No-Till Planter Components:

A Field Guide for Conservation Professionals

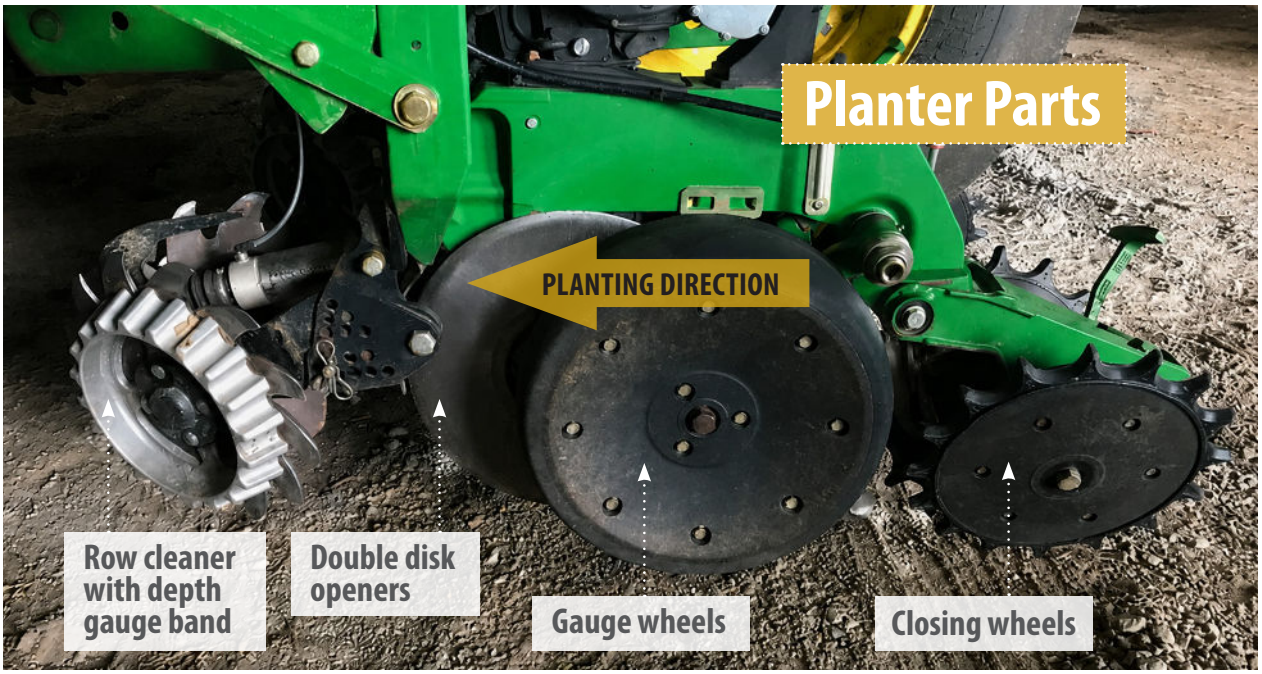

Figure 1. Pictured are the common parts of a planter row unit. Each row unit is responsible for planting one crop row. Planters are often composed of 6-, 8-, 12-, 16-, or 24-row units. (Stephanie McLain)

As soil disturbance decreases, the planter becomes an even more significant piece of equipment. In no-till and high-residue systems, **the planter is the heart of the operation**, placing seed, applying fertilizer, managing residue, and doing minimal tillage—all in a single pass. Because there's only one chance to get it right, understanding how planter components work together is essential to achieving uniform emergence of the crop.

Although planter brands differ, they generally use the same main components: row cleaners, no-till coulters, disc openers, gauge wheels, seed firmers, closing wheels, and drag chains. Many components can be upgraded to improve performance in reduced-tillage conditions.

Key Factors for Planter Operation

When operating a planter, consider these key factors:

- **Planter levelness.** A nose-up or nose-down toolbar can cause a variety of issues. A non-level planter can disrupt residue clearing, depth control, furrow creation, furrow closing, and seed placement.
- **Speed.** High operation speeds negatively affect performance. Slower speeds ensure better depth control, seed spacing, and seed-to-soil contact. Planter speeds of 5 mph or less are common in transitional no-till fields, with high-speed planters being an exception.
- **Parallel linkage or arms.** Parallel arms connect the row unit to the toolbar, allowing it to follow ground contours to maintain consistent planting depth and downforce. Worn bushings or arms can cause row unit chatter and uneven seed placement, leading to inconsistent emergence. Tight, well-maintained parallel arms keep the row unit steady to maintain proper depth without increasing compaction.
- **Placement of fertilizer tubes.** In-furrow fertilizer can give crops an early boost, especially in cool, high-residue soils, but rates must stay low to prevent seed injury. Placing fertilizer behind the closing wheels reduces burn risk and allows higher application rates, though nutrients may be less available at emergence. Many no-till farmers use a small in-furrow starter and place most fertility 2 inches away from the seed zone for added safety and flexibility, commonly referred to as a 2x0 placement.

Figure 2. Shark-tooth row cleaner with a treader wheel and pneumatic cylinder to provide downforce (Stephanie McLain)

Figure 3. A 13-wave coulter on a row unit (Stephanie McLain)

Row Cleaners

Row cleaners move residue and debris away from the seed row. They should lightly contact the soil surface to clear residue without moving soil, especially in no-till systems, where they should only "tickle" the surface. **Row cleaners work ahead of the disc openers to clear residue and prevent hair pinning, which occurs when residue is forced into the seed slot and interferes with seed placement and emergence.**

Row cleaners can be mounted either on the planter frame or directly on the row unit, and they may be fixed or floating. Frame-mounted cleaners are pulled through the field and don't affect row-unit down pressure, while row-unit-mounted cleaners are pushed and can influence down pressure. Fixed models use a pin to set the depth, which remains locked as the planter goes across the field. The biggest issue with these cleaners is that if they are set too deep, they can disturb too much soil, creating a trench that leads to challenges with seed placement and weed control.

Floating models use a pin-set minimum depth while allowing the row cleaner to lift and follow the soil surface. **In-cab-adjustable floating row cleaners are a major advantage in no-till systems because they allow operators to adapt to changing field conditions.**

No-Till Coulters

No-till coulters run ahead of the disc openers to pre-slice the seed furrow. They cut residue and slightly loosen soil to help the openers form the seed furrow. However, the value of no-till coulters is widely debated. Many farmers remove them and instead rely on well-adjusted row cleaners to clear residue without disturbing soil structure.

Because the coulters are mounted on the row units, they use part of the planter's available down pressure. In firm no-till soils, this can limit the down pressure available to the double disc openers, making it harder to reach the proper planting depth.

The coulters should run ¼ inch shallower than the depth of the double disc openers. If set too deep, they can create a false trench bottom that reduces seed-to-soil contact. Also, when set too deep, they can bring up moist soil that will stick to the gauge wheels, affecting depth control.

Figure 4. Serrated double disc opener next to a gauge wheel (Stephanie McLain)

Figure 5. Spoked gauge wheel (Doug Hauser)

Disc Openers

Disc openers cut through soil and residue to form the seed furrow, making them especially critical in no-till systems. Sharp, properly aligned discs with adequate down pressure help ensure consistent depth and even emergence. **No-till conditions increase opener wear, so blades should be checked regularly and replaced before reaching the manufacturer's wear limit. Failing to maintain this component can affect the effectiveness of other planter functions.**

Row-crop planters (e.g., corn, soybeans) typically use double disc openers to form a wider, deeper, V-shaped furrow suited for larger seeds that need consistent seed-to-soil contact.

Drills, which are commonly used for small-seeded crops and cover crops, are often equipped with single disc openers instead. Single discs work well because small seeds are planted at shallow depths in narrow rows and do not require a deep V-furrow. They also require less downforce, which is important since drills may have dozens of openers operating across the machine.

Disc opener size and performance vary by manufacturer, including differences with blade diameter and thickness. As planting depth increases, heavier-duty bearings are needed. Newer designs, including serrated disc openers, aim to improve residue cutting and performance in heavy residue conditions. Additional down pressure is needed for serrated disc openers.

Gauge Wheels

Gauge wheels control disc-opener depth and stabilize the blades to maintain consistent planting depth. **Consistent seed depth improves emergence uniformity and yield potential.** As the disc openers cut through the soil, the gauge wheel also supports the sidewall of the furrow and prevents excessive soil from pulling up or collapsing back into the furrow. Gauge wheels are set to run firmly against the disc blades with no clearance, which helps stabilize the openers and reduces mud buildup between the wheel and blade.

Gauge wheels range from 2.5 inches to 4.5 inches in width. A 4.5-inch wheel is standard on most planters in conventional systems, while 2.5-inch wheels are common on twin-row planters. In high-residue systems, a ridge of residue can build up on either side of the furrow that wide gauge wheels can ride up on, causing planter bounce and affecting seed depth. To prevent this from occurring, set the row cleaners to clear a wider path of residue away from the row. Narrow gauge wheels will ride inside of the ridge of residue moved by the row cleaners, but they can be prone to causing sidewall compaction in seed furrows.

Gauge wheels support the weight of the planter row unit, including applied downforce, to ensure consistent, accurate seeding depth. Maintaining proper ground contact (ideally 97–100%) ensures depth control. If gauge wheels are hard to turn when the planter is lowered, downforce is too high.

Gauge wheels come in different materials and designs. They are made of rubber or polyurethane and can have solid, semi-hollow, or reduced inner-diameter designs. Harder wheels last longer, while softer ones reduce bounce and improve depth consistency. Spoked gauge wheels are another option for wet conditions as they shed mud more effectively than solid wheels. Worn gauge wheels lose shape and reduce planting accuracy.

Figure 6. Seed firmer unit with a liquid tube for in-furrow starter fertilizer (Doug Hauser)

Figure 7. Spiked closing wheels with fertilizer application tubes (Stephanie McLain)

Seed Firmers

Seed firmers press the seed into the bottom of the seed furrow to ensure proper placement and good seed-to-soil contact. Seed firmers are a debated add-on. Farmers often either rely on them or avoid them entirely. Common complaints include seeds being dragged in the furrow or the firmer balling up with mud in wet conditions. On a positive note, many farmers credit seed firmers with improving seed-placement consistency and producing more even germination.

Seed firmers come in several styles, including low-stick versions designed for wet or tacky soils. Most models can also be fitted with a liquid tube to apply in-furrow starter fertilizer. For proper performance, seed firmers should run level and be checked daily for wear or damage. In tilled soils, where the bottom of the seed furrow can be loose, seed firmers are more prone to dragging seed.

Closing Wheels

Closing wheels finish the planting process by closing the seed furrow, firming soil around the seed, and removing air pockets. **Proper closing pressure is critical. Too little leaves poor seed-to-soil contact, while too much can cause compaction. Proper furrow closure protects seed, preserves moisture, and improves seed-to-soil contact.**

There are several different types of closing wheels. Conventionally tilled systems often use closing wheels made of traditional materials such as smooth rubber or polyurethane, which pinch the top of the furrow shut. While these work well in a loose seedbed, other designs have been developed for firmer no-till and high-residue conditions. Spiked closing wheels work by fracturing the sidewall compaction created by the double disc openers and gauge wheels, helping the furrow close more naturally and reducing sidewall smear. Other closing systems integrate cast-iron or heavy disc closing wheels with firming tires.

Down pressure on the closing wheels can be adjusted using the spring handles on the closing wheel tailpiece. Setting this correctly is important because excessive pressure can cause compaction and may also make it harder for the disc openers to maintain proper depth. Because many options are available, farmers should test systems and consult others with similar soils and residue conditions before investing.

Figure 8. Drag chain behind the closing wheels and starter-fertilizer application tubes (Barry Fisher)

Drag Chains

Drag chains are often used in conjunction with spiked closing wheels to help smooth and level the soil surface after the closing wheels finish the seed furrow. They pull loose soil over the row to fill gaps and create a uniform surface. One key advantage of drag chains is their ability to lightly incorporate fertilizer that has been surface-applied next to the furrow, improving contact without disturbing seed depth.

Resources

A Practical Guide to No-Till and Cover Crops in the Mid-Atlantic (Sustainable Agriculture Research and Education [SARE]), https://northeast.sare.org/resources/a-practical-guide-to-no-till-and-cover-crops-in-the-mid-atlantic/

Setting Planter Downforce with Levi Powell (video, Iowa State University Extension), https://youtu.be/FqdkZWpfjCI?si=hT0msGiEWLPGwsqY

Using Blocks to Check Planter Depth Settings (video, Iowa State University Extension), https://www.youtube.com/watch?v=t666eU4hwaA

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No-Till Planter Field Checklist

Equipment Pre-Check

- Is planter level from front to back?
- Are parallel arms tight, not sloppy (with no excessive play or chatter)?
- Are disc openers sharp and appropriately sized?
- Are disc opener bearings in good condition with blades aligned?
- Does each row unit move freely and evenly when lifted?

Field Setup & Equipment Operation

- *Planting speed:* Maintain 5 mph or less.
- *Planter levelness:* Parallel arms are parallel with ground during operation.
- *Row cleaners:* Set them shallow (to move residue off row, not soil).
- *Seed depth:* Check 3–5 rows for even depth across toolbar.
- *Downforce:* Down pressure should be adequate to prevent bouncing and over-compaction.
- *Gauge wheels:* Avoid mud buildup and maintain firm contact while still turning when lowered.
- *Seed firmers:* Check that firmers do not drag seed or plug.
- *Closing wheels:* Seed furrow should close without over-compaction.
- *Coulters* (if used): Set slightly shallower than disc openers.

Quick Field Check (Stop & Dig)

- Are seeds at a uniform depth across 3–5 rows?
- Is the furrow fully closed with no air gaps?
- Is there any hair pinning (residue pinned in seed furrow)?
- Are any seeds left on the surface?

Troubleshooting

Seeds on surface

- Increase downforce.
- Check depth setting.
- Adjust row cleaners.
- Check disc openers.
- Slow down.

Uneven depth

- Level the planter.
- Clean, replace, or adjust gauge wheels.
- Check depth setting.
- Vary traffic patterns to reduce compaction.
- Adjust row cleaners to redistribute heavy residues.

Hair pinning

- Sharpen/replace disc openers.
- Adjust row cleaners.
- Avoid wet residue.
- Increase seeding depth.
- Level the planter.

Sidewall compaction

- Adjust closing wheels.
- Avoid wet soils.
- If rain is forecast, reduce down pressure, switch to jagged closing wheels, or reduce closing-wheel pressure.

Uneven plant emergence

- Adjust depth settings across rows.
- Tighten parallel arms.
- Make sure row units float smoothly.
- Check seed furrow closures.
- Check opener sharpness.
- Check for sufficient residue clearing.

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