Chapter 8

Equipment

Adapted from the Penn State University Publication: ***Steps Toward a Successful Transition to No-Till***

Well maintained and adjusted planting and spraying equipment is crucial for obtaining good stands and weed control in conservation tillage systems. Late fall and winter are the best times to work on equipment upgrades, repairs and maintenance, because any problems from the past season that need attention are easy to recall. Planting time is not the time to be getting equipment ready. A bonus of conservation tillage is not having to maintain and repair a full line of tillage equipment, which means there is more time to fine-tune planting equipment. It also is less expensive to properly maintain a no-till planter and good post-emergence sprayer than to operate and maintain multiple pieces of tillage equipment. Figures 8-1 through 8-22 show examples of common equipment used in conservation tillage systems.

Planter and drill

A conservation tillage corn/cotton/soybean grower, in principle, only needs a planter, but drills provide many options for implementing a true conservation tillage system. Drills can seed cover crops, small grains and sometimes soybeans. There are advantages to drilling conservation tillage soybeans. Farmers can own or lease a planter or drill or may have a custom operator do the planting for them. For a beginning conservation tillage farmer, it may be beneficial to have the actual planting operation done by a custom operator who has experience with conservation tillage planting. Farmers can learn from the operator and eventually do the planting operation with their equipment.

Conservation tillage planters and drills actually differ little from modern conventional planters. Setting the planter for optimal operation is more involved, however. Conservation tillage planters can be adjusted to guarantee soil penetration to an appropriate depth in all conditions through the use of both down -pressure and depth-control settings. The planter has the ability to cut through all types of residue and ground cover and allow the residue to flow by without clogging the machinery. Seeds are planted through residue at appropriate depths for the crop and soil conditions. The seeds are covered and soil firmed around the seeds for complete seed coverage, protection against bird damage and good seed-to-soil contact. All of this is more challenging in conservation tillage, because the soil is firm but not pulverized.

To accomplish successful planting, conservation tillage planters likely will be equipped with similar but more options than conventional tillage planters. The list may include some or all of the following: 1) residue removers to move residue out of the row area; 2) a starter fertilizer opener or a device to place liquid starter in the row; 3) coulters to cut through crop residue and loosen a small volume of soil around the seeds; 4) metering unit to obtain accurate spacing between individual seeds; 5) seed tube to drop the seeds into the seed furrow; 6) double-disk openers to open a slot to the appropriate depth; 6) seed firmer to press the seeds to the bottom of the seed furrow; 7) insecticide applicator to apply insecticide in a "T"-band over the seed slot; and 8) firming and closing wheels to firm soil above the seeds and cover the seeds.

Figure 8-1. Six-row conservation tillage planter.

Forward residue removers

Residue cleaners move debris (crop or native vegetation) out of the drill area to enable easier planting and also greater warming of the soil in the row area. Multiple designs are available.

Several types of residue removers have been developed. Some with curved fingers or hoses, and these are less aggressive than residue cleaners with straight fingers. If the fingers intermesh, they maintain better cleaning action. Residue cleaners consisting of two concave disks also are available.

Residue cleaners can be unit-mounted or mounted on the toolbar. Residue cleaners mounted on the unit tend to have better depth control than those mounted on the toolbar. Some residue cleaners come as one piece with coulters.

The residue cleaners are meant to move residue, not soil. The depth has to be set appropriately to avoid creating a furrow with the residue cleaner that will subsequently compromise seed depth control.

Starter fertilizer opener

Starter fertilizer is useful in conservation tillage, as it is in conventional tillage, and is most useful for corn. Starter fertilizer openers are designed so some fertilizer can be placed next to the seed without damaging the young seedlings.

The standard method is to place fertilizer 2 inches next to and 2 inches below the seed. Liquid "pop-up" fertilizer can be placed in the seed furrow with corn but not with cotton. It is most conveniently applied through a tube situated behind the double disk openers and in front of the firming/closing wheels.

Coulters

Most conservation tillage planters and some drills have coulters in front of the seed openers – primarily to cut through crop residue and sometimes to help with opening the seed furrow and loosening soil.

If residue is not excessive, coulters usually are not needed when soil moisture is ideal to adequate and may not be needed in soil that has been in a long-term conservation tillage system. The surface soil organic matter content will have increased and the soil tilth improved to such an extent that the seed opener disks can do an excellent job without coulters.

In many instances, however, coulters can perform useful functions. There are different coulters, each having specific advantages and disadvantages. The following is a general description of commonly available coulters. Equipment dealers today will help you select the appropriate one for your conditions, or you can talk to an experienced conservation tillage farmer in your area for advice on which coulter may be best for you.

1. **Smooth coulters.** These coulters penetrate soil most easily and are usually the best choice because they have the smallest soil-to-surface area. They do not disturb much soil and therefore do not do not mix surface residue into the soil.

Figure 8-2. Residue cleaners with curved fingers

Figure 8-3. Residue cleaners with straight fingers.

2. **Bubbled coulters.** These coulters have a smooth edge and a bubbled section. They cut through residue well, just like the smooth coulters, but they sometimes move more soil than is desirable. They work well in dry soil conditions but not in wet and/or heavy soil, where they can create sidewall compaction.
3. **Fluted coulters.** These coulters have waved edges that help move and fracture some soil. There are 13-wave and 8-wave fluted coulters. They need more down pressure than smooth and bubbled coulters and are therefore suited to moist soil that is relatively "soft." Because fluted coulters disturb and fracture soil, they help dry the soil more quickly, thus increasing soil temperature and germination. Some new types of fluted coulters have waves that are angled (Turbo Coulters) to facilitate cutting residue and soil as well as reducing soil disturbance. These coulters generally are about a 20-wave coulter so they do soil fracturing.
4. **Rippled coulters.** These coulters are intermediate between smooth and fluted coulters and are a good option to the smooth coulters where only a small amount of soil disturbance is needed.

Double-disk openers and seed firmers

Double- disk openers should create a V-shaped slot, and the seed should be placed in the bottom of the trench. There are now heavier double- disk openers on the market. Some have notches to better handle residues. Some double-disk openers are offset, which helps the double disks to cut through residue and soil. For best results, use a seed firmer that gently pushes the seed to the bottom of the seed trench.

Figure 8-4. A seed firmer on a planter pushes the seed down into the seed slot to achieve optimum seed depth control. Pop-up fertilizer can be applied through the seed firmer.

Figure 8-5. Residue cleaners with concave disks.

Figure 8-6. Seed firmer on a drill also pushes the seed into the bottom of the seed slot.

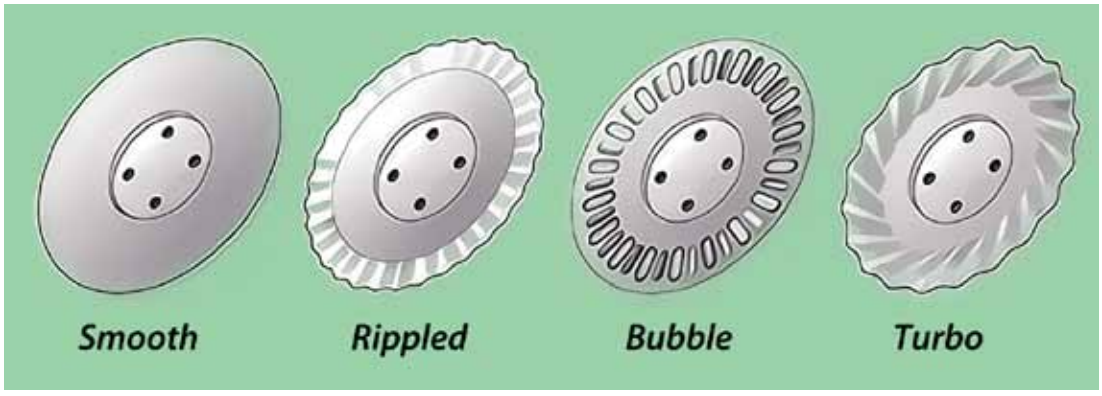

Figure 8-7. Smooth, rippled, bubble, and fluted turbo-coulters.

Depth-gauge wheels

The purpose of depth-gauge wheels is to control the operating depth of the double-disk openers and ultimately the planting depth. In conservation tillage systems, this adjustment is critical and must be evaluated when planting in different types and amounts of crop residues. It is especially important to spend the extra time necessary to get the adjustment calibrated properly when starting to plant each spring. As double-disk openers erode with use, the furrow depth will need to be appropriately adjusted to compensate for this wear.

There are different types of depth-gauge wheels. Some can leave loose soil next to the seed trench to provide additional loose soil for the closing wheels to move over the row. Other depth-gauge wheels are shaped to provide firming action next to the double disks. Many planter manufacturers will equip a planter with either type of depth-gauge wheels.

Metering unit and seed tube

Different seed metering units are available, such as finger-pickup, vacuum or pressure-driven systems.

Metering units for conservation tillage or conventional tillage usually are similar. The metering unit should be placed as close to the ground as possible.

Seed tubes should therefore also be as short as possible. Smooth and straight seed tubes are advisable to guarantee minimal interference between the metering unit and the seed placement. Worn seed tubes or tubes that are not completely smooth should be replaced immediately. It is important to inspect the seed tubes frequently to ensure no soil or residue has become lodged in a tube, blocking seed from dropping into the seed furrow.

Figure 8-8. A planter mounted with a bubble coulter.

Insecticide applicator

The insecticide applicator for conservation tillage is no different from that on conventional planters.

Closing wheels

Closing wheels can be made of cast iron or rubber and are made as solid wheels or with spikes, as well as so-called "posi-close" wheels. On planters, closing wheels are meant to seal the V-shaped seed slot but not compact the soil on the surface. On many drills, the closing wheel also controls seeding depth. Excessive down pressure on drills, however, can cause surface compaction. Closing wheels have been developed for specific purposes. In ideal soil conditions, most closing wheels work fine. Challenging, wet soil conditions generally are more difficult to manage, and differences between closing wheels tend to show up.

Cast-iron closing wheels are designed to compact soil beside and below the seed to guarantee good seed-to-soil contact in crumbling soils. If soil is moist, it is easy to excessively compact soil in the seed zone, which causes root penetration problems. It is important to limit down pressure on the iron closing wheels to avoid compaction but still close the seed slot.

Rubber closing wheels pose a lower threat of compaction, but using them in clay soils that are dry may not provide enough down pressure to fully close the slot. This also may occur when planting directly into spring-killed sod or a heavy winter cover crop.

Spading or spiked closing wheels have been designed for wetter, heavier conservation tillage soils. They are meant to crumble soil on top of the seed without

Figure 8-9. A fluted coulter with angled waves to facilitate soil penetration and reduce soil disturbance.

causing sidewall compaction. This crumbling action tends to aid in drying and warming the soil in the row. Some spiked closing wheels come with a depth band to ensure consistent operating depth. Also, some planters are equipped with one spiked and one solid cast or rubber closing wheel. Spiked closing wheels may not work in cover crops, especially when they are wet, because straw will wrap around them. The floating spader wheels apparently avoid cover crop wrapping as well as deep sinkage.

"Posi-close" wheels also are made for closing the seed slot in challenging conservation tillage conditions. The pattern is meant to prevent excessive soil compaction above the seed while still closing the slot. Drag chains can be mounted behind the seed firmers to crumble surface soil. Crumbling will only take place in low-residue conditions and if the surface soil is dry.

The Case-IH slot closing system is designed differently from that on most other planter types. In its case, the seed slot is closed by two small offset disks that push soil back on top of the seed. Then a broad rubber closing wheel firms soil on top of the seed. This closing wheel system needs good soil tilth to function properly. The closing wheel has treads to prepare a cracking pattern in crusting soils.

Figure 8-10. Cast-iron closing wheels.

Figure 8-12. Rubber closing wheels.

Figure 8-11. Case-IH rubber closing wheel.

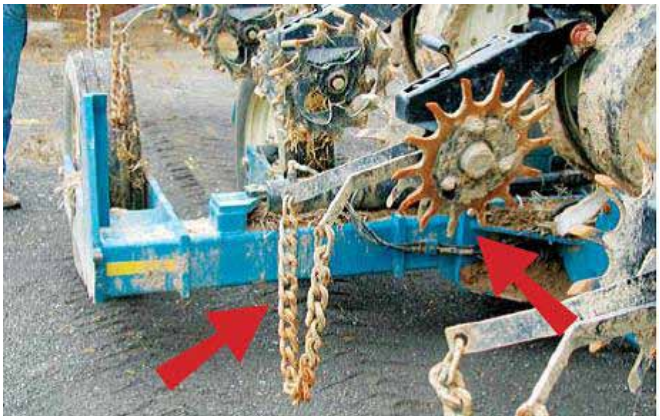

Figure 8-13. Spading/closing wheels with optional drag chain.

Figure 8-14. Some farmers mount one fingered and one cast iron closing wheel on a planter unit.

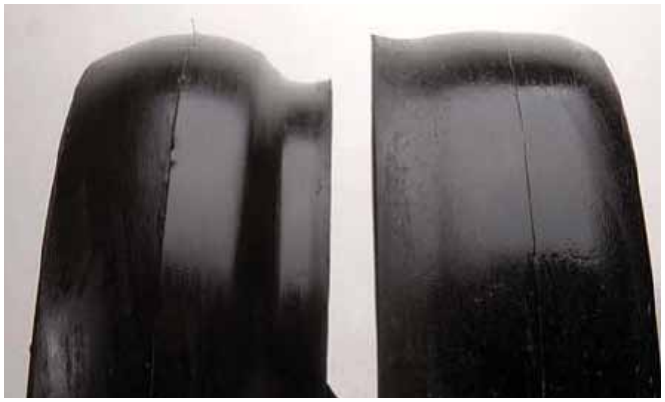

Figure 8-15. Comparison of two common types of depth gauge wheels. Case IH wheels are on the left and the other commonly used wheel is on the right.

Figure 8-16. Posi-close wheel.

Figure 8-17. Example of planter attachments available to manage heavy residue from crops or cover crops in conservation tillage.