Planter Aid for Heavy Residue Conservation Tillage Systems

H. A. Torbert,* J. T. Ingram, and S. A. Prior

ABSTRACT

The use of conservation tillage systems has many crop production advantages. However, plant residue left on the soil surface makes planting the crop more difficult. One potential problem is that standing residue often gets caught in the moving mechanisms of the planter, causing the planter to become clogged. To overcome this constraint, a forward residue mover was constructed. The forward residue mover pushes the standing residue away from the planter and prevents entanglement in the row cleaner mechanism. The device is constructed of a rigid steel frame and uses attached flexible hoses to move the standing residue away from the moving mechanism of the planter as it travels across the field. A description of the forward residue mover is given. Use of this device greatly improves planter performance by preventing clogging of the moving parts of the planter.

Conservation tillage cropping systems have been greatly researched and have been found to provide potential economic and environmental advantages compared with conventional tillage systems (Conservation Technology Information Center, 2005). These advantages have led to increased adoption of conservation tillage systems across the country in recent years. For example, in 2004, it was estimated that approximately 40.7% of planted acreage in the USA used a conservation tillage system that provided a residue cover of greater than 30%; many of these systems used winter cover crops.

Research in conservation tillage systems has demonstrated that winter cover crops provide erosion control and crop rotation benefits (Torbert et al., 1996). Improved soil physical (Jackson et al., 1993), chemical (Martin and Touchton, 1983; Jackson et al., 1993), and biological (Ries et al., 1977) properties have also been identified as possible rotation benefits. A substantial residue layer on the soil surface provides for this improved soil condition and protection. However, this residue accumulation can cause increased problems with seed planting operations. Row cleaners attached to planters have been shown to be effective at clearing the soil surface of residue immediately in front of the planter and providing an adequate seedbed for planting. Even with row cleaners, large amounts of standing residue often results in some residue getting caught in the moving mechanisms of the planter, causing the planter to become clogged (Phillips, 1984; Throckmorton, 1986). To overcome this constraint, a forward residue mover was constructed. The forward residue mover pushes the standing residue away from the planter and prevents residue from becoming entangled in the row cleaner mechanism. Because the forward residue mover is mounted above the main planter system, it can be used with any configuration of row cleaners. We describe a forward residue mover that can be added to a planter to prevent clogging of the planter mechanism.

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Construction and Operation

The forward residue mover described here was of a simple design that could be easily attached to no-till planters. The system described here is for a four-row JD 1700 planter (Deere & Company, Moline, IL) (Fig. 1 and 2) equipped with Yetter row cleaners (Yetter Manufacturing, Colchester, IL); slight modifications to this design easily render the forward residue mover usable with any no-till planter. A list of component parts and costs used to construct this device is shown in Table 1. The construction specifications are discussed in detail below and are shown in Fig. 2 and 3.

The forward residue mover consisted of three major components: (i) a triangular-shaped top piece, (ii) rebar studs for water hose attachment, and (iii) flat bar brackets for attachment to the planter (Fig. 3). The triangular top piece consisted of two 508 mm (20 in) lengths of angle iron (32 mm [1.25 in] by 32 mm [1.25 in] by 3.2 mm [0.125 in]) welded to form the tip of an equilateral triangle (Fig. 3A). The basal ends of these angle iron pieces were welded to a 508-mm (20-in) length of rectangular channel (25 mm [1 in] by 51 mm [2 in] by 3.2 mm [0.125 in]) (Fig. 3B). Rebar studs (76 mm [3 in] by 16 mm [0.625 in] diameter) were welded to each length of angle iron (Fig. 3C); these studs were located 117 mm (4.6 in) and 295 mm (11.6 in) from the leading point of the triangle (see top view in Fig. 3). These rebar studs were fitted with a polyethylene water hose (16 mm [0.625 in] inner diameter); these hoses were 203 mm (8 in) and 254 mm (10 in) long, with the shorter piece being attached with hose clamps (Fig. 3D) to the rebar stud located closest to leading tip of the triangle (Fig. 3F). Flat bar brackets (6.4 mm [0.25 in] by 51 mm [2 in] by 102 mm [4 in]) were welded to the underside of the rectangular channel (Fig. 3E) and were spaced 76 mm (3 in) to either side of the center of the rectangular channel (see top view of Fig. 3). Each flat bar piece had a 14-mm-diameter (0.56-in) hole drilled (see side view Fig. 3E) for bolting to the main frame of the planter (Fig. 1).

Discussion

A disadvantage associated with greater residue accumulation is that planters often have problems handling

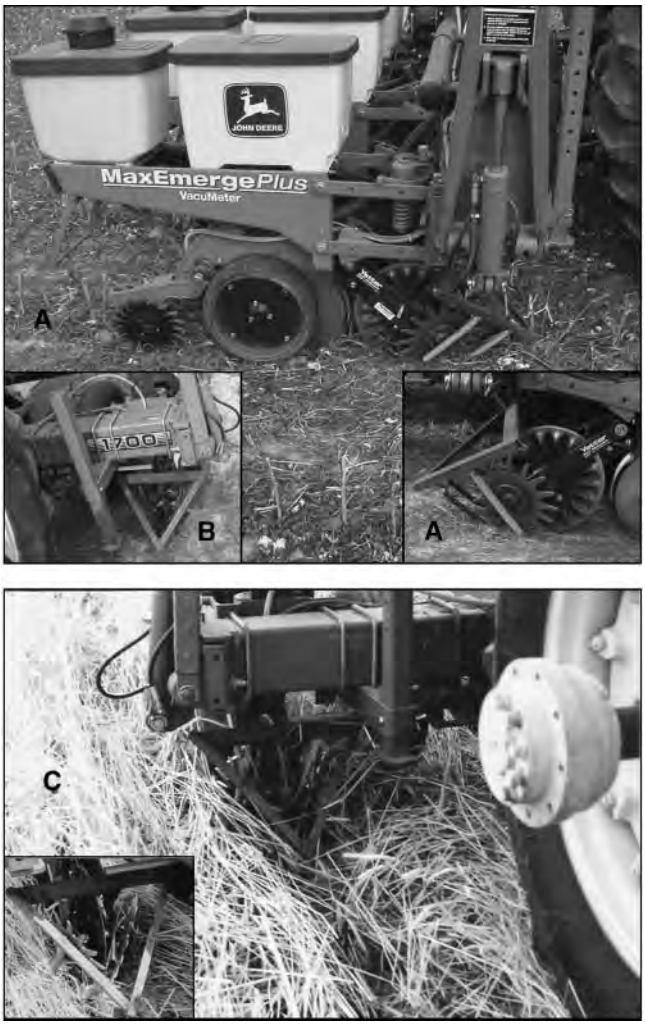

Fig. 1. Photographs showing different views of the forward residue mover attached to a planter. (A) Side views, (B) top view, and (C) top views of device in action in the field.

high amounts of residue during seedbed preparation/planting (i.e., clogged planters), resulting in poor stands (Phillips, 1984; Throckmorton, 1986). Reliable planting

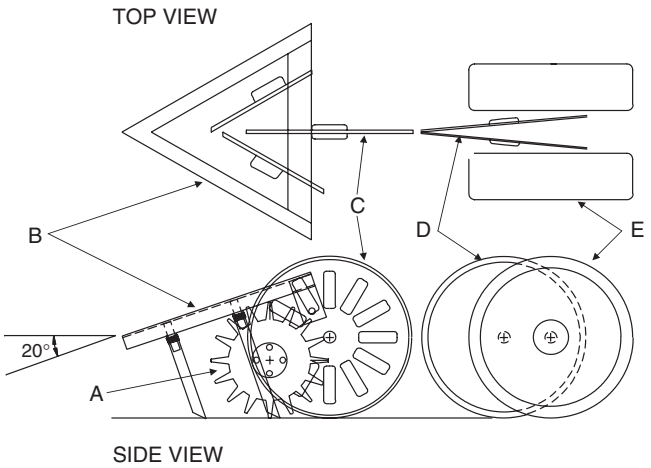

Fig. 2. Schematics of forward residue mover in relation to planter components (top and side views). (A) Row cleaners. (B) Forward residue mover. (C) Bubble coulter. (D) Double disc opener. (E) Depth gauge wheel.

Table 1. Components list and cost per row of items for the forward residue mover.

Component	Cost
Angle iron	$12.00
Rectangular channel	7.00
Flat bar	7.50
Rebar	1.00
Hose clamps	2.00
Water hose	6.00
Capscrews, lockwashers, hexnuts	5.00
Total	$40.50

methods are essential for good crop stand establishment. Row cleaners can effectively provide a suitable planting zone for no-till planters, but standing residue in the adjacent inter-row areas often causes clogging problems with the planter. This is particularly true in cropping systems where a small grain cover crop is planted and is killed immediately before planting. An example of a cotton (*Gossypium hirsutum* L.) planter operating in a killed rye (*Secale cereale* L.) cover crop is shown in Fig. 4A. In these systems, although the row cleaners do an excellent job of providing an adequate seedbed with minimum disturbance of the soil surface, the residue adjacent to the seedbed (i.e., the area not disturbed by the row cleaner) can interfere with the planter by entering from the sides and clogging the planter mechanisms. Unlike plant residue that has overwintered, newly killed residue remains standing and retains sufficient integrity to cause significant clogging.

Our objective was to design and construct a simple device that, when attached to a commercial planter, would push standing residue aside to prevent planter

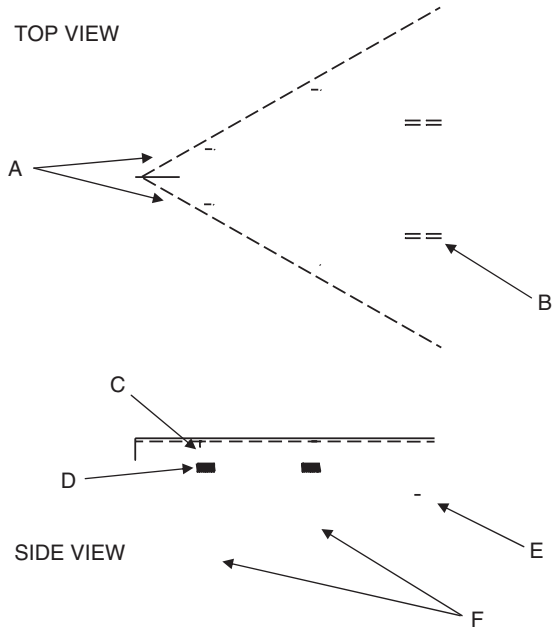

Fig. 3. Schematics of the forward residue mover (top and side views). Component parts are as follows. (A) Top view of angle iron pieces welded together at the front. (B) Top view of the rear rectangular channel welded to the angle iron pieces. (C) Rebar studs. (D) Worm gear hose clamp. (E) Flat bar bracket welded to the bottom of the rectangular channel (used for bolting to the planter). (F) Polyethylene water hose.

Fig. 4. Photographs of cotton production field with rye cover crop. (A) Cotton planting into killed rye cover crop using planter equipped with forward residue mover. (B) The same field showing resultant cotton stand.

clogging. Testing of the attachment was done on a large-scale cotton farm that had been in long-term conservation tillage management (>25 yr). This farm system (>300 ha) used a fall cover of rye. Figure 4A shows the cotton field during planting, using the forward residue mover, into this killed rye cover crop. Substantial standing residue remained in the field after the planting operation, but the forward residue mover prevented this standing residue from interfering with the planter without undue disturbance to the majority of the residue in the field. Figure 4B shows an excellent cotton stand and residue cover in the same field later in the growing season.

Before installing the forward residue mover to plant into standing rye cover, the farmer experienced periodic clogging of the planter that was sufficiently severe to require stopping the equipment to remove the obstructions. Mechanism clogging resulted in poor stand establishment (i.e., skipped rows) and time lost while correcting the problem. After installing the forward residue mover, the farmer experienced no further stoppages during that planting season. The forward residue mover has been successfully used by this farmer in cotton planting operations for the past 5 yr.

The forward residue mover can be used with any configuration of planting and row cleaning systems. This device is unique, and no similar device is commercially available; however, it can easily be constructed from the plans and description provided in this article. This device was inexpensive (Table 1), constructed of material commonly available to farmers, and easy to install.

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