The Pegasus Rapid Plowdown System: 
A New Concept In Cotton Tillage

Gary W. Thacker and Wayne E. Coates

Abstract

This new concept in tillage is to open a deep, temporary slot next to the cotton row and to insert the stalks and/or roots into the slot before the soil falls back in. The Pegasus Rapid Plow Down System is a relatively simple implement which offers good residue burial and reliability. Our limited field test data indicate that this invention requires less energy and field work time than conventional tillage systems.

Introduction

Over the last six years, we have been investigating alternative tillage systems for cotton in an attempt to identify tillage techniques which save time and money while creating less dust pollution (Coates and Thacker, 1994). In this study, both the Sundance System and the Uprooter-Shredder-Mulcher (USM) required less time, energy, and cost than a conventional tillage system. Crop yields under these alternative tillage systems were never significantly less than with conventional tillage.

In spite of the demonstrated benefits of the Sundance System and the USM, several cotton farmers had told us that they would not adopt either of these tillage systems. We conducted a mail survey of cotton farmers in Arizona to identify which characteristics of a tillage system were most important to them (Thacker and Coates, 1993). The majority of cotton farmers responded that they want a tillage system that cost less, requires less time, that does a good job of burying the crop residue, is easy to maintain, and is reliable. In this same survey they rated all of the currently available tillage systems in terms of those characteristics, and every tillage system received poor ratings in at least one important characteristic.

In an attempt to better meet the needs of Arizona cotton farmers, we began to develop a new concept in tillage.

The New Concept

The new concept which we have developed is to open a deep slot in the soil next to the plant row; and to insert the stalks and/or roots of the cotton plants (together with a small volume of soil around the roots) into this slot. As the machine moves forward, soil falls back into the slot, covering the stalks and/or roots.

This invention employs the concept of controlled traffic tillage (Williford, 1980), and can do essentially the same work as a USM with far less mechanical complexity. This is not the same concept as a two-level plow, which has been around for over 100 years (McMurray, 1884). We have secured U.S. Patent No. 5,285,854 for this invention.
The First Prototype

The first prototype we built is depicted in Figures 1-3. At the front of the implement we used a parabolic ripper shank with wings to loosen the soil to enable the large disk blades to penetrate hard soil. The tall disk blade then opens a deep slot in the soil next to the cotton stalks, as best shown in Figure 2. The soil from the slot is displaced upward and between the two opposing disk blades, shown as the cross-hatched soil in Figure 2. The soil which is to be inserted into the temporary slot is shown in wavy lines in Figure 2. Now referring to Figure 3, the second disk blade is a large flat coulter with engaging teeth, which shears off a section of soil near the plant roots and pushes it and plant material down into the slot (the slot is the lee behind the tall disk blade). As the implement moves forward, soil falls back into the slot, covering the plant material.

This implement was shown to be capable of handling large, standing long staple cotton stalks and stuffing them beneath the soil surface (Figure 4). After re-listing the beds there was little plant residue on the surface and the whole plants remained buried well beneath the surface. However, Arizona plow down regulations specifically call for shredding the stalks. As a consequence, we modified the design.

The Present Prototype

The present prototype was built by the Pegasus Machinery Company, which was formed to bring this new concept to the market. It is a two-row machine which utilizes fixed moldboard plows to make the slot (rather than the tall disk blades on the first prototype). This machine has a flail shredder positioned behind the moldboard plow; as the slot is opened in the soil the shredder begins feeding plant material down into the slot. After the stub and root pass beneath the shredder, a disk coulter with engaging teeth shears off a section of soil near the plant roots and inserts the sheared soil, together with the roots, into the slot.

This machine can be used as a direct substitute for the USM, by shredding and burying standing cotton stalks. Alternatively, it can also be used to plow under the stubs and roots of cotton plants that have already been shredded. However, residue burial is not as good without the integral shredder.

Energy Requirements

While collecting energy data in our ongoing study on alternative tillage systems (Coates and Thacker, 1994), we tested the present Pegasus prototype by making ten passes in the guard rows of the experimental plots. As with all of the implements in the tillage study, we recorded implement draft, tractor speed, and PTO torque and speed. While these are not properly replicated field plot data, they are data taken from the same field and year in which we were testing other tillage systems.

For comparison purposes, we will contrast the energy data from the Pegasus with that of the USM taken in the four replicated passes in 1993 (Table 1). Both machines handle standing cotton stalks, both are two-row implements, and both accomplish essentially the same tillage work; hence this comparison is between the most similar of implements we have tested.

The tractor speed with the USM was 2.7 miles per hour, and was 4.1 miles per hour for the Pegasus (Table 1). The draft power was slightly higher for the Pegasus, with 45.6 horsepower recorded for the Pegasus and 41.6 horsepower for the USM. The PTO horsepower requirement for the USM was 29.8 as compared to 22.7 for the Pegasus. The total power requirement for the USM was 71.4 horsepower, as compared to 68.3 horsepower for the Pegasus. In terms of horsepower-hours per acre, the Pegasus required about two-thirds as much energy as the USM, due to its higher field speed.
Conclusions

In our study on alternative tillage systems, we have shown that the USM requires less energy and field work time than a conventional tillage system (Coates and Thacker, 1993). Based on the even lower horsepower-hour per acre energy requirement of the Pegasus, combined with its faster travel speed, these limited data taken in 1993 indicate that the Pegasus can offer considerable savings in time and energy over a conventional tillage system.

Acknowledgments

This new concept in tillage originated from a research project funded by the Arizona Department of Environmental Quality - Air Quality Fund.

Literature Citations


Figure 1. Side schematic view of the first prototype of the Pegasus Rapid Plow Down System.
Figure 2. Front schematic view of the first prototype of the Pegasus Rapid Plow Down System.

Figure 3. Rear schematic view of the first prototype of the Pegasus Rapid Plow Down System.
Figure 4. Schematic cross-section of two cotton rows plowed down by the first prototype of the Pegasus Rapid Plow Down System.

Table 1. Speed and Energy Requirements of the Uprooter-Shredder-Mulcher (USM) and the present prototype of the Pegasus Rapid Plow Down System at the University of Arizona - Marana Agricultural Center, Field D-1, 1993.

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