PREPLANT AND POST-PLANT TILLAGE FOR FULL SEASON SOYBEANS ON CLAYEY AND SILT LOAM SOILS

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INTRODUCTION

Many experiments have been performed where no-till production systems are contrasted to tilled production systems. These production systems are compared in-total to decide which are the most conducive to profitable production systems.

On soils that have poor internal drainage or impermeable layers close to the surface (less than 22 inches), preplant tillage that produces a surface mulch may conserve soil moisture by preventing evaporation in the spring prior to planting. This would be especially true in regions of ample late-winter and early-spring rainfall. Soils, such as those described above, will have a profile that is full of water. It is conceivable that a surface mulch of dead plant debris could have the same moisture conserving effect. A similar moisture conservation scenario could also be operational after planting.

The infiltration rate of swelling clay or crusting silt loam soils may be increased dramatically by physical plowing or cultivation. This could also be a contributing factor for surface mulches of plant debris that would trap and hold water in the field longer for increased infiltration.

Aeration may also be a factor that limits plant root growth and moisture uptake. Poor root growth could also be the result of soil density or compaction that can be ameliorated by tillage operations.

The basic question of the value of preplant and post-plant tillage has not been addressed in Arkansas. The objective of studies reported herein was to assess the effect of convention flat seedbed preparation and post-plant tillage on soybean production on a Sharkey and Loring soil.

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MATERIALS AND METHODS

Experiments were initiated in 1992 at the Northeast Research and Extension Center (NEREC) at Keiser, AR and at the Cotton Branch Experiment Station (CBES) at Marianna, AR. The experimental design was a stripped split plot. The main plots were preplant tillage with the subplots being post-plant cultivation. The treatment design was a 2 x 2 factorial of preplant (yes or no) and post-plant (yes or no) tillage. Selected cultural practices and site characteristics are described in Table 1. Grain yields were adjusted to 13% moisture. Estimated costs and profits were made utilizing modifications of published crop production budgets (Windham, et al, 1991a; Windbam, et al, 1991b).

RESULTS AND DISCUSSION

The yield results obtained for 1992 are presented in Table 2. It should be noted that 1992 was an extremely wet growing season with ample, well-distributed rainfall. The yield differences, though small, at NEREC were statistically significant for preplant tillage but not for post-plant tillage. Those obtained for both pre- and post-plant tillage were not statistically significant at CBES.

The economic returns for each treatment combination are presented in Table 3. Production costs generally increase as tillage inputs increase. However, profits are decreasing with the increasing tillage at NEREC. A component analysis is presented in Table 4. It is quite informative to note the loss in profit associated with pre- and post-plant tillage at NEREC. At a time when profits and losses are critical, this one year's data strongly suggests that tillage is just an added expense on clay soils and is only marginally profitable, at best, on a silt loam.

REFERENCES

Windham, T.E., CA. Stuart, and B.E. Herrington, Jr. 1991. Estimating 1992 production cost in Arkansas-Soybean loamy soils. Univ. of Ark Ext. Bull. No. 150.

Windham, T.C., CA. Stuart, and B.E. Herrington, Jr. 1991. Estimating 1992 production cost in Arkansas-Soybeans drilled loamy soils. Univ. of Ark. Ext. Bull. No. 151.

Table 1. Selected site characteristics, cultural practices, and temporal log for tillage experiments at NEXEC and CBES.

	Location	
	NEXEC	CBES
Soil *Type*	Sharkey silty clay	Loring soil
Planting Date	**6-24-92**	**6-18-92**
Seedbed Prep.		
Disking	**6-24-92**	**6-15-92**
Chem. Burndown'	**6-24-92**	**6-15-92**
Variety	**AS5403**	**AS5403**
Seeds/Row-R	**3-5**	**3-5**
Row Spacing	**19** inches	**19** inches
Harvest Date	**10-29-92**	**10-19-92**
No. Reps		
Preplant Tillage	**4**	**9**
Post-plant Tillage	**4**	**3**

[1] Burndown was with Roundup at 15pt/A of 4.7 Ib ai/gal formulation.

Table 2. Pre- and post-plant tillage effects on soybean grain yield.

Location	Tillage					
	Preplant			Post-plant		
	Yes	No	Diff.	Yes	No	Diff.
	bu/A-					
NEXEC	**48.8b'**	**51.6a**	**2.8**	50.3a	50.0a	**0 3**
CBES	**30.0a**	**28.la**	**1.9**	**302a**	**27.8a**	**2.4**

* Numbers at same location and compared for either preplant or post-plant tillage followed by the same letter are not different at the **10%** level according to Fisher's F test. **The** differences at Marianna had a probability of a greater value of F of **0.11** and **0.18 for** pre- and post-plant tillage, respectively.

Table 3. Economic returns estimated for various tillage regimes for soybeans.

Tillage				
Preplant	Yes		No	
Post-olant	Yes	No	Yes	**No**
	NEXEC			
Operating Cost'	**$63.42**	**$60.15**	**$52.86**	**$56.86**
Total Cost[2]	**$95.08**	**$88.74**	**$79.14**	**$80.07**
Profit'	**$180.44**	**$18230**	**$208.70**	**$190.97**
	CBES			
Operating cost	**$56.19**	**$52.75**	**$5227**	**$52.74**
Total Cost	**$8655**	**$79.77**	**$7725**	**$7438**
Profit	**$8425**	**$84.87**	**$89.63**	**$7458**

[1] Operating costs are taken from published crop production budgets with modifications to reflect changed production practices.

[2] Total costs are taken from published crop production budgets with modifications to reflect changed production practices.

[3] Profit computed as soybean yield times $5.60/bu minus total costs.

Table 4. Component analysis for pre- and post-plant tillage operations.

	Yield (bu)	Operating Cost[1]	Total Cost[2]	Profit[3]
		$/A		
	NEREC			
Base (No-Till)	51.8	$50.86	$80.07	$211.13
Adding Preplant Tillage	-2.8	$9.93	$12.31	-$29.11
Adding Post-Plant Tillage	0.3	$2.64	$2.71	-82.70
Total	49.3	$63.43	$95.09	$179.32
	CBES			
Base (No-Till)	26.5	$52.74	$74.38	$74.02
Adding Preplant Tillage	1.9	$1.97	$7.35	$2.74
Adding Post-Plant Tillage	2.4	$1.49	$4.83	$7.50
Total	30.8	$56.20	$86.56	$84.26

[1] Operating costs are taken from published crop production budgets with modifications to reflect changed production practices.
[2] Total costs are taken from published crop production budgets with modifications to reflect changed production practices.
[3] Profit computed as soybean yield times $5.60/bu minus total costs.