STUBBLE MANAGEMENT, PREPLANT TILLAGE, AND ROW SPACING FOR DOUBLE-CROPPED SOYBEANS

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INTRODUCTION

Growers in Arkansas double-crop almost all the wheat acreage with soybeans. The most accepted practice has been to burn the wheat straw, disk, and plant. State laws were passed in 1990 making a grower liable for automobile accidents caused by burning wheat straw. Conservation compliance has caused many growers to begin Investigating alternatives to burning of wheat straw. Federal clean air standards make burning of wheat straw illegal. These clean air standards have not been rigorously enforced. Limited research has shown substantial yield increases to narrowing rows from 38 to 19 inches (Mascagni et al., 1992). Different yield responses were obtained on different soil types, depending on whether straw was removed or left on the soil surface.

The objective of this study was to investigate 1) narrower row spacings similar to that obtained by grain drills versus that needed to physically cultivate or direct spray herbicides (17 to 22 inches), 2) straw managements of incorporation by disking versus straw burning versus no-till planting into undisturbed straw behind the combine, 3) no-till seedbed preparation versus disking for previously stated row spacings and straw managements.

MATERIALS AND METHODS

Experimental sites were selected at two Arkansas locations: the Cotton Branch Experiment Station (CBES) at Marianna and Little Rock. Experiment design was split, split, split plot with four replications. Main plot was disk twice or no-till. First split was row spacing of 19 or 22 inches versus 6 to 10 inches (drilled). Second split was stubble management, i.e., burn or no burn. Third split was post plant cultivation, yes or no. Dates for performing selected cultural practices and other site characteristics are shown in Table 1. Soil types at CBES and Little Rock were Loring silt loam and Rilla silt loam, respectively.

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All preplant no-till plots received a burndown treatment of glyphosate (Roundup) at 0.9 Ib ai/A Tilled plots were disked once with imazaquin (Scepter) at 0.28 lb ai/A being incorporated on the second disking or do-alling. Weed control followed Arkansas Cooperative Extension recommendations on a plot by plot evaluation of the need to apply herbicides. At Little Rock and CBES, postemergence applications of fomesafen (Reflex) at 0.375 lb ai/A and fluazifop-P (Fusilade 2000) at 0.188 lb ai/A were applied as needed for least cost weed control. Yields were adjusted to 13% moisture.

Table 1. Selected experimental sites and crop developmental characteristics.

	Little Rock	CBES
Soil Type	Loring silt loam	Rilla silt loam
Burndown Date	6-24-92	6-25-92
Disking Date	6-24-92	6-25-92
Planting Date	6-24-92	6-25-92
Row Spacing Wide	22.5	19
Row Spacing Narrow	7.5	9.5
Harvest Date	10-23-92	10-21-92

RESULTS AND DISCUSSION

For the 1992 growing season, no interaction between any of the main effects was found. Asa result, each effect is additive and will be addressed separately.

Narrowing the rows resulted in a 10 and 14 bushel yield increase (Table 2). Previous results have shown yield increases by narrowing row spacing from 38 to about 20 inches to be as much as 60%. From a practical implementation, a row spacing of 17 to 22 inches is about as narrow as can be cultivated or herbicides directed under the canopy. This test goes one step further, narrowing rows to 10 inches or less. This could become very important if planting after wheat harvest.

Table 2. Yield results for double-cropped soybeans at Little Rock and CBES, 1992.

Location	Row Spacing Wide[1]	Row Spacing Narrow	Preplant Tillage Yes	Preplant Tillage No	Straw Burning Yes	Straw Burning No	Post-Plant Tillage[2] Yes	Post-Plant Tillage[2] No
	(bu/A)							
Little Rock	**24**	**38**	**38**	**23**	**32**	**29**	**23**	**24**
CBES	16	26	22	20	22	20	17	16

[1] Row spacings were 22.5 and 7.5 or 19 and 9.5 inches at Little Rock and CBES, respectively.
[2] Post-plant cultivation was conducted only in wide rows.

Preplant tillage resulted in a 2- to 15-bushel yield increase. Little Rock had a thin stand of wheat, resulting in a light straw load. Consequently, partly because of the wet spring, partly because of the thin stand, vegetation was very heavy and older at Little Rock. Large broadleaf weeds and grasses were not completely controlled with the chemical burndown. Consequently, Scepter over top (OT) was used on some plots. Additionally, preplant tillage at Little Rock controlled all weeds, and we feel this preplant weed control is the primary reason preplant tillage resulted in a yield increase.

For this one year, burning wheat straw gave an advantage over unburned. This is contrary to results we have obtained in drier years. The straw burn was very poor at Little Rock, leaving several large broadleaf weeds and grasses. TheCBES was normal with a good straw load and relatively light weed pressure. The fire was hot enough during the straw burn to completely kill all existing aboveground vegetation.

Post-plant cultivation resulted in a nonsignificant change of -1 bu/A at Little Rock and +1 bu/A at CBES. No previous work is available for reference.

Operating and ownership expenses, as well as profits, were estimated using crop production budgets (Windham et al. 1991a and 1991b). These costs and profits are reported in Table 3. A savings of preplant tillage was offset by the cost of burndown chemicals. The yield response at Little Rock from the preplant tillage resulted in dramatic profit increases. The burning offset the burndown herbicide cost during this wet year. Post-plant cultivation reduced profits at Little Rock about $10.00/A but made essentially no change in profit at Marianna.

Yield component analysis was performed to assign values to various management options (Table 4). By analyzing the options in this way, a Best Management Practices (BMPs) package can be developed. The cost of different management options can also be determined. The base yield is the lowest obtained in the test. There is a minimum cost of production that can be associated with the base yield. Note, there was a net loss if no practices were used to improve profitability. If all of the BMPs were followed, the net profit was improved from -$8.70 to $148.09 and -$22.14 to $41.09 at Little Rock and CBES, respectively.

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Table 3. Costs and profits associated with different cultural practices for double-cropped soybeans.

Specification	Little Rock		CBES	
	---$/A---			
Row Spacing	**Wide**	**Narrow**	**Wide**	**Narrow**
Cost'	**$71.24**	**$81.22**	**$70.10**	**$79.48**
Profit'	**$60.36**	**$125.98**	**$19.50**	**$65.98**
Preplant Tillage	**Yes**	**No**	**Yes**	**No**
cost	**$80.44**	**$68.69**	**$78.22**	**$68.24**
Profit	**$114.63**	**$49.84**	**$34.71**	**$33.50**
Burning	Yes	No	Yes	No
cost	$74.64	$74.49	$73.41	$73.05
Profit	$84.96	$7951	$40.46	$27.75
Cultivation	Yes	No	Yes	No
cost	$74.47	$74.61	$73.49	$73.10
Profit	$5433	$96.19	$18.91	$41.70

[1] Cost are variable costs adapted from crop production budgets of Windham et al., 1991a and 1991b.
[2] Profit is defined as yield times $5.60/bu minus cost.

Table 4. Component analysis of best management practices to produce the most economical yield.

Cultural Practice	Little Rock Yield	Little Rock Total Cost'	Little Rock Profit Above T.C.[2]	CBES Yield	CBES Total Cost'	CBES Profit Above T.C.[2]
	-bu/A-	---$/A---		-bu/A-	---$/A---	
Base Yield Contrib.	13.7	61.65	16.75	113	6120	0.40
From Nar. Rows	132	9.98	6953	9.6	938	43.82
From Preplant Till	14.9	11.75	64.97	1.6	9.98	121
From Burning Straw	2.8	0.15	5.45	1.4	036	12.71
From Post-plant'	--	0.00	0.00	--	0.00	0.00
Total	44.6	83.53	156.70	232	80.92	58.14

[1] Total ownership cost is adapted to cultural practices actually used from the production budgets of Windham et al. 1991a and 1991b.
[2] Profit is defined as yield times $5.60/bu minus cost.
[3] Best system was narrow rows, and there is no post-plant tillage with narrow rows.