PLANTING EQUIPMENT

In no-till, effective crop establishment requires the proper selection of no-till tools or components. Knowing the nuts and bolts of no-till equipment is fundamental to setting up and fine-tuning your equipment to suit your operation.

Because equipment will be your largest investment, it will also be among your best opportunities to save in the long run. Less equipment can do more acres in no-till.

When you bring the planter or drill to the field, you're immediately reminded that the field looks almost the same as when you harvested the previous crop.

Without the benefit of several tillage passes, your planting equipment must:

- cut residue
- move excess residue
- loosen the seedbed for good seed-to-soil contact
- place seed in moist soil
- properly place other inputs
- close planting furrow and adequately press soil around seed.

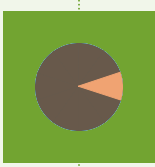
Failure to meet most or all of these goals will result in uneven germination and emergence. And this can cause further problems with pests and growth during the growing season.

In this section, you'll learn:

- the components of no-till planting equipment
- how no-till planting components can be put together
- how to fine-tune the system, and
- how to troubleshoot.

Six years ago we grew 1,300 acres of crop and required three 4-wheel drive tractors. Today a 145 hp tractor is more than adequate to grow our 1800 acres plus 500 acres of custom work.

Bob Hart, Oxford County



Without tillage, no-till planting equipment has to help create favourable seedbed conditions.

PLANTING EQUIPMENT

COULTERS

Properly selected coulters should:

- ▸ cut residue
- ▸ move residue (fluted coulters)
- ▸ till narrow strip of soil for seed and fertilizer placement.

TILLAGE COULTERS COMPARED

	TYPE & SUITABILITY	COMMENTS
	RIPPLE/PLOW • up to 50 cm (20") diameter **Suitable for:** • drills with frame-mounted coulters • planters with 3-coulter system • planters with coulters and row cleaners	• relatively low pressure required to penetrate soil • cuts residue • accomplishes deep tillage with minimal soil disturbance • leaves smoothest seedbed under damp soil conditions
	FLUTED • 43 cm (17") diameter • 8 waves per blade • 3-5 cm (1-2") flutes **Suitable for:** • drills with coulter caddy (3 cm or 1" flute) • 2-coulter planter setups (5 cm or 2" flutes)	• the long cutting edge on fluted coulters requires high downward pressure • with a wider flute and more waves per blade, more tillage action occurs and more pressure is required • works well for fertilizer and manure incorporation • good in dry soil, but can be a problem in damp conditions because soil may be thrown from seedbed, particularly on clays and clay loams • wider flutes do more tillage and will incorporate more than narrow flutes

PLANTING EQUIPMENT

TILLAGE COULTERS COMPARED, cont'd.

	TYPE & SUITABILITY	COMMENTS
	FLUTED • 43 cm (17") diameter • 3/4-7/8" flute, 12-13 waves/blade • 5/8" flute, 24-25 waves/blade **Suitable for:** • drills with coulter caddy • 3-coulter planter setups • coulter and row cleaner planter set-up	• good for fertilizer and manure incorporation • less of a problem in damp soils • will not till as wide an area as wider coulters • 24-25 waves/blade are ideal for mounting on planter units; best for dry clay soils
	BUBBLE • usually 43 cm (17") **Suitable for:** • drills with coulter caddy • coulters and row cleaner planter setup	• shoulders on the bubbles impede penetration on hard soil • straight leading edge makes it cut effectively • provides more tillage than a ripple coulter • may cause sidewall compaction in damp clay soil
	STRAIGHT-EDGED COULTERS **Suitable for:** • ridge till cultivators	• straight edge cuts residue and penetrates mellow soils well • don't move or incorporate residue effectively

Eighteen-wave blades are also available and perform similarly to 24-wave blades.

This is a 24-wave blade coulter.

PLANTING EQUIPMENT

ROW CLEANERS

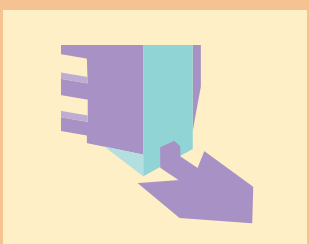
Row cleaners should be selected to move residue from the row in no-till, and to move soil and residue from the ridge top in ridge tillage. They are usually mounted on the planter unit or just ahead of it. They must be adjustable so that they can be set to move only residue in no-till.

ROW CLEANERS COMPARED

	TYPE & CONFIGURATION	COMMENTS
	NOTCHED DISK V configuration **Suitable for:** • ridge till planters • no-till planters	• moves residue effectively and much better than smooth disks • low power requirement when set to run shallow • not effective in sod situations • may be difficult to control depth on fields with variable conditions
	SPIDER WHEELS V configuration **Suitable for:** • ridge till planters • no-till planters	• can be set to lightly rake soils and speed drying • low horsepower requirement when set to run shallow • under some conditions, may wrap with residue • interlocking spiders may be bent • can be set to do shallow tillage requiring slightly more horsepower
	3-COULTER TILLAGE SYSTEM **Suitable for:** • no-till planters • pre-tillage	• if not too deep, it can effectively clear the crop residue • easy to operate, but requires more power than notched disks or spider wheels • popular on clay and variable soil conditions • speed is required to move the residue

PLANTING EQUIPMENT

ROW CLEANERS COMPARED, cont'd.

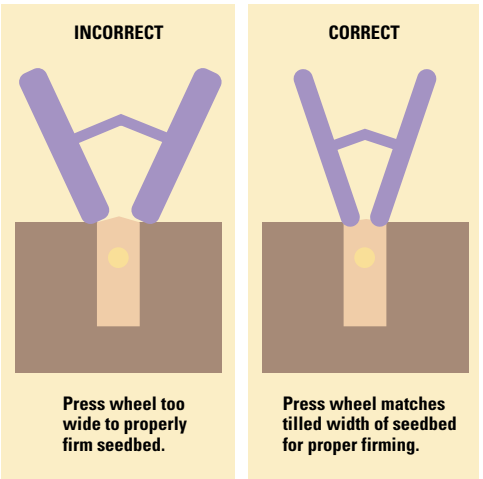
	TYPE & CONFIGURATION	COMMENTS
	COMBINATION COULTER/ ROW CLEANER **Suitable for:** • ridge till planters • no-till planters	• does minimal tillage directly ahead of the seed row • cuts and clears residue effectively
	HORIZONTAL DISK **Suitable for:** • ridge till planters	• usually used as ridge cleaners • moves too much soil for no-till • easier to set shallow than sweeps
	SWEEP **Suitable for:** • ridge till planters	• usually used as ridge cleaners • effective for levelling ridge tops • moves too much soil for no-till

PLANTING EQUIPMENT

PRESS WHEELS

Press wheels firm the soil over and around the seed. They must work within the tilled strip of soil prepared for seed and fertilizer placement.

Press wheels can play a role in depth control on drills.



PRESS WHEELS COMPARED

	TYPE & SUITABILITY	COMMENTS
	V-TYPE PRESS WHEEL **Suitable for:** • planters and drills	• combined width should not exceed the width of loosened soil in the seed trench (less critical in sandy conditions) • V-type press wheels may inhibit residue flow in narrow rows • cast iron and rubber wheels are available • down pressure can be adjusted on some models
	CLOSED CENTRE PRESS WHEEL **Suitable for:** • drills • some planters	• works well where loose soil would push up between V-type press wheels (i.e., sand) • used for depth control on variable soils

PLANTING EQUIPMENT

PRESS WHEELS COMPARED, cont'd.

	TYPE & SUITABILITY	COMMENTS
	RIBBED CENTRE PRESS WHEEL COMBINATION WITH CLOSING DISKS **Suitable for:** • planters	• works well under a wide range of soil conditions • requires closing disks or strip tillage to loosen a strip of soil as wide as the press wheel • rib allows better plant emergence under crusting conditions
	NARROW 3-5 cm (1"-2") PRESS WHEEL **Suitable for:** • drills	• used primarily to firm seed in the bottom of the seed trench with no-till drills (1") • used to firm soil on top of seed (2")
	"COMBINATION" PRESS WHEEL 3 cm (1") + V-type **Suitable for:** • planters and drills	• ensures excellent seed-to-soil contact and covers the seed without compacting the soil on the seed

OTHER COMPONENTS

SEED DEPTH CONTROL

Planting units need sufficient downward pressure to make seed openers work precisely.

Planting units should not bounce. (Speed can influence this.)

Excessive pressure on downward pressure springs will result in damage to planting units, possibly causing planter drive wheel slippage.

If your planter is not equipped with walking beam gauge wheels, then install this necessary attachment to improve seeding depth on rough ground.

PLANTING EQUIPMENT

Seed firming devices can improve seed-to-soil contact.

SEED FIRMING DEVICES

Seed firming devices, while not a requirement, provide significant benefits to some soils. They can improve seed-to-soil contact and the accuracy of seed placement. **Caution:** in wet situations, seed firming wheels (especially small diameter wheels) may become clogged with mud.

MARKERS

Hard soil and heavy residue require more effective and durable planter markers. Use heavy-duty bearings and notched disk blades for aggressive action. Angle the marker for more aggressive marking action. Add weight to the marker for good penetration.

Planter markers may require a depth band to avoid moving too much soil. Foam spray markers can be an alternative where soil disturbance is a concern.

Notched disc blades work well as markers in hard soil and heavy residue conditions. The one shown includes a depth band.

TRASH GUARDS

Heavy residue, particularly corn stalks, can become lodged in drive chains and sprockets. Protect against damage and planting interruptions with purchased or home-fashioned guards. Protect the following components:

- fertilizer and herbicide delivery lines – lines can also be run behind metal components (frame, components) or metal tubes can be welded on to run lines through
- drive chains.

NO-TILL SEED DRILLS

SETTING UP SEED DRILLS

To make drills work in no-till, you need to concentrate on:

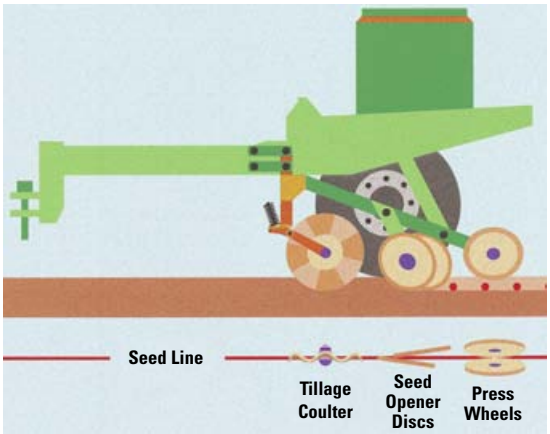
- managing excess or problem residue
- keeping the seed openers at the right depth
- matching the press wheels to soil conditions.

The following illustrates the setup of components of a no-till drill (single disc opener).

Trash guards protect planting equipment from damage by lodged corn stalks.

No-till drills are mostly used for seeding cereals, forages and soybeans.

PLANTING EQUIPMENT



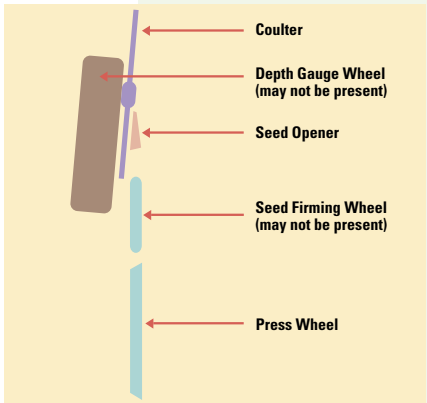
The components of a no-till drill.

A number of features are common on no-till drills. Other features have been specially designed to improve performance. There are three common drill designs that facilitate seed and fertilizer placement:

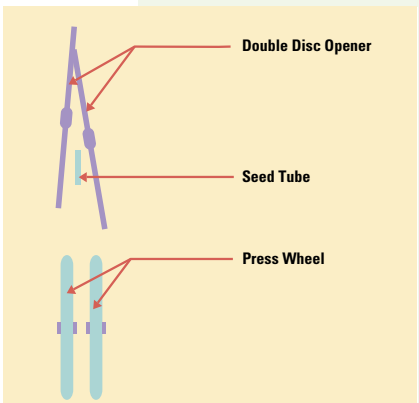
Single disc opener – a single straight coulter running at a slight angle tills a narrow seedbed and creates a slot for the seed. The seed is placed in the slot with a shoe positioned directly beside and behind the coulter hub. Some drills have a depth gauge wheel for better seed depth control. Soil is firmed around the seed using a narrow 2.5 cm (1") press wheel.

Double disc opener – the seed opener consists of two sharp discs, one leading the other. By staggering one ahead of the other, a narrower zone is tilled, allowing for easier penetration and better residue cutting. This system works best when it follows coulters. The discs have either a smooth or serrated leading edge. Seed is delivered to the seed slot by a tube located behind and between the discs. Depending on the width and extent of tillage, a range of press wheels may be used – typically, a single 5 cm (2") by 33 cm (13") or a double V 2.5 cm (1") by 30 cm (12").

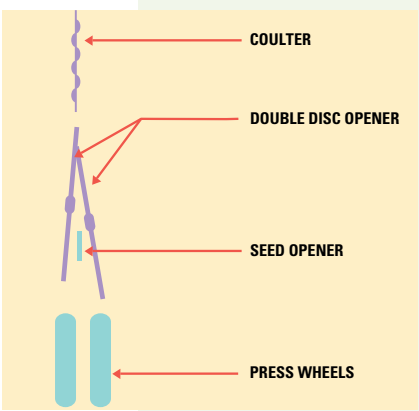
Disc opener + tillage coulter – a tillage coulter leads the disc opener. This coulter cuts residue, and tills a narrow seedbed for seed and fertilizer placement. As the distance between the opener and tillage coulter increases (as in coulter caddy setup versus endwheel no-till drill), the aggressiveness (i.e., the width of the coulter) should be increased. This allows proper tracking of coulter and double disc opener. The seed slot opener can be an offset double disc unit, but usually is a conventional unit. The press wheel should be matched to the zone of tillage. The wider the zone, the wider the press wheel.



Single disc opener.

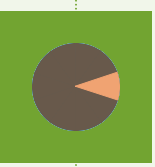


Double disc opener.



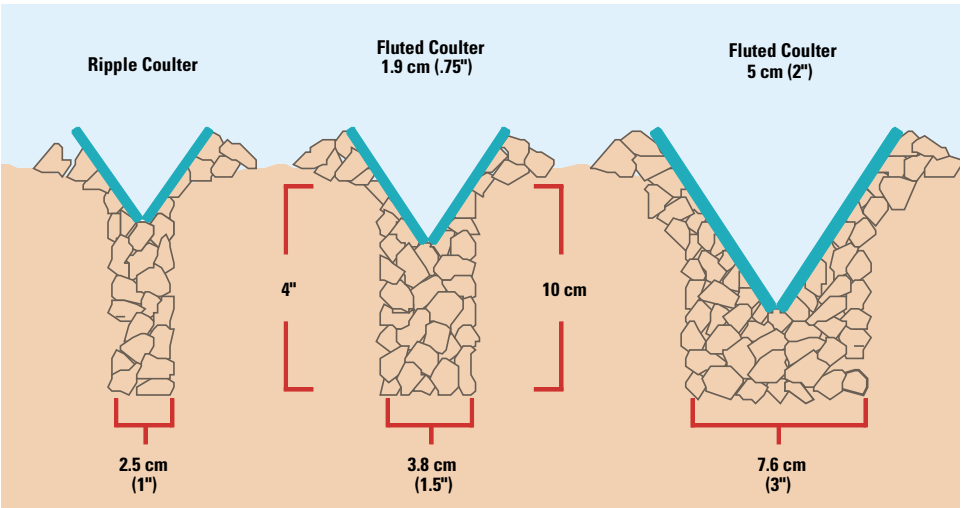
Disc opener and tillage coulter setup.

PLANTING EQUIPMENT



Planting Equipment

When using narrow row settings, plant at an angle to old crop rows to reduce residue plugging.



A ripple coulter tills a narrow strip of soil, which may restrict opener depth. A wider-tilled strip may be necessary to improve seed or fertilizer placement. A narrow-fluted coulter is usually adequate, but a wide-fluted coulter may be necessary for wide openers.

FINE-TUNING THE SEED DRILL – CHECKLISTS

FOR DEPTH CONTROL AND PENETRATION

Make sure coulter caddy is level with the seed openers.

Check for disc wear and make adjustments as necessary.

Adjust depth stops on wheels to maintain a constant depth.

Add or remove weights to ensure proper penetration under the toughest soil conditions in the field, even when the seed and fertilizer hoppers are empty.

Adjust downward pressure springs as needed.

Make sure tillage coulters are aligned with seed openers.

Add sufficient weight to ensure proper penetration of the openers, even when seed and fertilizer hoppers are empty.

FOR RESIDUE MANAGEMENT

Adjust cutting depth and pressure.

Match coulters to residue:

- ▸ wider coulters (up to 3 cm [1"] fluted) will move more residue
- ▸ ripple or narrow coulters will cut residue more effectively.

Use wider row spacings.

Stagger seed units.

Note: always match width of press wheels to width of zone worked, unless 4" press wheels are being used for depth control in sandy conditions.

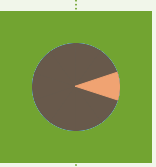
Harrows are often added to the back of a drill to help move soil back over the seed row, and spread residue evenly.

PLANTING EQUIPMENT

TROUBLESHOOTING NO-TILL SEED DRILLS

PROBLEM	CAUSE	SOLUTION
SHALLOW SEED/FERTILIZER PLACEMENT	• poor coulter penetration	• add weight • adjust coulter depth • change type of coulter – a narrower coulter is easier to get into the ground • ensure coulters are sharp, not worn out • avoid planting when the soil is too dry
	• poor tracking of seed/fertilizer unit	• line up tillage coulter with fertilizer or seed opener • do not plant around corners • choose a wider or more aggressive coulter (especially on coulter caddies) • ensure bushings and linkages are tight and not bent
	• seed unit bounce	• increase tension on seed unit down pressure springs • reduce speed
	• poor seed unit penetration	• check seeding depth setting and mud buildup on gauge wheels • increase spring pressure on the unit and decrease on the press wheel(s) • adjust depth of coulters to ensure loose soil to planting depth • align tillage coulters with openers and check for wear
POOR SEED TRENCH CLOSURE	• inadequate firming of soil	• increase downward pressure on press wheel or change to a heavier press wheel • change to a narrower press wheel or wider, deeper tilled strip (more aggressive coulter tillage)
	• soil too wet	• plant when the soil is at proper moisture • install tile drainage to improve variable soil moisture conditions • use rotary hoe, walking chain harrow or shallow coulter tillage to move residue and speed drying

PLANTING EQUIPMENT



TROUBLESHOOTING NO-TILL SEED DRILLS, cont'd.

PROBLEM	CAUSE	SOLUTION
ERRATIC SEED DROP/SKIPS	• slipping drive wheel/coulter	• add weight to the drill • ensure coulters are not holding the unit out of the ground • use narrower coulter blades, go shallower • add fluid to the drive wheel • do not use excessive downward pressure on seed units
SEED PLACED TOO DEEP	• planter units running too deep	• remove weight from the drill • adjust depth setting on the units • add depth stops to the hydraulic cylinders on the lift wheels • adjust press wheels to proper depth • change to a wider press wheel to ensure depth control
RESIDUE PLUGGING	• poor residue flow	• there should be adequate space between seed units, press wheels, lift wheels, etc. to allow for good residue flow • residue flow can be improved by staggering the seed units • stagger coulters – 6-8" offset on 17" blades • use a narrow type press wheel
	• too much residue	• drive at an angle to old crop rows • plant between the old rows • bale the straw • spread residue evenly at harvest • use rotary hoe, walking chain harrow or shallow coulter tillage to move residue around
	• residue not cut	• match coulter size to depth of cut (see page 35) • make sure coulter blades are sharp and not worn • adjust coulter depth • use rotary hoe, walking chain harrow or shallow coulter tillage to move residue around • use a ripple (plow) coulter
UNEVEN PLANT STAND	• residue incorporated into tilled strip	• adjust coulter depth and travel speed so that residue is thrown clear of the crop row

PLANTING EQUIPMENT

Weight may be added inside the drill or planter frame.

For good seed unit penetration, ensure the tillage coulter is aligned with the seed opener.

Coulters should be sharp and set at the proper depth for good residue cutting.

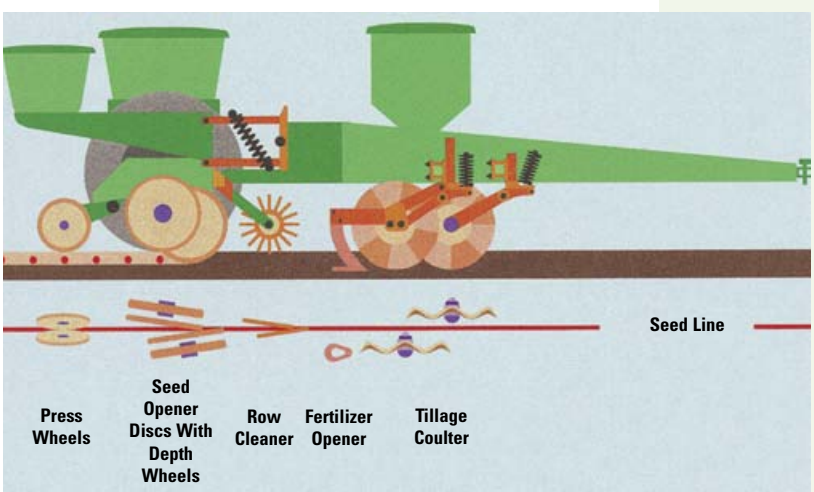
NO-TILL PLANTERS

PLANTER SETUPS

To make no-till planters work, you need to concentrate on:

- coulter setup
- uniformity of seeding depth and placement
- weight.

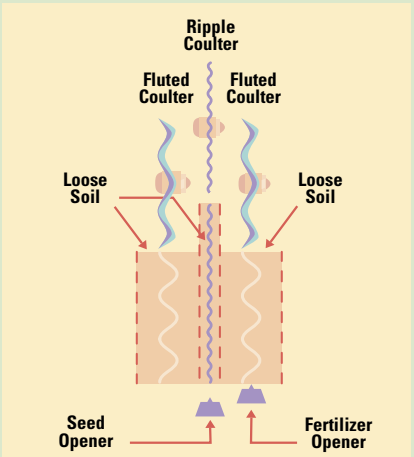
Ensure the planter is adjusted for field conditions.



The components of a no-till planter. The coulters till the soil for seed and fertilizer placement. The row cleaner moves residue from the row.

PLANTING EQUIPMENT

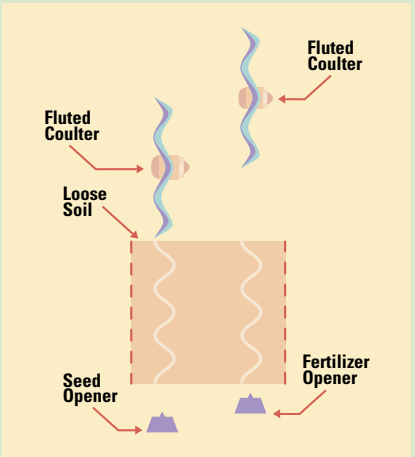
COULTER SETUP AND SELECTION



3-Coulter System

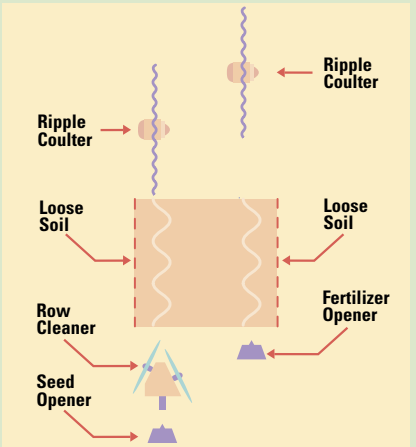
Two outside coulters are at least 5 cm (2") away from the seed zone. A fertilizer shoe or knife may follow one or each. The centre coulter (in line with seed opener) ensures the seed slot opener places seed at the proper depth, in tilled soil that is clear of residue. Tips:

- the centre coulter should lead the other two coulters
- planter speed must be adequate to move residue off row.



2-Coulter System

The two coulters used are set closer together so the tilled zone is narrower. Coulters with left and right arms allow residue to flow between them more easily.



Coulter Plus Row Cleaner

This system normally uses two coulters. If fertilizer units can penetrate untilled soil, only one coulter is needed. This system uses bubble, fluted or ripple coulters. The tilled zone is narrow (with two coulters). Residue is removed by row cleaners mounted on the seeding unit. The configuration you choose will depend on the type of residue on the soil.

PLANTING EQUIPMENT

COULTER BLADE SELECTION

In a **2-coulter system:**

- ▸ choose 5 cm (2") fluted coulters for a wider tilled zone
- ▸ a 3 cm (1") fluted coulter will till a narrower zone and leave a finer seedbed.

A combination can be used, e.g., a 3 cm (1") fluted coulter in front of the starter fertilizer, and a 5 cm (2") fluted coulter for nitrogen application.

In a **3-coulter system:**

- ▸ a 5 cm (2") fluted lead coulter will throw residue farther but won't throw much soil
- ▸ two 3 cm (1") fluted coulters would follow
- ▸ different coulter combinations can also be used
- ▸ a row cleaner may be added to this system but may be too aggressive under most conditions.

Using 2 coulters and row cleaner:

- ▸ 3 or 5 cm (1" or 2") fluted coulter is in front of the starter fertilizer
- ▸ 24-25 wave blade or ripple coulter is in front of the seed opener.

If the coulter is not located in front of the seed opener, then use a 1" or 2" coulter as in the 2-coulter system. A third coulter could be added to this system.

COULTER DEPTH AND ARRANGEMENTS

Coulters should till soil to the desired width and depth. Some farmers till a seedbed 3" wide and 5" deep. Others till 8" to 10" wide and 6" deep. As the amount of tillage increases, so do equipment cost, planter weight and horsepower requirements. It is important to avoid more tillage than necessary for crop conditions.

Easy adjustment is also important as soil conditions change from field to field and within a field – hydraulic adjustable coulter bars are an advantage.

Mount tillage coulters on a toolbar, not on seeding units. Seeding units are the precision part of the planter and should not be subjected to abuse.

In a 2-coulters/row cleaner and 3-coulter system:

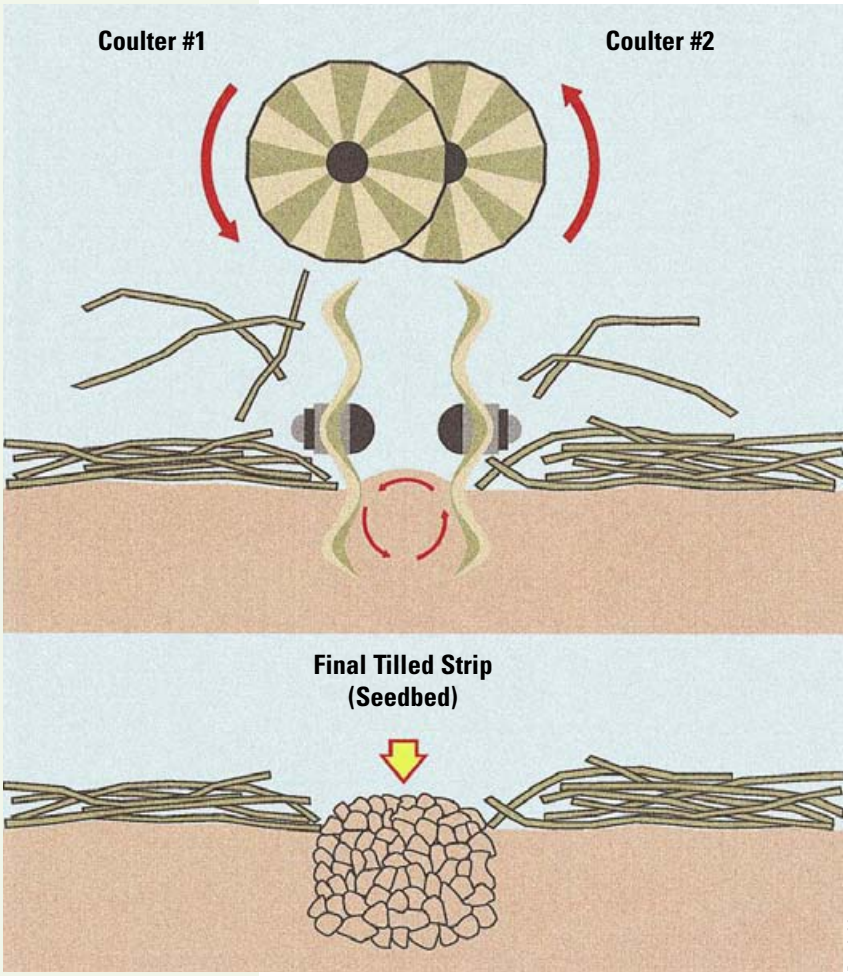
- ▸ when the coulter is in line with the seed and there is no further tillage (i.e., no coulters behind and to the side of it) then the coulter should be set no deeper than 1 cm ($^1/_2$") below seed depth
- ▸ tillage coulters should be set to run as deep as dry soil or as deep as desired
- ▸ when a coulter is in line with the seed, and tillage coulters follow, then set the coulter to run as deep as dry soil.

Peter Johnson of the Ontario Ministry of Agriculture, Food and Rural Affairs explains the importance of proper coulter selection and setup to achieve a good stand.

SETUP TIP

When mounting coulters for the first time, drop the planter down until the parallel linkage is level. Then measure from the toolbar and add an amount equal to the depth the coulters will run. Test in the field.

PLANTING EQUIPMENT



Don Lobb

Coulters in action creating a seedbed. Soil is crumbled between them and residue is thrown from the row area.

WHY OFFSET TILLAGE COULTERS?

Coulter #1 is rotating up at the same point where Coulter #2 is rotating down because Coulter #1 is mounted ahead of Coulter #2.

Opposing rotating directions due to offset coulters cause the soil to be rolled and crumbled between the coulters. This creates good soil loosening with minimal soil being thrown from the seedbed by the coulters, particularly when coulters with narrow waves or ripples are used.

The final seedbed is in a condition similar to that of conventional tilled soil – hence a good seed environment and no need for abuse of precision-planting components. Excessive down pressure and cast-iron press wheels are usually not needed.

PLANTING EQUIPMENT

RESIDUE FLOW

COULTERS

Residue flow through multiple coulters can be improved by:

- using right and left coulter arms to avoid obstructions between close coulters
- staggering coulters, which makes plugging less likely and also improves soil crumbling between coulters.

Coulters must cut residue effectively to avoid plugging, so they must be kept sharp. Sharpen with a grinder. Deeper tillage requires larger diameter coulters to avoid pushing residue in front of them.

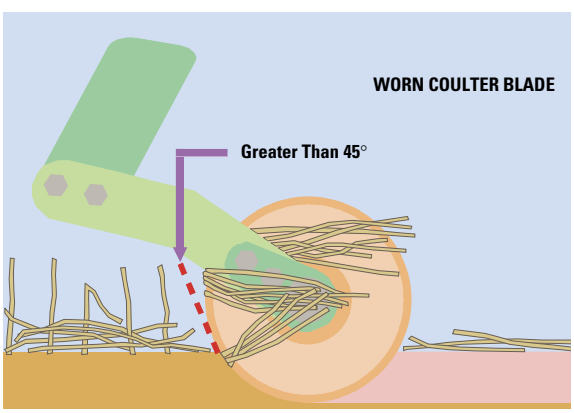
SEED UNITS

Residue flow can be improved by staggering the seed units.

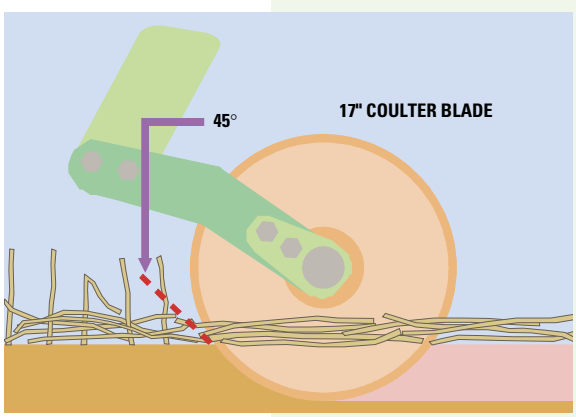
WEIGHT

Additional weight is often needed to:

- resist upward lift of the frame by coulters – when the soil is hard or dry, the coulters may not penetrate the soil to the desired depth, which may prevent planting units from planting at the desired depth
- keep drive/gauge wheels in good contact with the soil to avoid slippage.



Replace coulters when they start to push residue.



A coulter that is not worn will have the proper angle to cut residue.

PLANTING EQUIPMENT

WEIGHT REQUIREMENTS

The amount of required weight will depend on:

- ▸ number of rows
- ▸ number and type of coulters per row
  - ▷ coulters with long cutting edges, such as fluted coulters, require more weight for penetration than straighter blades
  - ▷ use the fewest tillage coulters possible to achieve necessary tillage effect – each coulter added increases the weight, power requirement and costs
- ▸ soil conditions
- ▸ wheel configuration of planter frame
- ▸ coulter location on the frame.

Adequate planter weight is necessary to ensure coulter penetration in hard dense soil, often as much as 400 pounds per coulter. Planter frame strength is important to withstand this stress.

POSITIONING OF WEIGHTS

Mount coulters toward the front of the planter and add weight toward the rear of the planter to reduce the total weight and power requirement.

Correct Positioning of Weights on a No-till Planter for Coulter Penetration

The planter frame is really a simple lever, hinged at the tongue of the drawbar. To minimize horsepower requirements, you will want to know where to place the minimum additional weight for the maximum effect.

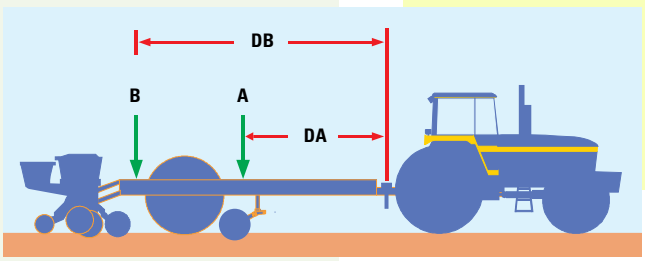
The following is the equation used to calculate the effect of a weight placed at different points on a planter.

$F_B \times DB = F_A \times DA$ Where F_B = 1000 lbs

F_A = $(F_B \times DB)/DA$ DB = 15'

= $(1000 \times 15)/10$ F_A = unknown force

= 1500 lbs DA = 10'



Placed at point A, 455 kg (1000 lbs) will put 455 kg of force on the coulters. The same weight at point B will put 680 kg (1500 lbs) of force on the coulters.

PLANTING EQUIPMENT

FERTILIZER PLACEMENT ATTACHMENTS

FERTILIZER FORM	FUNCTION	TYPE OF ATTACHMENT	COMMENTS
DRY	• to place fertilizer beside and below the seed	• single disc opener	• disc cuts residue
		• coulter and double disc	• offset discs work better • the disc angle should not be too wide
		• coulter and knife	• this setup is prone to plugging with residue and small stones
		• coulter and fertilizer tube	• this setup relies on the fluted coulter to incorporate the fertilizer (incorporation may not be as deep as desired)
	• to place fertilizer with the corn seed	• insecticide unit	• fertilizer is placed in the seed trench (granule size is a consideration)
LIQUID	• to place fertilizer beside and below the seed • to place pop-up fertilizer with the seed	• coulter and injector • fertilizer tube	• fertilizer is injected in the slot opened by the coulter

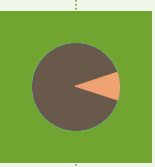
The coulter must cut residue to allow proper placement of fertilizer.

Note: Make sure fertilizer is placed a sufficient distance from the row, and safe rates are used.

TROUBLESHOOTING NO-TILL PLANTER EQUIPMENT

PROBLEM	CAUSE	SOLUTION
SHALLOW SEED/FERTILIZER PLACEMENT	• poor coulter penetration	• add weight to the planter frame • adjust tillage coulter depth • change type of coulter – a narrower coulter is easier to get into the ground • avoid planting when the soil is too dry • ensure coulters are sharp
	• poor tracking of seed/fertilizer unit	• line up tillage coulter with fertilizer or seed opener • monitor parallel linkage for wear, as this can affect coulter and seed unit alignment • on coulter caddies, a wider, more aggressive coulter may be necessary
	• planter unit bounce	• install oscillating depth stops on gauge wheels • increase seed unit downward pressure • increase width of tilled zone • keep hoppers full • reduce planting speed

PLANTING EQUIPMENT



TROUBLESHOOTING NO-TILL PLANTER EQUIPMENT, cont'd.

PROBLEM	CAUSE	SOLUTION
SHALLOW SEED/FERTILIZER PLACEMENT	• poor seed unit penetration	• adjust seeding depth of unit • adjust spring pressure on the unit and/or the press wheel(s) • adjust depth of tillage coulters • align tillage coulters with openers • increase width of tilled zone
	• worn double disc openers	• check double disc wear and replace when diameter is less than 1" of normal • compensate for the smaller diameter by adjusting depth stops • replace worn discs
POOR SEED TRENCH CLOSURE	• inadequate firming of soil	• increase downward pressure on press wheel • change to a narrower press wheel or wider tilled strip • change coulters to till wider area (more coulters)
	• soil too wet	• plant when the soil is at proper moisture • use a burndown to speed soil drying • install tile drainage to improve variable soil moisture conditions • bale and remove cereal straw • pre-tillage
ERRATIC SEED DROP/SKIPS	• slipping drive wheel/coulter	• add weight to the planter • add fluid to the drive wheel • change to a more aggressive drive wheel/coulter • reduce down pressure on seed units • use fewer tillage coulters
SEED PLACED TOO DEEP	• tillage coulters set too deep • planter units running too deep	• raise the coulters up • adjust depth setting on the units • add pressure to the press wheels • remove weight from the planter
RESIDUE PLUGGING	• poor residue flow	• there should be adequate space between seed units, press wheels, lift wheels etc. to allow for good residue flow
	• too much residue	• plant between the old rows • remove the straw from cereal fields • spread residue evenly at harvest
	• residue not cut	• match coulter size to depth of cut • make sure coulter blades are sharp • delay planting until residue is dry • adjust coulter depth
EXCESSIVE HORSEPOWER REQUIREMENTS	• tillage coulters or row cleaners set too deep • too much coulter tillage	• raise tillage coulters • raise row cleaners to just clear residue from the row • use fewer coulters • till shallower

PLANTING EQUIPMENT

RIDGE TILL PLANTERS

Ridge till planters clear the tops of ridges of residue and a small amount of soil, and move them into valleys between the ridges. Row-crop cultivators provide subsequent weed control. There are several ways to clear the top of ridges, as outlined on page 20 and in *Field Crop Production* (Best Management Practices).

EQUIPMENT CONSIDERATIONS FOR NARROW-ROW CORN

Narrow-row corn is considered any row width less than the 28" to 36". Much of the work done by researchers and farmers over the past few years has concentrated on the effects of narrowing rows. But little attention has been paid specifically to no-till narrow-row corn.

Consider the following:

- narrow rows mean less space between rows for residue flow
- nitrogen application options are limited
- the additional residue may impact the following crop.

Be sure that someone is examining components and setup after each field.

Many ridge tillers are no-tilling on the ridge with the 2-coulter and row cleaner setup.