

Canopy Development of Wheat in Conventional, Reduced, and No-till Tillage Systems

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INTRODUCTION

Reduced tillage programs have gained popularity primarily in spring-planted crops in Louisiana. Wheat is usually either drilled, or broadcast onto the surface of tilled soil and then lightly cultivated. This study was initiated to determine wheat performance in reduced and no-till tillage systems.

MATERIALS AND METHODS

A cropping systems and tillage experiment was initiated in 1991 on a Norwood silt loam soil at the Dean Lee Research Station in central Louisiana. The test area was fallowed for one year prior to establishing the experiment. The test contained eight cropping systems and three tillage systems in a split plot design with tillage as main plot and cropping system as sub-plot. Initially the test had four replicates, but the fourth replication was dropped due to interference from poor drainage. Two of the cropping systems involved doublecropping with winter wheat. Since this was the first year of the study and there was no effect of other crops, wheat data were pooled in the first year to determine tillage effects.

The three tillage systems were conventional, reduced, and no-till. The conventional system included sub-surface tillage to an approximate 9-inch depth with a chisel, followed by discing and conditioning with a seedbed tool. The reduced system was the same as the conventional system except that there was no sub-surface tillage. There was no cultivation performed in the no-till

system. Burndown chemicals were applied, and the entire experimental area was mowed prior to planting.

At harvest, the experimental units were 4.2 m wide (19.05-cm drill rows) and 26 m long. 'Coker 9877' was planted at 112 kg ha⁻¹ on 5 November. Above ground plant material for 1 m of row was harvested at 35-day intervals and dried. Leaf area index was determined at the same time using a LAI-2000 Plant Canopy Analyzer (LI-COR, inc.). Harvest date was 19 May.

General linear models procedures from the Statistical Analysis System (SAS Institute, 1985) were used to analyze leaf area index, dry matter production, yield and test weights. Means from each time period were used to calculate crop growth and net assimilation rates. Trends and observations are not to be interpreted as statistically significant unless stated.

RESULTS

Wheat leaf area development was similar in the three tillage systems (Figure 1). Although sigmoid growth models have not been fitted to the data, there was a trend for the reduced tillage regime to have a slightly higher LAI after the fifth week. Leaf area development in the no-till system was not significantly different from the reduced or conventional systems at any sampling date.

There was a trend for greater dry matter production in the no-till system as the season progressed (Figure 2). It was apparent that dry matter production was as high or higher for

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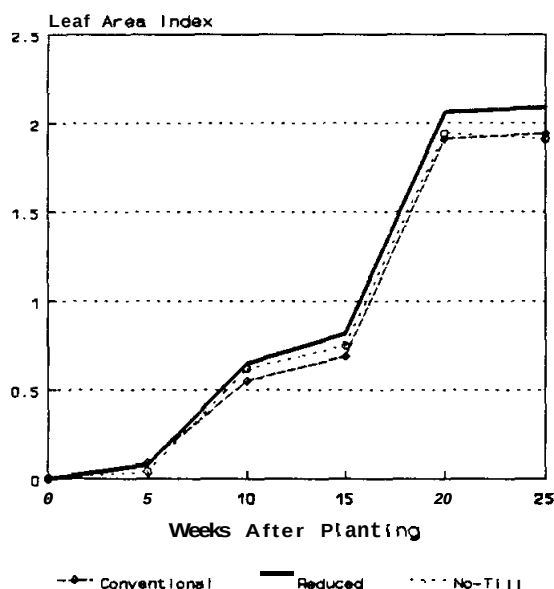


Fig. 1. Effect of tillage on wheat LAI.

wheat in a no-till system as in conventional or reduced tillage regimes.

Crop growth rates for wheat increased as the season progressed in all three tillage regimes (Figure 3). There was a trend for higher crop growth rates in the no-till system when compared to the other two systems.

Net assimilation rate measured the amount of dry matter production per unit area (m^2) of leaf surface and was an indicator of photosynthetic efficiency. Highest net assimilation rates were recorded at week 5 for each tillage system (Figure 4). There was a trend for net assimilation rates to be higher in the no-till system.

There were no significant differences in wheat yields among the three tillage systems (Table 1). The test mean was 2948 kg ha^{-1} , which may be slightly lower than average but probably representative of wheat yields on this soil type in the area for 1992. The coefficient of variation (14%) indicated that error in the test was at an acceptable level. There were no significant differences among test weights of

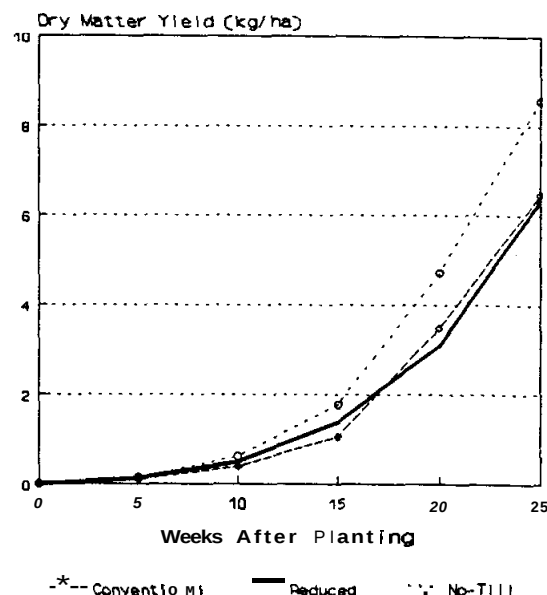


Fig. 2. Effect of tillage on wheat DMY.

wheat harvested in the three tillage systems.

DISCUSSION

Crop growth analysis revealed no negative trends for no-till wheat compared to conventional and reduced systems. Data for 1991-92 still need to be fitted to models and tested for differences; however, it is likely that most differences detected in 1991-92 would be in favor of the no-till system. Although trends in crop growth parameters appeared to be in favor of the no-till system, these were not translated into a significant increase in yield or test weights. Based on one year's data, wheat production in no-till systems approximates that in conventional and reduced systems. More year's data are needed to determine average and long-term effects of tillage on wheat performance.

REFERENCES

SAS Institute. 1985. SAS/STAT: Guide for personal computers. Version 6 ed. SAS Inst. Inc., Cary, NC.

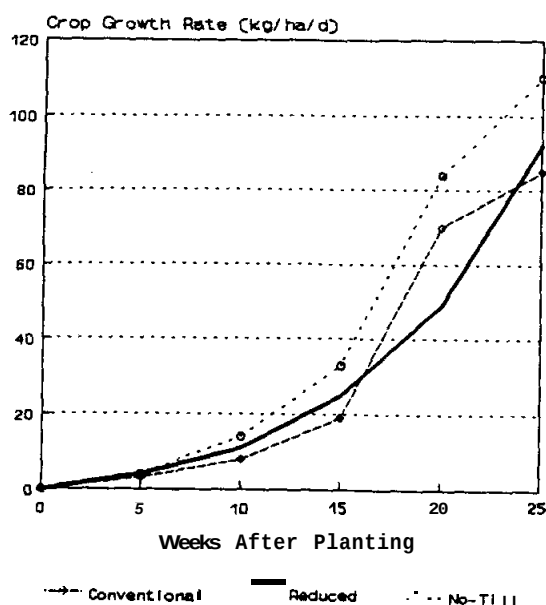


Fig. 3. Effect of tillage on wheat CGR.

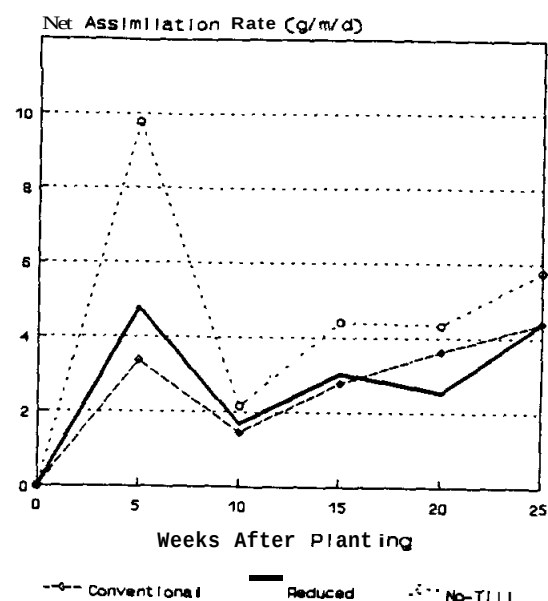


Fig. 4. Effect of tillage on wheat NAR.

Table 1. Effect of tillage systems on yield and test weight of winter wheat on a silt loam soil in central Louisiana, 1991-92.

Tillage System	Yield	Test Weight
	kg ha ⁻¹	kg hl ⁻¹
Conventional	3045	65.28
Reduced	2947	64.82
No-till	2853	65.38
F Test (p=0.05)	NS	NS
Mean	2948	65.16
% C.V.	14	4.31