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Abstract

The Pegasus plow is a new implement for one-pass cotton plowdown. Invented in a University of Arizona research project on reducing dust emissions from tillage, the Pegasus is unique in that it is capable of burying the whole cotton stalk (without shredding). Stalks are buried under the bed, at about the same depth as the furrow bottoms. A very simple and reliable machine, the Pegasus gives cotton farmers the option of using controlled traffic tillage without sacrificing good residue burial or easy machinery maintenance.

Introduction

Many cotton growing states enforce "plow down" regulations as a means of breaking insect and disease life cycles. Regulations vary from state to state and generally require that the tap root be detached from the soil and the crop residue buried.

Present farmer practices require many field operations in order to meet the "plow down" requirements and prepare a seedbed for the next crop. In the West, the adoption of controlled traffic tillage systems is complicated by the difficulties of stalk disposal. Winters are mild, hence the large and robust cotton stalks will grow as perennial plants if not killed with tillage.

Over the last fifty years, several machines have been developed in attempts to more efficiently dispose of cotton stalks (Carter, 1996). Virtually all of these attempts involve some means of uprooting the cotton stalks and incorporating the residue into the soil. However, alternative tillage systems have not achieved wide acceptance with cotton farmers because the machines are either difficult to maintain or do not do a very good job of stalk disposal. In a survey of tillage practices in Arizona, 99% of the farmers responded that they use conventional tillage practices in cotton-to-cotton rotations, even though most were unhappy with the high cost and time requirements (Thacker and Coates, 1993). Ten percent of these farmers do use alternative tillage when rotating to other crops such as wheat.

Invention and Development of the Pegasus Plow

This invention resulted from a tillage research project at the University of Arizona (Coates and Thacker, 1997). One of

our objectives was to determine if it was possible to reduce dust emissions from cotton tillage operations.

We actually measured dust emissions from various tillage operations. It was no big surprise to find that stalk shredders are heavy contributors to dust pollution. Realizing that irrigated desert soils are a biological furnace, we began to ponder methods of burying whole cotton stalks to let the soil microflora do the job of breaking the stalks down. This would eliminate the cost, energy, and dust involved with stalk shredding.

This method of whole stalk burial is to open a deep, temporary slot in the soil next to the cotton row and insert the stalks into the slot before the soil falls back in. We built a breadboard prototype, made it work, and secured a patent (Thacker and Coates, 1994). The machine proved to be capable of plowing under six-foot tall cotton stalks. The whole stalks were buried under the beds in a rope-like bundle at about the same depth as the furrow bottoms. However, Arizona "plow down" regulations specifically require that stalks be shredded. As a consequence, the development efforts have since focused on plowing under shredded cotton stubble.

Benefits of the Pegasus Plow

We have just introduced four-row and six-row models of the Pegasus plow in Central Arizona. They offer a unique combination of product benefits:

- Lower Cost. A farmer who now uses conventional tillage can save \$30 to \$40 per acre.
- Less Time. The six-row model plows under 7.5 acres per hour; the four-row model plows under 5.0 acres per hour. This is at 4.0 MPH; the optimum speed range is 4.0 to 4.5 MPH.
- Good Residue Burial. Stalks and tap roots are buried under the beds at about the same depth as the furrow bottoms.
- Easy Maintenance. The Pegasus has no PTO or hydraulics. All moving parts are powered by the soil as you pull it. There is one grease zerk per row. The principle wear parts are the plow shares and root knives.
- Less Dust. Reducing trips across the field creates less dust. Dust emissions will be even less if farmers can park their shredders and use the Pegasus to bury whole stalks.

This is a combination of benefits that gives cotton farmers the option of using controlled traffic tillage without sacrificing the residue burial and easy machinery maintenance they require.

The Pegasus plows accommodate row spacings of 36 to 42 inches. They work very well in variable-row cotton such as 34" - 42" and 36" - 44". Availability outside Arizona will

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depend on how fast we can grow the company. A narrow row model is not yet available.

We are just beginning to explore other uses for the Pegasus plow. It plows under grain sorghum stubble (single row on a bed) and wheat stubble on beds. Because it flips the bed over and leaves whatever was on top underneath, it is also promising for use in renewing vegetable beds for a subsequent crop. One firm uses a Pegasus to plow under sewage sludge.

Future Development of the Pegasus

Even though we are now marketing Pegasus plows to dispose of shredded cotton stubble, the invention is moving full circle toward whole stalk burial. Pegasus Machinery Company is working on a Cooperative Research and Development Agreement with the USDA-ARS to investigate the potential benefits of whole stalk burial at the University of California - Shafter Research Station.

The major objective of the study is to determine the fate of organic matter and humus in cotton production. A hypothesis of the study is that whole stalks may decompose at slower rates than shredded stalks, thus maintaining higher levels of organic matter in the soil.

The treatments in the study are conventional tillage, whole stalk burial with the breadboard "disk" Pegasus prototype, burial of shredded stubble with the "disk" prototype, whole stalk burial with the current "moldboard" Pegasus, and burial of shredded stubble with the "moldboard" Pegasus.

We measured substantial energy savings over conventional tillage with both Pegasus machines (Carter et al, 1996). For both types of Pegasus plows, energy savings are greatest with whole stalk buriall.

We are now in the second year of the study. There have been no disease problems and no differences in cotton yields between any of the treatments (Carter, 1996).

Although the current production models of the Pegasus are designed to bury shredded cotton stubble, they can be adapted for whole stalk burial with minor modifications.

Summary

The Pegasus plow is unique in that it is capable of plowing under whole cotton stalks. It gives cotton farmers the option of using controlled traffic tillage without sacrificing good residue burial or easy machinery maintenance.

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