

# MANAGING COTTON FOR REDUCED WIND DAMAGE WITH RIDGE TILL SYSTEMS

Gene Stevens, Bobby Phipps, Jill Mobley  
University of Missouri-Delta Center  
Portageville, MO

## Abstract

A four year study was conducted to compare ridge-till and conventional till cotton cropping systems at Portageville, Missouri. Ridge-till systems provided protection for cotton seedlings from wind and blowing sand. Cotton planted ridge-till into killed wheat was usually taller early in the season than conventional till cotton with greater light interception by leaves. Lint yields from cotton planted with ridge-till into killed wheat were either equal or greater than yields with conventional till cotton. Wheat cover crop in continuous ridge-till systems became less important after two growing seasons as native winter weeds became established.

## Introduction

Exposure of cotton to excessive wind is a problem in the Delta region and the Southern High Plains where the topography is level and trees are sparse. In recent years, many trees in the northern Mississippi Delta have been removed around field borders to allow for larger field equipment and center pivot irrigation systems. The incorporation of small fields into larger fields has helped increase labor and equipment efficiency. However, the trees around the fields provided protection for cotton seedlings from early spring wind and blowing sand. In 1995, approximately 25% of the cotton fields in Southeast Missouri had cotton stand losses from wind damage.

Conservation tillage has been hypothesized as a means of protecting cotton seedlings from wind and sand damage (Nabors and Jones, 1991). In the Texas Southern High Plains, Keeling et al. (1995) found that irrigated cotton planted into terminated wheat produced greater yields and net returns than conventional or minimum till without cover crops. They indicated that after five years of continuous cotton planted minimum till without cover crops, yields were lowest relative to other systems and that deep breaking was needed to turn under sand. Barker et al. (1989) reported that cotton exposed to wind produced a smaller plant with less leaf area. Sheltered cotton consistently produced more lint than unsheltered cotton at all planting dates and irrigation levels.

Most of the conventional till cotton in the North Delta region is planted on beds to minimize seedling diseases and promote warmer soil temperatures in the seed furrow

(Riley et al. 1964). Valco and McClelland (1995) reported that only 12,090 acres of cotton in Missouri was planted with conservation tillage in 1994, but nearly all of it was in ridge-till. In Mississippi, Johnson and McGregor (1995) found that fall hipping in a ridge-till system should be delayed when soil moisture is excessive to avoid having a rough, cloddy seedbed in the spring. They reported greater early season growth and yields with cotton on beds than no-till planted cotton. Five weeks after planting, cotton plants on beds were four inches taller than cotton no-till planted. Seedcotton yields averaged 1712 lbs/acre for cotton planted on fall hipped beds and 1550 lb/acre for no-till planted cotton.

A four year field study was conducted at the University of Missouri Delta Center Lee Farm, Portageville, MO to compare ridge-till systems and a conventional clean-till system. The study was established in 1992 on a Tiptonville sandy loam soil. The objectives of the study were to determine the effect of cropping systems on crop microclimate (early season soil temperature and canopy wind speed), cotton lint yield, cotton growth, and pest pressure.

## Materials and Methods

Three cropping systems were tested in a randomized complete block design with plots 16 rows wide and 220 feet long. The cropping systems were conventional till, ridge-till planted into killed wheat, and ridge-till planted into killed winter weeds. Cotton stalks were cut in the fall in all systems.

In the ridge-till systems, beds were reshaped with a disk bedder in the fall. In the ridge-till with wheat system, wheat was sowed at a rate of 1 bu/a with a Gandy-type drop spreader immediately after bedding. Wheat was planted only in the row middles. This was done by taping spreader tubes closed above ridges. Prior to cotton planting, the tops of beds for both ridge-till systems were leveled with a Buffalo™ row cleaner equipped with sweeps.

In the conventional till system, plots were disked, chiseled and bedded in the spring. Before planting, beds were knocked down with a reel and harrow row conditioner.

Chemicals used for weed control in conventional till plots were 0.625 lb a.i./a trifluralin PPI, and 0.8 lb a.i. /a fluometuron PRE. Burndown chemicals used in ridge-till plots were 0.56 lb a.i./a glyphosate and 0.1 lb a.i./a oxyfluorfen applied 2 to 3 weeks before planting. In 1995, paraquat ( 0.6 lb a.i./a) was applied at planting because glyphosate failed to kill evening primrose. Preemergence herbicide applied on ridge-till plots were 0.5 lb a.i./a fluometuron and 1 lb a.i./a pendimethelin.

Hourly and daily soil temperatures were recorded using a Campbell Scientific CR-10 datalogger attached to eight

Fenwal Electronics Thermistor probes placed two inches below the soil surface adjacent to the crop row in conventional till and ridge-till planted into killed wheat. Hourly and daily wind were also recorded using a Campbell Scientific CR-10 datalogger attached to eight R.M. Young anemometers placed near canopy level with a minimum six inch height above the soil surface. Plant maps were made for all cropping systems biweekly beginning at first square. Photosynthetic Active Radiation (PAR) interception readings were made with a Sunfleck™ Ceptometer on the same days that plant maps were made. This ceptometer measures photosynthetically active light (400-700 nm wavelength) interception by cotton leaves which is an indirect measure of leaf canopy size and density.

### Results and Discussion

No significant difference in soil temperature or plant population was found between cropping systems in any of the four years. At first square, ridge-till cotton planted into killed wheat always averaged 1 to 3 inches taller than conventional till cotton plants but was only significantly different in height in 1994. Light interception readings averaged 10 % greater with ridge-till cotton with wheat than conventional till in 1992 and 1993. Light interception readings in 1994 were invalid because of instrument problems. No difference in light interception between cropping systems was found in 1995.

On windy days, canopy level wind speed in conventional till cotton during May and early June was 2 to 3 miles per hour greater than in ridge-till with wheat (Figure 1 and 2). This may have been responsible for the greater early season plant height and light interception in the ridge-till cotton with wheat system. No wind measurements were made with the ridge-till without wheat. After two seasons, winter annuals such as chickweed and henbit became abundant in ridge-till plots without wheat. This probably helped to reduce wind speed and prevent blowing sand.

The greatest difference in reproductive growth between conventional and ridge-till with wheat occurred in 1992. Boll dry matter biomass at 83 days after planting was 278 lb/a in conventional till cotton, 655 lb/a in ridge-till cotton with wheat, and 670 lb/a in ridge-till without wheat.

Yields were numerically greater with cotton planted ridge-till with wheat as compared to cotton planted conventional till in all years but were statistically different only in 1992 (Figure 3). After only a small yield difference in 1993, response to ridge-till tended to increase slightly each year. Yields from ridge-till with wheat were significantly greater than ridge-till without wheat in the first two years of the study (1992 and 1993), but were not different in the following years (Figure 4). This indicates that planting cover crops such as wheat may become less important for wind protection as native winter vegetation become established after several years of continuous ridge-till.

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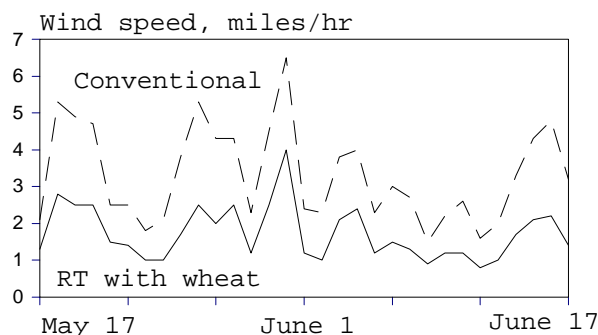


Figure 1. Average daily canopy wind speed in 1994.

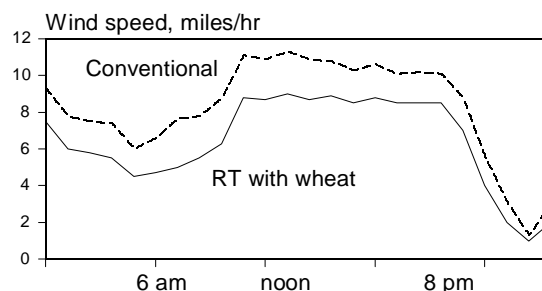


Figure 2. Average hourly wind speed on May 28, 1995.

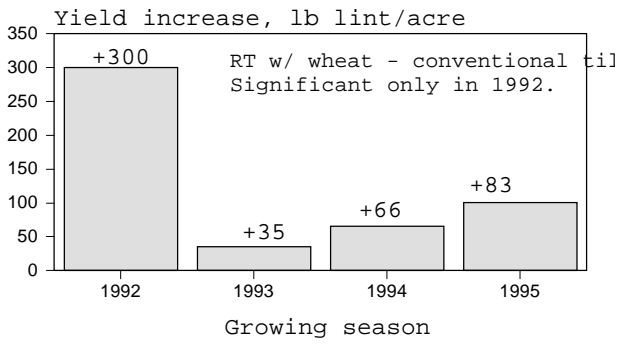


Figure 3. Yield increase from ridge till wheat as compared to conventional till.

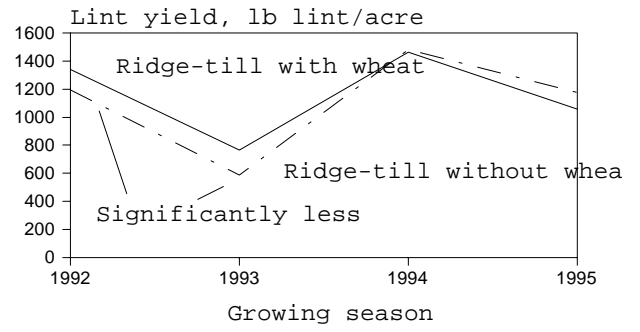


Figure 4. Effect of wheat cover crop on yield in ridge till.