

ASAE S477 DEC01
Terminology for Soil-Engaging Components for Conservation-Tillage
Planters, Drills, and Seeders



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Terminology for Soil-Engaging Components for Conservation-Tillage Planters, Drills, and Seeders

Developed by the ASAE Cultural Practices Equipment Committee; approved by the ASAE Power and Machinery Division Standards Committee; adopted by ASAE April 1989; reaffirmed December 1993, December 1998; reaffirmed December 1999; reaffirmed for one year January 2001; reaffirmed for five years December 2001.

1 Purpose and scope

1.1 The purpose of this Standard is to provide uniform terminology for the soil-engaging components of planters, drills and other seeders used in conservation-tillage systems so as to improve communication among those who design, develop, produce, sell, service, demonstrate and report the performance of such machines.

1.2 This Standard is limited to machine components for planters, drills and other row-type seeders used for establishing field crops with conservation-tillage systems. It does not include components for aerial, broadcast or other random-pattern seeding machines, nor those used exclusively for seeding vegetable or other speciality crops.

1.3 This Standard is limited to those machine components that actively engage and/or penetrate the soil during the seeding operation and which affect the total performance of the seeding machine.

1.4 This Standard includes numerous references to, but does not attempt thorough descriptions of, machine frames or transport components, drive mechanisms, metering devices, suspensions for seeding units, and hoppers and containers for seed or other materials that may be applied during the seeding operation.

1.5 Dimensions, spacings, operating depths and velocities are used in some cases as part of the component descriptions. These are for informational purposes only and do not imply performance specifications for any type of component design, soil condition, or seeding practice.

1.6 This Standard is intended to be consistent with terminology in other ASAE standards including ASAE Standard S414, Terminology and Definitions for Agricultural Tillage Implements, and ASAE Engineering Practice EP291, Terminology and Definitions for Soil Tillage and Soil-Tool Relationships.

2 Definitions

2.1 Soil-engaging components: Seeding-machine mechanical components that actively engage and penetrate the soil during the seeding operation, which are designed for or used to accomplish seeding functions or the placement or incorporation of fertilizers or pesticides. Also, those seeding-machine mechanical components that engage, but do not penetrate the soil during the seeding operation, which are designed for or used to control the depth of soil penetration or to actively press on the soil surface.

2.2 Conservation tillage: Any tillage and planting system which maintains a minimum of 30% residue cover on the soil surface after planting or maintains at least 1 120 kg/ha (1000 lb/acre) of flat, small grain residue equivalent on the surface during critical erosion periods.

2.3 Planters, drills and air seeders: Three basic categories of row-type seeding machines that are appropriate for use in conservation-tillage environments.

2.3.1 Planters: Machines with multiple row-seeding units that are individually suspended from a main frame. Seed hopper and singulated metering for each individual row may be separately mounted on each row-seeding unit or centralized with seed delivery tubes to individual row units. Seeding depth is principally controlled by depth-control components on each seeding unit.

2.3.2 Drills: Machines with multiple row-seeding units that are each suspended separately or in gangs (2 or more) from a main frame. A main frame also supports a common seed hopper and seed metering for all rows. Metered seeds free-fall or are pneumatically transported through individual delivery tubes to the point of deposition in each row. Seeding depth is controlled by main frame elevation, by depth-control components on each seeding unit or on each gang of seeding units, and/or by the flotation characteristics inherent with the "soil opening for seed placement components" (see paragraph 4.4) on each seeding unit.

2.3.3 Air seeders: Machines with points of seed deposition which are behind multiple shovel or sweep tillage tools of a chisel plow or field cultivator (see ASAE Standard S414, Terminology and Definitions for Agricultural Tillage Implements). Seed delivery to each shovel or sweep tool is through a single pneumatic delivery tube from a remote seed hopper and central seed-metering system. Actual seed deposition may be at one point only, or at two or more points through multiple-discharge seed dispersers attached to each shovel or sweep tool. Seeding depth is controlled by tillage depth through lifting/gauge wheels on the main frame and by position of the seed deposition outlets in relation to tillage depth. Optional depth-control wheels may be attached to individual tillage tools.

3 Special use of components

3.1 Components for seeding in conservation-tillage environments have been partitioned into seven functional groups. On a seeding machine (see Fig. 1) one or more compatible components from each group may be used to assure that seed is satisfactorily planted and that components which perform sequential functions will perform properly. Conservation-tillage environments require special functions or sequences of functions to compensate for little or no tillage to cut, incorporate, or bury previous crop residues and to loosen the soil prior to the seeding operation. The severity of the residue and soil conditions will determine which components should be used and whether or not some functional groups may be omitted from a seeding machine. Most of the components described herein were originally developed for tillage implements (see ASAE Standard S414, Terminology and Definitions for Agricultural

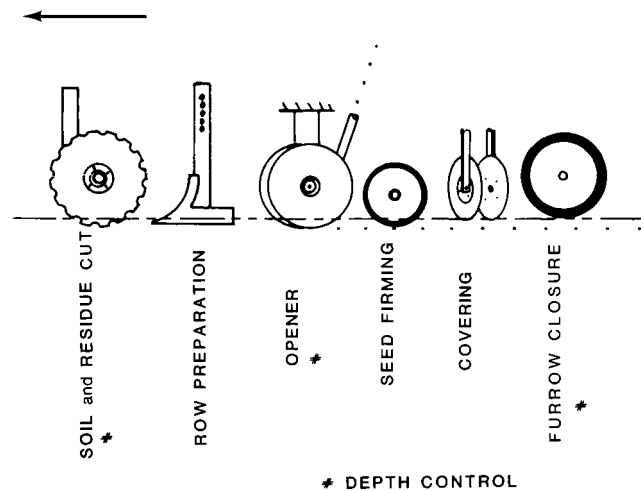


Figure 1 – Example of a sequence of soil-engaging components on a conservation-tillage seeding machine. The depth-control component may be located at any one or more of the locations indicated

Tillage Implements), or for seeding machines for residue-free, tilled-soil seeding environments. Those components are used with or without modifications in special configurations or sequences in the design of seeding machines for conservation-tillage environments.

4 Component terminology and illustrations

4.1 Components described in this Section are illustrated in Figs. 2–8. The illustrations depict a common configuration of the component, understanding that many variations occur among manufacturing sources. All illustrations are side views with direction of travel from right to left, unless otherwise specified.

4.2 Soil and residue cutting components: These components cut and/or orient surface residue in the row area and cut or loosen the soil to enhance the performance of the components which follow. Soil and residue cutting components, if employed, precede all other planter, drill and seeder components. They may also serve as a drive wheel for seed metering or other mechanisms. Soil and residue cutting components penetrate the soil surface to a depth usually no greater than one or two times seeding depth. When conditions and seeding practices do not require separate soil and residue cutting components, the dual function of some “row preparation” components (see paragraph 4.3) or “soil opening for seed placement” components (see paragraph 4.4) will accomplish soil and residue cutting. The components described below are illustrated in Fig. 2.

4.2.1 Smooth couler: A flat circular disc blade with a sharpened circumference.

4.2.2 Notched couler: A flat circular disc blade with a sharpened circumference and spaced, sharpened notches in the circumference.

4.2.3 Couler with depth bands: A smooth or notched couler with concentric cylindrical rings attached to both faces to limit the depth of soil penetration.

4.2.4 Offset couler: A circular disc blade with sharpened circumference and various lateral offsets from the flat surface—rounded offsets or protrusions alternating between sides of the blade. The offsets are typically sinusoidal in cross section. Position, spacing, and radial length of the offsets distinguish between different offset coulers, as given below.

4.2.4.1 Bubble couler: Offsets are recessed from the circumference providing a smooth cutting edge. Offsets are typically spaced at about 10 deg, and protrude about 10 mm (3/8 in.) to each side, producing a working width of approximately 20 mm (3/4 in.). Offset radial length is about 70 mm (2.8 in.) for a blade of 450-mm (18-in.) diameter.

4.2.4.2 Rippled couler: Offsets are either extended radially inward from the circumference providing a sinusoidal cutting edge, or recessed from the circumference with a sharpened cutting edge. Offsets are typically spaced at 3.6 deg or less, and protrude about 5 mm (3/16 in.) to each side, producing a working width of approximately 10 mm (3/8 in.). Offset radial length varies from 50–80 mm (2–3.2 in.) depending on the type of cutting edge and blade diameter.

4.2.4.3 Fluted couler: Offsets extend radially inward from the circumference to the blade hub, providing a sinusoidal cutting edge. Offsets are typically spaced at 25 deg or more, and protrude up to 12.7 mm (1/2 in.) to each side, producing a working width of up to 25.4 mm (1 in.) for “narrow” fluted coulers. “Wide” fluted couler offsets protrude a greater distance to each side of the blade, producing correspondingly wider working widths.

4.2.5 Powered blade or couler: A toothed, flat disc blade or smooth, notched, or offset couler driven at a peripheral velocity different than ground speed. The orientation may be angled from the direction of travel to produce a greater working width.

NOTE: The vertical plane of the rotating cutting edge of coulers (see paragraphs 4.2.1–4.2.5) is usually perpendicular to the field surface and usually parallel with the direction of machine travel. Typical couler blade thickness and diameter are 3–12 mm (1/8–1/2 in.) and 380–600 mm (15–24 in.), respectively.

4.2.6 Strip rotary tiller: One or more powered vertical assemblies of several flat, ell-shaped blades, typically 50–100 mm (2–4 in.) wide by 6–12 mm (1/4–1/2 in.) thick, radially attached to hubs on a powered shaft. The overall diameter of a rotor assembly is typically 380–600 mm (15–24 in.). The leading edges of the blades, parallel to the powered shaft, are sharpened for cutting. Powered rotation is in the forward direction with a peripheral velocity greater than ground speed. Action of the unit is to cut surface residue and/or to incorporate it with the soil in the row area.

4.2.7 Dual secondary residue discs: Opposing sharpened flat or concave circular disc blades, positioned on each side of a couler (see paragraphs 4.2.1–4.2.4). The disc blades are in-line with the direction of travel and adjusted to either hold or cut surface residue on each side of the row area while the couler cuts residue directly over the row. Typical disc blade thickness is 3–10 mm (1/8–3/8 in.). Typical disc blade diameter is 200–300 mm (7.8–11.8 in.).

4.2.8 Straw straightener: A spring steel rod tine, typically 3–10 mm (1/8–3/8 in.) in diameter, coiled or flexibly mounted at the upper end. Tine length usually varies from 250 to 400 mm (10–16 in.). A single tine may be used to align surface residue in the row area with the direction of machine travel.

4.3 Row preparation components: These components alter surface residue and/or soil conditions in preparation for seed-furrow opening and seed deposition. Row preparation components, if employed, precede the components designed for “soil opening for seed placement” (see paragraph 4.4). These components may be used on flat, ridged or

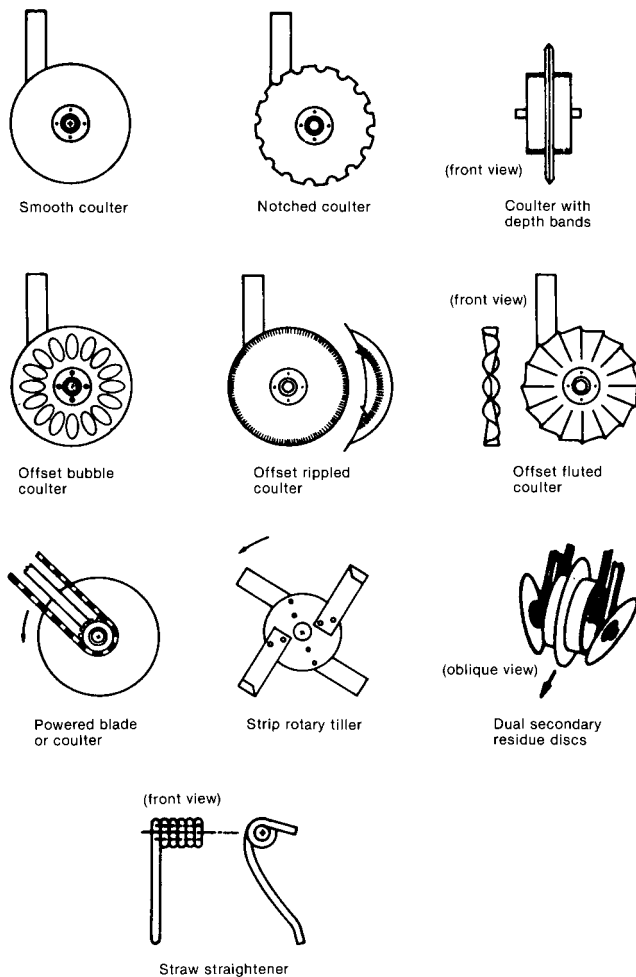


Figure 2 – Component options for soil and residue cutting

bedded field surfaces to perform various actions: (a) residue and soil removal from the row area, (b) residue incorporation of soil loosening in the row area, or (c) clod pulverization, firming and smoothing of loosened soil in the row area. Various row preparation depths range from the soil surface to subsoil-tillage depths. As many as two or three row preparation components may be used in sequence to achieve a desired effect. Some conditions and seeding practices do not require row preparation components, relying on the functions of either "soil and residue cutting" components (see paragraph 4.2) or "soil opening for seed placement" components (see paragraph 4.4) for adequate seeding. Those components are illustrated in Fig. 3.

4.3.1 Sweep row cleaner: A wing-shaped sweep shovel of 250 mm (9.8 in.) or more in width with low lift-angle and shank-mounted residue deflectors to remove surface residue and/or soil from the row area. The width of the "cleaned row" strip depends on the width of the sweep and the setting or position of the residue deflectors.

4.3.2 Vertical-discs row cleaners: Two opposed concave disc blades with smooth or notched sharpened circumferences to remove surface residue and/or soil from the row area. The plane of the rotating cutting edge of each disc is usually perpendicular, or nearly-perpendicular, to the field surface and at an angle to the direction of machine travel. Typical discs are 3–10 mm (1/8–3/8 in.) thick and 250–380 mm (9.8–15 in.) in diameter. The width of the "cleaned row" strip depends on blade diameter, the angle between the planes of the blade cutting edges and the lateral distance between blade hubs.

4.3.2.1 Even discs row cleaner: The leading edge of both disc blades are at the same fore-and-aft position, with or without a lateral space between them.

4.3.2.2 Staggered discs row cleaner: The leading edge of one disc blade precedes the other.

4.3.3 Horizontal-disc row cleaner: A concave disc blade, with smooth, sharpened circumference and shank-mounted residue deflectors, to remove surface residue and/or soil from the row area. The plane of the cutting edge of the blade, which is free to rotate, is nearly parallel to the field surface, but is typically inclined 10–15 deg with the leading edge lower than the trailing edge. Typical blade thickness is 3–10 mm (1/8–3/8 in.). The width of the "cleaned row" strip depends on the blade diameter, typically 250–380 mm (9.8–15 in.) working depth and the setting or position of the residue deflectors.

4.3.4 Wide-fluted coulters loosener: (See paragraph 4.2.4.3) A coulters for loosening a strip of soil behind a soil and residue cutting component.

4.3.5 Chisel ripper: A shank with a sweep, chisel, tooth or shovel tool for loosening soil in the row area to a depth of less than 350 mm (13.8 in.). Width of the loosened strip depends on depth of operation, characteristics of the soil and the particular shank and tool combination used. A delivery tube may be attached to the rear of the shank for fertilizer deposition.

4.3.6 Subsoil ripper: A shank with a replaceable tooth-like tool which is set at a lift angle, for loosening soil in the row area to a depth of more than 350 mm (13.8 in.). Width of the loosened strip depends on depth of operation, characteristics of the soil and the particular shank and tool combination used. A delivery tube may be attached to the rear of the shank for fertilizer deposition.

4.3.7 Packer roller: A set of solid or open-centered wheels on a common axle for clod pulverization and firming or smoothing loosened soil in the row area. Wheel sections are available in various widths, diameters and sectional profiles; such as flat, angled, V-shaped or rounded.

4.3.8 Basket roller: A wide cylindrical wheel unit of various dimensions with an open grid pattern at the circumference formed by various arrangements of straight or curved rods or bars for clod pulverization and firming or smoothing loosened soil in the row area.

4.3.9 Rotary cultivator: A set of wheels with curved, finger-like spikes extending radially from the individual wheel hubs, mounted on a common axle, for loosening, clod pulverization, and smoothing loosened soil in the row area, depending upon the angled orientation to the direction of travel and the curvature of the spikes. The overall diameter of the rotating wheel assembly is typically 250–380 mm (9.8–15 in.). Cross section of the base of the spikes, which may be tapered (thinner at the outer tip), is typically 10 × 25 mm (3/8 × 1 in.) (see ASAE Standard S414, Terminology and Definitions for Agricultural Tillage Implements).

4.3.10 Spring tine cultivator: Multiple spring-steel wire upright tines, each typically 3–10 mm (1/8–3/8 in.) in diameter and coiled at the upper end for flexible mounting. Tine length varies from 250–400 mm (10–16 in.). Tines smooth loosened soil.

4.3.11 S-tine cultivator: A flexible S-shaped shank with a sweep, chisel, tooth, or shovel tool, used individually or in a ganged arrangement (2 or more), to loosen soil in the row area to a depth of less than 100 mm (3.9 in.) (see ASAE Standard S414, Terminology and Definitions for Agricultural Tillage Implements).

4.4 Soil opening for seed placement components: These components "open" a continuous cleft, "furrow," or undercut in the soil to facilitate subsurface seed deposition in a row. They are commonly called seed openers, furrow openers or seed-furrow openers. Soil opening for seed placement components may or may not be preceded by soil and residue cutting components and/or row preparation components depending upon the type of opener used and the conditions and seeding practice. The performance of openers is usually sensitive to travel velocity, type and condition of soil and residue, and seeding depth. These components are illustrated in Fig. 4.

4.4.1 Double-disc opener: Two sharpened, opposed flat or slightly concave disc blades which are set at a small angle to the direction of movement and to vertical. The blades are of equal or unequal diameters

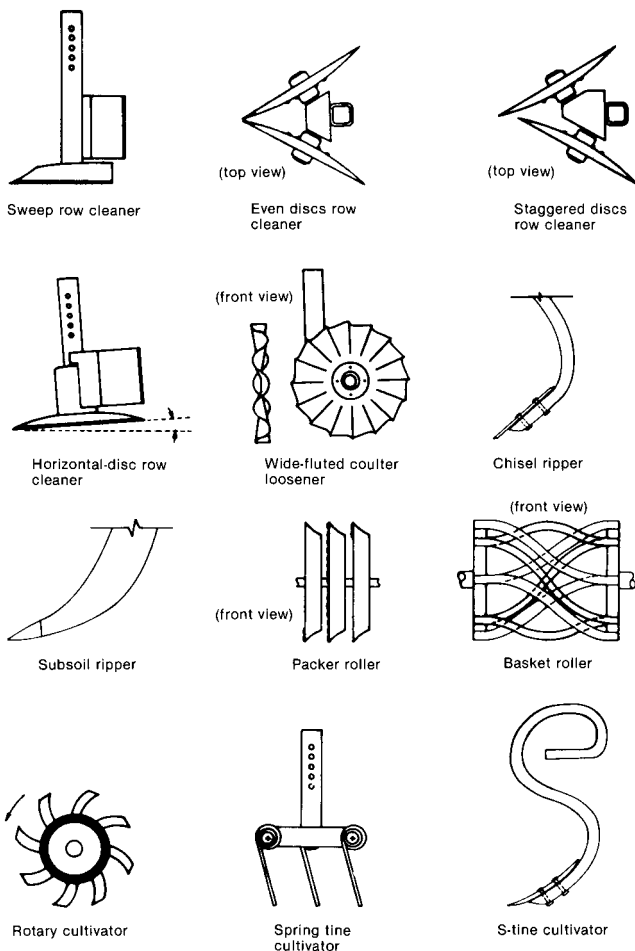


Figure 3 – Component options for row preparation

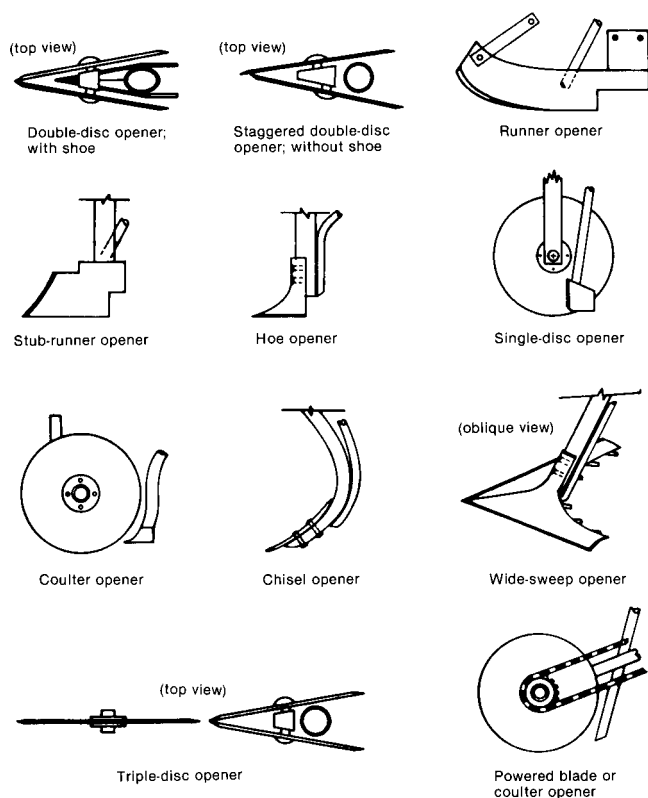


Figure 4 – Component options for soil opening for seed placement

with leading edges which touch. Typical disc blade thickness and diameter are 3–6 mm (1/8–1/4 in.) × 200–600 mm (7.8–23.6 in.), respectively.

4.4.1.1 With shoe: A wedge-shaped rigid form which when positioned between the lower portions of double discs, forms a particular shape to the bottom of the furrow or increases the duration that the furrow is held open for seed deposition.

4.4.1.2 Without shoe: No shoe between the lower portions of double discs.

4.4.2 Staggered double-disc opener: Two sharpened, opposed flat or slightly concave disc blades which are set at a small angle to the direction of movement and to vertical. The leading edge of one disc precedes the second disc to provide aggressive cutting. The blades may be of equal or unequal diameters. The leading blade may be notched at the circumference or otherwise configured for aggressive cutting.

4.4.2.1 With shoe: (See paragraph 4.4.1.1)

4.4.2.2 Without shoe: (See paragraph 4.4.1.2)

4.4.3 Runner opener: A fixed, elongated, blade-like opener which is vertically split to form a wedge-shape for cutting and moving soil laterally to form a furrow. The leading edge is typically curved upward. The bottom edge may be flat, rounded or V-shaped at the rear. Typical dimensions are 250–380 mm (9.8–15 in.) in length, 76–127 mm (3–5 in.) in depth (at the rear), and 20–38 mm (0.8–1.5 in.) in width (at the rear).

4.4.4 Stub-runner opener: A truncated or shorter version of the runner opener (see paragraph 4.4.3), typically 200 mm (7.8 in.) or less in length.

4.4.5 Hoe opener: A shank-mounted, narrow, vertical or forward-curved tool with a pointed or rounded leading edge. The seed delivery tube is attached to the rear of the shank. Hoe openers are used for relatively deep penetration in dry soils leaving an incompletely filled furrow trench.

4.4.6 Single-disc opener: An upright, flat or slightly concave disc blade with a sharpened circumference. The blade is set at a slight angle to the direction of movement and to vertical to move soil laterally to form a furrow.

4.4.7 Coulter opener: A rolling coulter (see paragraph 4.2.1) operating in line with the direction of movement. Seed is deposited behind or beside the coulter by means of a wedge-shaped form which is positioned adjacent to or behind the trailing edge of the coulter blade to undercut or move soil laterally to form a furrow.

4.4.8 Chisel opener: A shank-mounted tillage tool of various dimensions (see ASAE Standard S414, Terminology and Definitions for Agricultural Tillage Implements) with a blunt forward-curved leading surface. The seed delivery tube is attached to the rear of the shank.

4.4.9 Wide-sweep opener: A shank-mounted sweep shovel with low-lift-angle wings spanning a lateral width of 1.5–1.8 m (4.9–5.9 ft). The wide sweep opens the soil for seeding by undercutting rather than by forming a seed furrow. The shank-mounted (primary) pneumatic seed tube delivers seed to sweep-mounted (secondary) pneumatic seed tube(s) positioned under the wings for seed deposition at various lateral “row” positions along the wings.

4.4.10 Triple-disc opener: A combination of a coulter (see paragraph 4.2.1) preceding a double-disc opener (see paragraph 4.4.1) or a staggered double-disc opener (see paragraph 4.4.2), but all integrally mounted to a common assembly to maintain fixed relative positions between the subcomponents.

4.4.11 Powered blade or coulter opener: Same as paragraph 4.2.5 with either forward or counter blade rotation in relation to the direction of machine travel and an attached seed delivery tube positioned behind the powered unit.

4.5 Components for firming uncovered seed: These components press seed into the soil at the bottom of the seed furrow to improve seed-to-soil contact. Components for firming uncovered seed closely follow the components for “soil opening for seed placement” (see paragraph 4.4) and actual seed deposition, preferably before any seed covering occurs. The components used for this purpose are wheels of widths narrower than the seed furrow width, usually 6–25 mm (1/4–1 in.) and of diameters of 150–250 mm (6–10 in.). Firming wheels may have downforce springs to reduce wheel “bounce” and/or to apply additional firming force. Performance may be affected by the furrow opener characteristics, the mounting position of the firming wheel, the width, profile and material of the circumferential wheel surface, and the adhesiveness of the soil. Seed firming wheels are illustrated in Fig. 5.

4.5.1 Semi-pneumatic wheel: A narrow vertical wheel with a flexible semi-pneumatic tire to resist soil accumulation.

4.5.2 Solid wheel: A narrow vertical wheel of various materials.

4.6 Seed-covering components: These components fill a furrow by moving soil from the edges of the seed furrow into or over the seed furrow. Seed-covering components, if employed, follow seed deposition and components for “firming uncovered seed” (see paragraph 4.5). Such components are typically used only when the components which follow, for “seed furrow closure and firming” (see Fig. 7), are either not used or are inadequate to consistently cover the seed. Dragging-type components are used mainly for shallower-seeded crops. Cutting-type components may be adjustable for depth and angle of cut and may or may not have adjustable downforce springs. Performance with both types is improved with the presence of loosened soil in the immediate area and is degraded by entanglement with surface residues. Seed-covering components are illustrated in Fig. 6.

4.6.1 Single-covering disc: A sharpened, flat or concave disc blade,

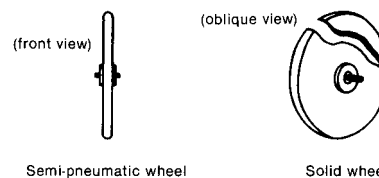


Figure 5 – Component options for firming uncovered seed

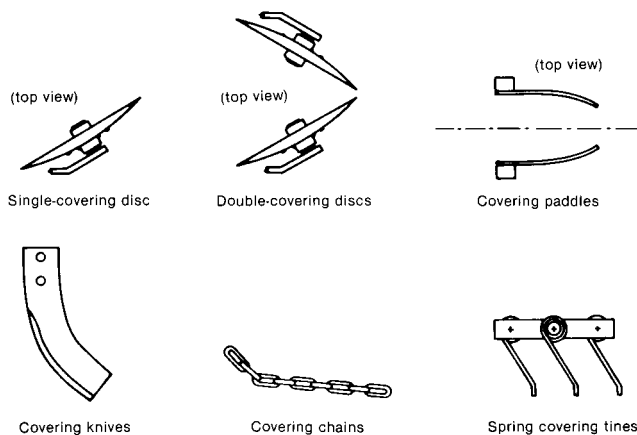


Figure 6 – Component options for seed covering

positioned upright and at an angle to the direction of travel at the side of the seeded furrow. Aggressiveness of soil cutting and moving is adjusted by changing the angle and depth. Typical disc blade thickness and diameter are 3–10 mm (1/8–3/8 in.) \times 150–300 mm (5.9–11.8 in.), respectively.

4.6.2 Double-covering discs: Two opposing disc blades positioned evenly or staggered on each side of the seeded furrow.

4.6.3 Covering paddles: One or two opposing elongated blade-like soil deflectors or scrapers positioned along each side of the seeded furrow with curved trailing ends to move soil over the row. Paddles may be equipped with downforce springs. Paddles are typically 3–6 mm (1/8–1/4 in.) thick, 25–76 mm (1–3 in.) wide, and of various lengths.

4.6.4 Covering knives: One or two opposing, sharpened, rigid, elongated blades which are rigidly positioned upright on either side of the seed furrow. Knives may be straight or curved inward or rearward. Knife-depth position is adjustable. Knives are typically 6–12 mm (1/4–1/2 in.) thick, 50–100 mm (2–3.9 in.) wide, and of various lengths and curvatures.

4.6.5 Covering chain: A chain of various styles and lengths, attached to drag loosened soil into the furrow.

4.6.5.1 Loop: A length of chain with both ends connected behind the furrow opener, forming a loop which drags over the seeded furrow.

4.6.5.2 Trailing: Multiple connected chain links dragging rearward on top of the seeded row.

4.6.6 Spring covering tines: (Similar to paragraph 4.3.10) Multiple spring-steel wire upright tines with flexible mountings. Tines are positioned in various spatial arrangements to redistribute loosened soil behind the furrow opener (see paragraph 4.4.1).

4.7 Seed furrow closure and firming components: These components accomplish one or more of the following: a) initiate and/or complete seed covering and seed furrow closure, b) improve soil-to-seed contact, c) create a specific soil-surface condition or profile over the row, d) control or gauge the depth of operation of preceding soil-engaging components, and e) serve as a drive wheel for seed metering or other mechanisms. Seed furrow closure and firming components, commonly called presswheels, if employed, are positioned to follow all other seed function components on planters, drills and other seeding machines. Presswheels are wheels of various widths, diameters and arrangements with or without scrapers or flexible coverings to reduce soil adhesion. Various single or dual circumferential ridges on the presswheels and the opposed-angled mounting of dual presswheels serve to move soil laterally to cover the seed and/or to apply surface pressure on one or both sides of the seeded row, in vertical planes, or at angles to a vertical plane coincident with the seeded row to firm the soil over or around the seed. Presswheels may be fixed or flotation and loaded with ballast or downforce springs. Presswheels may be mounted on individual seeder

units or in gangs and may carry the entire weight of the machine. Clearance space may be inadequate for wide or dual presswheel assemblies on narrow row and drill-type seeders. Presswheel diameters vary from 305–660 mm (12–26 in.). Components are illustrated in Fig. 7.

4.7.1 Wide presswheel: A single semi-pneumatic or steel wheel which is typically wider than 100 mm (3.9 in.) centered over the seeded row.

4.7.2 Single-rib presswheel: A wide, single semi-pneumatic or steel wheel (see paragraph 4.7.1) with a center circumferential rib to concentrate soil firming directly over the seeded furrow.

4.7.3 Double-rib presswheel: A wide, single semi-pneumatic or steel wheel (see paragraph 4.7.1) with two circumferential ribs spaced to concentrate soil firming on each side of the seeded furrow.

4.7.4 Narrow presswheel: A single semi-pneumatic or steel wheel which is narrower than 100 mm (3.9 in.) centered over the seeded row.

4.7.4.1 V-shaped: A V-shape or modified V-shape on the circumference of the tire or wheel to concentrate soil firming directly over the seed.

4.7.4.2 Rounded: A rounded shape on the circumference of the tire or wheel to firm the soil over the width of the wheel.

4.7.5 Dual-angled presswheels: Two semi-pneumatic or steel wheels which are typically positioned at angles less than 30 deg from vertical, toward the opposing wheel at the bottom. Wheels may be directly opposed or staggered to reduce blockage.

4.7.6 Split narrow presswheels: Two narrow, vertical wheels (see paragraph 4.7.4), usually steel, which are closely spaced on a common axle, with flat or inward or outward angled surfaces, to concentrate soil firming on each side of the seed position.

4.7.7 Dual wide presswheels: Two wide, vertical wheels (see paragraph 4.7.1), usually steel, on a common axle which are spaced to straddle the seeded furrow. These wheels are used to avoid furrow compaction and wheel sinkage.

4.8 Depth-control components: These components limit or regulate the depth of soil-penetrating components on individual row units, on gangs of row units or on units which are supported by the machine frame. Depth-control components, if employed, are attached to the machine frame or at the front, sides or rear of soil-engaging components on seeding machines (see Fig. 1). They may be an integral part, an attachment to, or the multiple use of another machine component or a

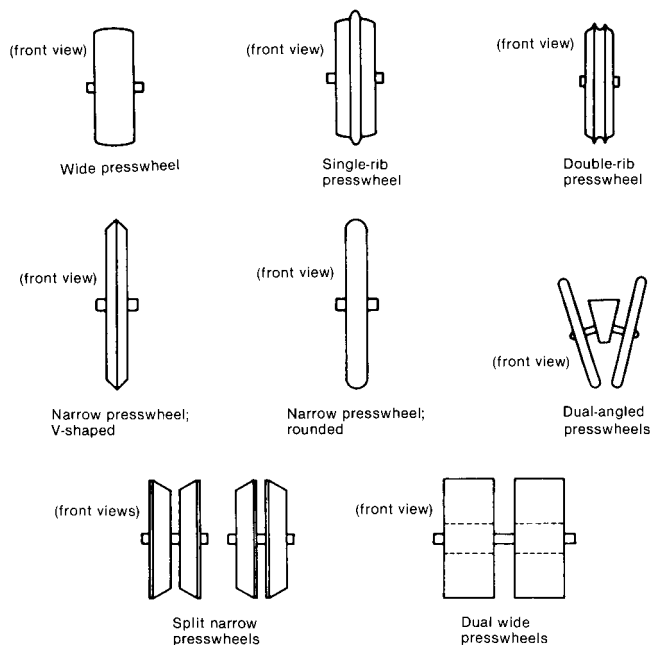


Figure 7 – Component options for seed furrow closure and firming

separate component for depth control. Most depth-control devices are adjustable to change the depth of soil penetration. Depth-control components are illustrated in Fig. 8.

4.8.1 Rear presswheel: Single or dual wheels (see paragraph 4.7) which operate on or beside the planted seed furrow at the rear of the machine. Variable wheel sinkage in loosened furrow soil will impair depth control.

4.8.2 Side gauge wheel: Single or dual wheels located on one or both sides of the furrow opener (see paragraph 4.4). Typical assembled width is 200–500 mm (7.9–19.7 in.) which may be excessive for closely-spaced row-seeding units on drills.

4.8.3 Skid plate: A rectangular plate of various dimensions with an upturned leading edge to slide over the soil surface. Furrow openers may have individual skid plates fastened onto both sides or a large wide skid plate with a center opening to fit around the opener.

4.8.4 Front wheels and rear presswheels tandemed: Interconnected front wheel(s), located ahead of the furrow opener, and rear presswheel(s) (see paragraph 4.7) which are mechanically linked and mounted on pivots.

4.8.5 Frame lifting/gauge wheels: Wheels which control the height of the main frame of the machine when there is no other provision for the depth control of row-seeding units.

4.8.6 Depth band: An open centered or wheel-like circular form which is concentrically attached to a rotating circular soil penetrating seeder component to limit the depth of penetration. Bands are typically 25–100 mm (1–4 in.) wide.

4.8.6.1 Bands on front leading coulter: (See paragraph 4.2.3) Permanently attached bands on one or both sides of a coulter blade. Their use for depth control assumes that the coulter will penetrate to the depth of the bank location.

4.8.6.2 Bands on disc opener: Exchangeable bands on one or both sides of coulter and single or double-disc blade furrow openers (see paragraph 4.4). Depth of soil penetration depends upon the relative diameters of the bands and the blades, and it changes with radial blade wear.

4.9 Fertilizer applicators: Fertilizer applicators on seeding machines, if employed, apply fertilizer materials near or below the soil surface either in the seed furrow, beneath the seed furrow, to one or both sides of the seed furrow, or between pairs of seed furrows. Fertilizer materials may be liquids, granules, prills or pressurized liquids. Applicators may be (a) integral parts of the initial penetration (see paragraph 4.2), row preparation (see paragraph 4.3), or soil opening components (see paragraph 4.4), or (b) separate attachments to the seeding units.

4.9.1 In-row liquid tube: A tube, of various materials, which is positioned in or behind the soil-opening component (see paragraph 4.4) so that liquid fertilizers are deposited in the seeded furrow before closure.

4.9.2 Chisel/subsoiler tube: (See paragraphs 4.3.5 and 4.3.6) A tube for deep placement of fertilizers under, beside, or between seed furrows.

4.9.3 Split boot: A divided shoe in a double-disc opener (see paragraphs 4.4.1.1 and 4.4.2.1) or in a runner opener (see paragraphs 4.4.3 and 4.4.4) for deposition of seed in one side of the furrow and fertilizer in the opposite side of the furrow.

4.9.4 Single-disc applicator: Similar to a single-disc opener (see paragraph 4.4.6) but used for fertilizer deposition beside or between seed furrows.

4.9.5 Double-disc applicator: Similar to a double-disc opener (see paragraph 4.4.1) but used for fertilizer deposition beside or between seed furrows.

4.9.6 Staggered double-disc applicator: (See paragraphs 4.4.2 and 4.9.5)

4.9.7 Coulter/knife applicator: One of various types of coulter blades (see paragraph 4.2) followed by an integrally-mounted forward curved, vertical, or backward curved fertilizer application knife with an attached deposition tube on the trailing edge. Positioned before, beside, or between seed furrow soil-opening units.

4.9.8 Coulter/nozzle applicator: One of various types of coulters (see paragraph 4.2) which cut a straight slit in the soil, followed by a solid-stream hydraulic nozzle for the deposition of liquid fertilizers in the opened soil slit beside or between seed furrows.

4.10 Chemical incorporation components: These components, if employed, incorporate a narrow or wide band of pesticides into the soil over seeded furrows. Chemical incorporation components operate behind soil-opening components and may be integral with seed covering or seed furrow closure components or may trail behind those components.

4.10.1 Drag chain: (See paragraph 4.6.5)

4.10.2 Rolling basket: (See paragraph 4.3.8)

4.10.3 Rotary cultivator: (See paragraph 4.3.9)

4.10.4 Spring tines: (See paragraph 4.3.10)

Cited Standards:

- ASAE EP291, Terminology and Definitions for Soil Tillage and Soil-Tool Relationships
- ASAE S414, Terminology and Definitions for Agricultural Tillage Implementations

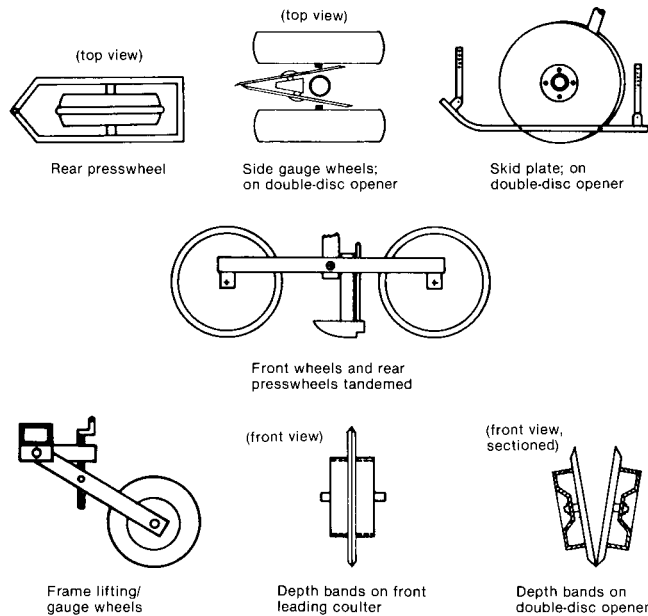


Figure 8 – Component options for planting depth control