The Concept of Controlled Traffic Tillage

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Abstract

With controlled traffic tillage, the field is divided into “traffic zones” to which all wheel traffic is confined and “production zones” where the plants are grown and there is no wheel compaction. Researchers have shown that using this concept can result in significantly lower tillage costs and field work time than with conventional “broadcast” tillage systems. Most researchers have shown that controlled traffic cotton yields are as high, and are sometimes higher than with conventional tillage systems. In our research, we have not measured any differences in yield or soil compaction between controlled traffic and conventional tillage systems.

Introduction

With a conventional “broadcast” tillage system, tillage operations are performed over the entire surface of the field. These operations criss-cross the field in several different directions, with wheel compaction occurring in random patterns. The resulting compaction is alleviated by deep ripping, usually diagonal or perpendicular to the crop rows. Wheel traffic from subsequent operations immediately begins recompacting the soil after ripping. Research at the National Soil Dynamics Laboratory in Auburn, Alabama showed that the first pass of a wheel causes 70 to 90 percent of the total compaction that can occur (5).

Although controlled traffic tillage does not eliminate compaction it does manage it better than conventional tillage, yielding a number of benefits.

Managing Compaction

Compaction crushes the pores of the soil, which restricts the movement of roots, water, nutrients, and gasses necessary for plant growth. Compacted layers from repeated moldboard plowing at the same depth have been shown to reduce cotton yields (4). Soils low in clay content are especially susceptible to compaction because of their lack of shrinking and swelling action which breaks up and aerates the soil.

For moving machinery through the field, compaction can be beneficial. Compaction increases traction, reduces rolling resistance, and helps to support heavy machinery in wet conditions. Seedbed preparation, planting, and cultivating operations are often performed when the soil is near its field capacity in terms of water content. As a consequence, significant compaction invariably occurs in the wheel traffic furrows.

With controlled traffic tillage, certain areas of the field are designated as production zones which never receive wheel traffic, while the traffic zones are managed as roadways.

Gantry or Wide Tractive Vehicles

The ultimate application of this concept is using gantries or wide tractive vehicles. These huge machines span 30 feet or more as they cross the field (Figure 1). The wheels are at the ends of the machine, and run in designated paths, and the areas between the paths never feel the weight of equipment. Researchers have used such machines to measure crop and soil conditions under conditions of no machinery compaction.
Practical Applications of Controlled Traffic Tillage

While gantries are not generally practical in production agriculture, cotton farmers can enjoy the benefits of controlled traffic tillage with ordinary farm tractors. By adopting tillage systems which essentially re-work the existing cotton beds, certain furrows in the field are utilized as traffic zones. Restricting all wheel traffic to the traffic zones creates production zones which then receive no wheel compaction (Figure 2).

By maintaining the same traffic zones and production zones year after year, no money, time, or energy is wasted by deep ripping areas which will be re-compacted by wheel traffic. Researchers across the Cotton Belt have measured significant savings in time, cost, and energy with controlled traffic systems (1, 4, 6). Most never measured lower cotton yields with controlled traffic tillage, and in fact yields were often higher. These results are consistent with our research at Marana and Maricopa, Arizona (2, 3). In addition, no significant differences in soil compaction among any of the controlled traffic and conventional tillage systems have been found in the growing zones (2).

Ongoing Research in Controlled Traffic Tillage

An article in this volume (3) reports on our research which compares two controlled traffic cotton tillage systems to a conventional tillage system. Our data show that with controlled traffic tillage:

- Energy consumption is reduced by 26 to 48 percent.
- Field work time requirements are cut in half.
- Cost savings ranged from $8 to $24 per acre.
- Yields were not significantly different.

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Literature Citations


Figure 1. Schematic view of a wide tractive vehicle.

Figure 2. Practical application of controlled traffic tillage with conventional six-row equipment.