

Many planters use press wheels to firm the soil around the seed after it has been covered (*Figure 5*). Other planters use a narrow seed firming wheel to firm the seed into the soil. This firming wheel operates in front of the seed covering device and presses the seed into the bottom of the furrow, ensuring good seed-to-soil contact. The remaining planters use closing wheels, often mounted in a V-shaped configuration, to close the seed furrow and firm the seedbed at the same time.

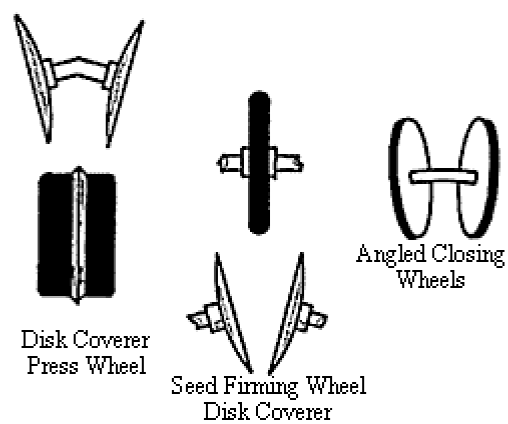

Figure 5. Types of seed covering and firming devices

Currently, there is no combination of covering devices and press wheels that offers a distinct advantage in the variety of tillage and soil conditions encountered. The combination of seed covering devices and press wheels selected should cover the seed with soil, not residue; firm the soil around the seed, but avoid excessive compaction; and provide a soil surface not vulnerable to crusting after planting.

Planter Adjustments

Follow the operator's manual recommendations for correct preparation of the planter for field use. This involves inspecting and leveling the planter, as well as adjusting the planting depth and seeding rate.

Each step should be done carefully to ensure the best possible performance.

Inspect equipment after the planting season when more time is available to replace worn or broken parts. Check shafts, bearings, seals and gaskets for wear and replace them as necessary. Pay close attention to fiberglass and plastic parts since they may become brittle and crack with age. Replace worn parts, especially in the seed metering and drive components. Lubricate all chains and grease fittings and replace if necessary. Check all bolts and clamps for proper tightness.

Improper leveling of the planter can cause irregular seeding depth that may result in seeds being planted too deep or too shallow. Generally, the tool bar or main frame should operate parallel to the ground, both front to rear and side to side.

Leveling pull-type planters primarily involves adjusting the hitch position and setting the cylinder stop on the carrying wheels. To level from front to rear, the hitch can be raised or lowered by adjusting the bolt position where the hitch clevis attaches to the planter tongue.

Three-point lift arms or gauge wheels can be used to establish the proper height of the tool bar above the ground on semi-mounted and mounted planters. To level these planters from side to side, adjustments may be required in both the gauge wheels and the lift arms. Top link adjustments generally are used to level mounted planters from front to rear. The cylinder stop on lift assist wheels are used for front to rear leveling semi-mounted planters.

On planters equipped with runner or slot shoe seed furrow openers, the planter should operate with the back of the opener slightly lower than the front. This "tail down" position helps create a well-formed seed furrow with a firm bottom. A firm bottom is required for planters which use a narrow seed firming wheel to push the seed into the soil.

To achieve uniform soil penetration, planters used in no-till may require more weight than ones used in tilled soil. Down-pressure springs generally are used to transfer weight from the toolbar to the row units. Usually located on the parallel linkage supporting the row units, down pressure springs may need tightening to achieve greater soil penetration.

On older planters, springs may need to be added or existing springs may need to be replaced with stronger ones. The frame must be heavy enough to prevent the springs from lifting the drive wheels off the ground. If necessary, weights may be added to the frame, or liquid fertilizer tanks may be kept partially filled with fertilizer or water.

A range of three to seven miles per hour usually gives satisfactory seeding rates. Under cloddy or rough field conditions, ground speed should be lower to avoid equipment bounce and subsequent slippage of the drive, loss of depth control and inadequate seed covering. Finger pickup planters tend to increase seeding rates at higher field speeds because more than one kernel may be dropped at a time. Problems with air planters vary depending on the design, but at higher speeds, skips or doubles may occur. Seeding rates are reduced with plate planters because the seeds do not always drop into the cells at higher speeds.

The devices driving the seed metering mechanism can be carrying wheels, gauge wheels, press wheels or coulters. Slippage of these drive units can result in seeding rates that are less than desired.

Slippage of press wheel drives may occur more often than with carrying or gauge wheels because they operate in soil loosened by the seed furrow opener. While additional weight or down-pressure springs

can reduce press wheel slippage, too much weight on the press wheel can cause excessive soil compaction around the seed, resulting in poor emergence.

Soil conditions are a factor influencing slippage of carrying wheel, gauge wheel and coulter drives. Loose or tilled soil conditions increase the potential for slip, especially on coulter drives. On planters with carrying and gauge wheel drives, additional weight can help reduce slippage.

Tire pressure is important in carrying and gauge wheel drives. Tires inflated to the recommended level tend to make planting more accurate. An under-inflated tire has a smaller circumference, causing more rotations at a given ground speed. This causes the metering mechanism to drop more seeds, and overplant. Conversely, over-inflated tires cause under-planting.

Checking Planting Results

Although the operator's manual serves as a guide for setting the planter, make your final adjustments in the field to account for varying soil conditions. Two major adjustments are planting depth and seeding rate.

Planting depth, influenced by leveling adjustments, generally is controlled by either gauge wheels or press wheels. Adjustments of these are outlined in the owner's manual. Plant deep enough to ensure that adequate moisture exists for germination and early growth, but not so deep that emergence is poor or delayed.

Because considerable soil can be moved by the planting unit, the depth should be determined by measuring from the seed to the impression left by the press wheel rather than to the original ground level. To achieve a good stand, this depth should be from 1 1/2 to 2 1/2 inches for corn and from 1 to 1 1/2 inches for soybeans or grain sorghum.

Seeding rate in the field can be checked by uncovering and counting seeds in a row length equivalent to 1/1,000 of an acre (*Table I*). Multiply the seeds counted by 1,000 to obtain the number of seeds planted per acre. Following operator manual recommendations, adjust the seed metering mechanism as necessary to obtain the desired population. Also, dig up some seeds in each row to verify seed is being planted at the correct depth and spacing.

Table I. Length of row to equal 1/1,000 acre for various row spacings.

Row Spacing	Row Length
10"	52' 3"
15"	34' 10"
19"	27' 6"
30"	17' 5"
36"	14' 6"
38"	13' 9"
40"	13' 1"

Planter Performance

The uniformity of seed or plant spacing can be used to judge planter performance. Using this as a criterion, research has been conducted in Nebraska to evaluate planter performance in different tillage systems. Results showed that seed spacing uniformity in current planters was unaffected by tillage systems (*Table II*). Performance in no-till and other reduced tillage conditions was as good as the performance in cleanly tilled, residue-free conditions.

With accurate seed placement, competition for nutrients and soil moisture is reduced and crop yields can be increased. Regardless of the tillage system used, successful planting can be achieved by maintaining and properly adjusting planter equipment.

Table II. Average seed spacing errors for six planters used in different tillage systems.

Tillage System	Spacing Error (percent)
Plow	33.2
Chisel	34.7
Disk	34.0
No-till	32.9

File G684 under: FARM POWER AND MACHINERY
B-4, Machinery
Revised September 1989; 12,000 printed.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.