USE OF STRIP-TILLAGE FOR CORN PRODUCTION IN KANSAS

W.B. Gordon, R.E., Lamond, and L.J. Ferdinand
Department of Agronomy
Kansas State University, Manhattan, KS 66506
bgordon@oznet.ksu.edu. (785) 335-2836

ABSTRACT

Conservation tillage production systems are being used by an increasing number of producers. Early season plant growth and nutrient uptake can be poorer in no-tillage than in conventional tillage systems. Strip-tillage may offer many of the soil-saving advantages of the no-tillage system while establishing a seed-bed that is similar to conventional tillage. Field studies were conducted at Belleville and Manhattan, KS to compare the effectiveness of strip tillage to no-tillage and to access the effects of fall verses spring applications of N-P-K-S fertilizer on growth nutrient uptake and yield of corn. The 2002 growing season was characterized by much below normal rainfall at both locations. Com yields were severely reduced by the hot, dry conditions. Even though grain yields were low, strip-tillage improved early season growth and nutrient uptake of com at both locations. Grain yields of strip-tilled com were significantly greater than no-tillage at Belleville but not at Manhattan. At the Belleville location, strip-tillage shortened the time from emergence to mid-silk by 7 days and also reduced grain moisture content at harvest. In 2003, the growing season was again very dry at the Belleville location. Yields were low but the use of strip-tillage increased yields by 15 bu/acre over no-tillage corn. Yields were excellent at Manhattan in 2003 and strip-tillage proved to be superior to no-tillage. Soil temperature was consistently warmer in strip-till than in no-tillage at both locations. Early season growth was greatly improved in strip-tillage when compared to no-tillage. Fall fertilization was as effective as spring fertilization at both Belleville and Manhattan. Strip-tillage appears to be an attractive alternative to no-tillage for Great Plains producers.

INTRODUCTION

Production systems that limit tillage are being used by an increasing number of producers in the central Great Plains because of several inherent advantages. These include reduction of soil erosion losses, increased soil water use-efficiency, and improved soil quality. However, early-season plant growth can be poorer in reduced tillage systems than in conventional systems. The large amount of surface residue present in a no-tillage system can reduce seed zone temperatures. Lower than optimum soil temperature can reduce the rate of root growth and nutrient uptake by plants. Soils can also be wetter in the early spring with no-tillage systems. Wet soils can delay planting. Early season planting is done in order for silking to occur when temperature and rainfall are more favorable. Strip-tillage may provide an environment that preserves the soil and nutrient saving advantages of no-tillage while establishing a seed-bed that is similar to conventional tillage. The objectives of this experiment were to compare the effectiveness of strip-tillage to no-tillage and to access the effects of fall applied, spring applied or split applications of N-P-K-S fertilizer on growth, grain yield, and nutrient uptake of com grown in strip-till or no-till systems.

METHODS

Studies were conducted at the North Agronomy Farm at Manhattan Kansas and the North Central Kansas Experiment Farm near Belleville to compare strip-tillage and no-tillage systems for dryland com production. Fertilizer treatments consisted of 40, 80 or 120 Ib N/acre with 30 Ib P_2O_5, 5 Ib K_2O and 5 Ib S/acre. An unfertilized check plot also was included. In the strip-tillage system, fertilizer was either applied in the fall at the time of strip-tilling or in the spring at planting. Fertilizer was applied in the spring at planting in the no-till system. At Manhattan, strip-tillage was done in soybean stubble in early March in 2002 and into grain sorghum stubble in late October in 2003. At Belleville strip-tillage was done in wheat stubble in early October in both years of the study. The zone receiving tillage was 5-6 inches in width. Spring applied fertilizer was placed 2 inches to the side and two inches below the seed at planting. Nutrients were supplied as 28% UAN, ammonium polyphosphate (10-34-0), and potassium thiosulfate. Com was planted in early April at both sites, both years. Soil test phosphorus , potassium, and sulfur were in the high category at both sites.

RESULTS

Due to the very dry growing season in 2002, grain yields at both sites were very low and response to applied N was variable. When averaged over fertilizer treatment at Manhattan, strip-tillage improved early season plant growth and uptake of N, P and K compared to no-tillage (Table 1). Even though the strip-tillage was done only a month before planting, the tilled zone provided a better environment for plant growth and development than did the no-till plots. There was no significant difference in grain yields between the strip-tillage and no-tillage plots.

At Belleville, strip-tillage improved early season growth, nutrient uptake, and grain yield of com compared to no-tillage (Table 2). When averaged over fertility treatment, strip-tilled plots reached mid-silk 7 days earlier than no-tillage plots. The early season growth advantage seen in the strip-tilled plots carried over all the way to harvest. Grain moisture in the strip-tilled plots was 2.8 % lower than in no-till plots. In this very dry year, yield advantage may have been the result of the increased rate of development in the strip-till system. The com plants reached the critical pollination period sooner in the strip-tilled plants while some stored soil water was still available. The soil water reserve was depleted 1 week later when the plants in the no-tillage plots reached mid-silk.

Soil temperature in the early growing season was warmer in the strip-tillage system than in the no-tillage system (Figures 1 and 2). In 2003, corn grain yields at Manhattan were excellent. Yields in the strip-till system were greater than no-till at all levels of fertilizer (Table 3). Under Kansas conditions, fall applied fertilizer was as effective as spring applied (Table 4 and Table 6).

Grain yields were low at Belleville in 2003 due to very hot and dry conditions in July and August. Even at the low yield levels, strip-tillage proved to be a more effective production system than no-tillage (Table 5).

Strip-tillage does provide a better early season environment for plant growth and development, while still preserving a high amount of residue on the soil surface. This system may solve some of the major problems associated with conservation tillage, thus making it more acceptable to producers.

Table 1. Early season growth, nutrient uptake, and yield of corn, averaged over fertility treatments, Manhattan, 2002.

Treatment	V-6 Whole Plant Dry Weight lb/acre				Yield, bu/acre
	Dry Weight	N	P	K	
Strip-Tillage	490	17	2.0	13	58
No-Tillage	379	13	1.5	10	55

Table 2. Early season growth, number of days from emergence to mid-silk, grain moisture at harvest and yield of corn, averaged over fertility treatments, Belleville 2002.

Treatment	V-6 Dry weight, lb/acre	Days from Emergence to mid-silk	Harvest Moisture, %	Yield, bu/acre
Strip-Tillage	456	58	13.8	49
No-Tillage	296	65	16.6	37

Figure 1. Soil Temperature at planting depth, Manhattan, 2003.

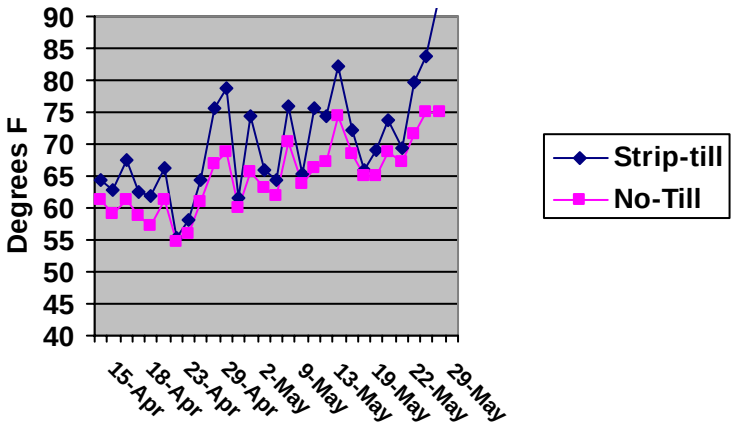

Figure 2. Soil Temperature at planting depth, Belleville, 2003.

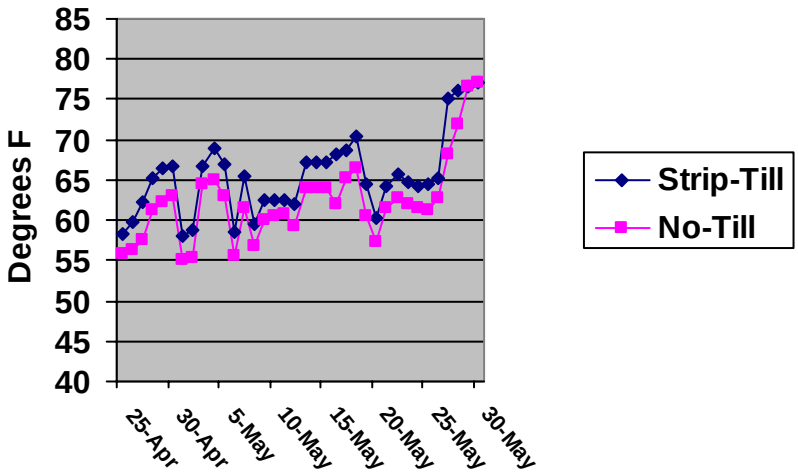

Table 3. Corn grain yield as affected by tillage and spring applied fertilizer, Manhattan, 2003.

Fertilizer Treatment	Strip-Till	No-Till
lb/acre	Grain yield, bu/acre	
40-30-5-5	52	45
80-30-5-5	60	48
120-30-5-5	71	51
Average	61	48

Table 4. Corn grain yield as affected by fall or spring applied fertilizer in the strip-till system, Manhattan, 2003.

Fertilizer Treatment	Strip-Till, Fall Fertilize	Strip-Till, Spring Fertilize
lb/acre	Grain yield, bu/acre	
40-30-5-5	182	185
80-30-5-5	192	187
120-30-5-5	205	187
Average	193	186

Table 5. Corn Grain Yield as affected by tillage and spring applied fertilizer, Belleville 2003.

Fertilizer Treatment	Strip-Till	No-Till
lb/acre	Grain Yield, bu/acre	
40-30-5-5	52	45
80-30-5-5	60	48
120-30-5-5	71	51
Average	61	48

Table 6. Corn grain yield as affected by fall or spring applied fertilizer in the strip-till system, Belleville, 2003.

Fertilizer treatment	Strip-till, Fall Fertilize	Strip-till, Spring Fertilize
lb/acre	Grain yield, bu/acre	
40-30-5-5	56	52
80-30-5-5	58	60
120-30-5-5	68	71
Average	61	61