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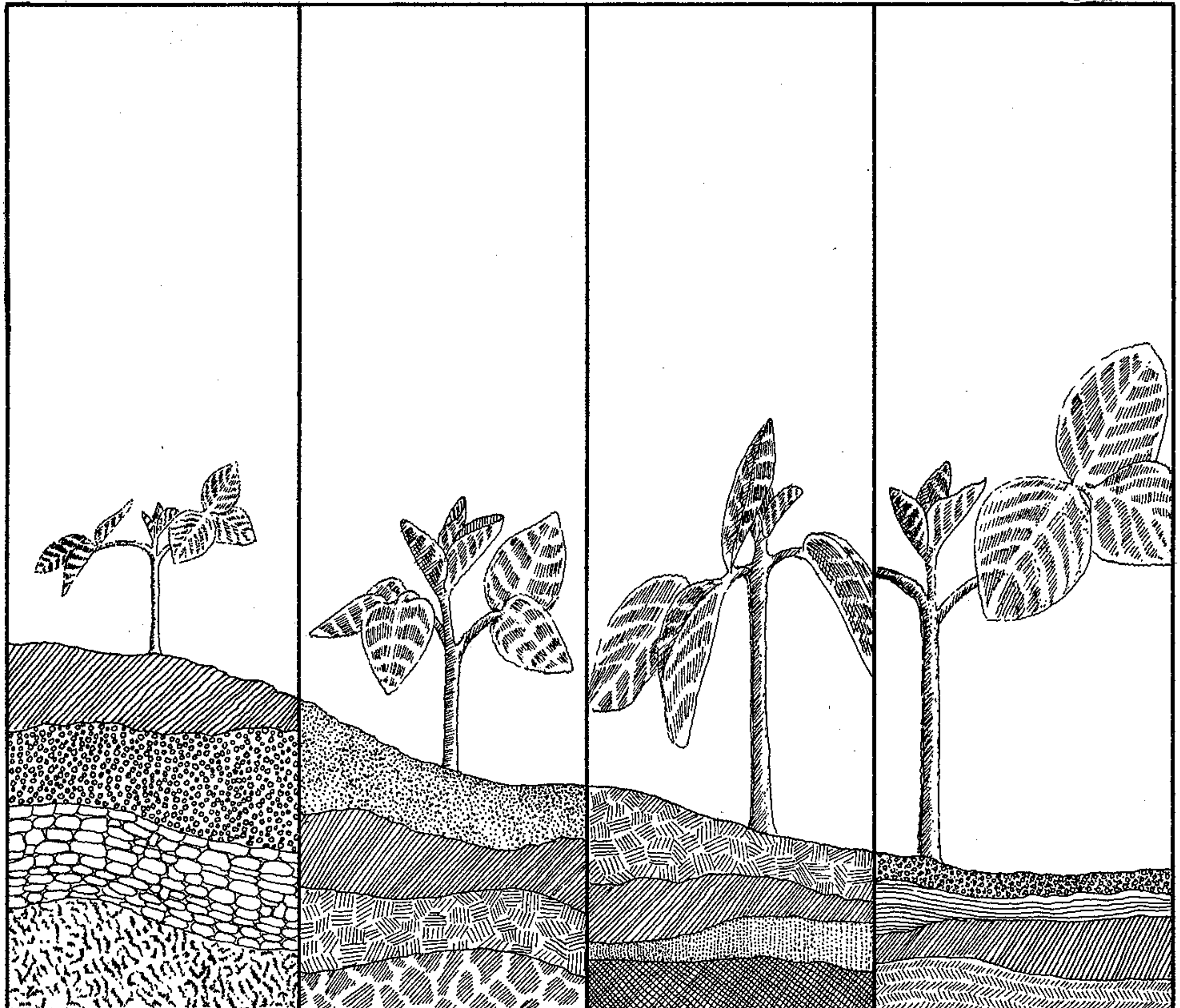

Economic analysis of stale seedbed concept of soybean production on clay soil

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Introduction

The lower Mississippi River alluvial flood plain occupies about 20 million acres from the Boot Heel of Missouri to New Orleans, Louisiana. About 9.3 million acres of this area consist of shrinking-swelling clayey soils. Previous research (Heatherly, 1981; Barrentine and Tupper, 1983) has shown that these soils require little or no primary tillage (subsoiling, chisel plowing, or deep disking) for soybean production. In fact, recent findings (Heatherly and Elmore, 1983) have shown that a "stale" or weathered seedbed can be used for planting soybeans in these soils, and the timeliness of planting achieved with this concept, in combination with irrigation during the full reproductive cycle, will achieve maximum seed yield (Heatherly, 1984).

Economic analysis (Salassi et al., 1984) has shown that properly timed irrigation of soybeans grown on soils of the Delta can result in increased returns to land, management, and general farm overhead. The objective of research reported in this bulletin was to determine if the stale seedbed concept for planting soybeans on clay soil, in combination with irrigation during reproductive development, will result in greater net return to the grower.

A thorough understanding of just what comprises the stale seedbed concept is necessary before a proper evaluation of its worth can be made.

The stale seedbed concept is geared toward avoiding delays in planting soybeans on clay soils. These soils give up water very slowly, and thus do not support rapid vegetative growth that is seen on the coarser-textured soils of the Delta (Heatherly and Russell, 1979). Therefore, use of a stale seedbed can aid in utilizing as much growing season as possible in order to realize optimum plant growth. Conservation of soil and fossil fuel resources is inherent in the process.

There are no set steps to follow, nor is there a specific order that must be adhered to. The following points describe the theory and general methodology which make up the concept.

(1) The shrinking-swelling clay, silty clay, and clay loam soils do not require tillage from a physical standpoint; that is, they do not have hardpans, etc., that only tillage can remedy. Therefore, tillage should be used only for weed control and smoothing of the soil surface.

(2) Following soybean harvest, a field may be disked to smooth the soil surface or remove old rows. A preplant incorporated (PPI) grass herbicide can be applied at this time if land does not flood. If the area is not tilled in the fall, then these operations can be performed in late winter or early spring. The idea is to ensure that enough time remains between the tillage and intended planting time to allow the seedbed to weather and become smooth.

(3) The tillage described in (2) is not necessary unless combine ruts are present or a PPI herbicide must be applied for grass control. The availability of postemergence herbicides for grass control reduces dependence on the PPI materials. If there are no combine ruts, and/or a PPI herbicide will not be applied, the present year's soybean crop can be planted in last year's old rows with no tillage.

(4) The clay soils are usually too wet in the early spring for chiseling or disking. A tractor irreparably ruts the field if any type of tillage operation is attempted. However, a planter with double-disk openers can be used without prior tillage, and any ruts created by the tractor tires during planting will be in the row middles and should present no problem. In fact, they provide a natural furrow for drainage or furrow irrigation. Therefore, these soils can be planted before any other operations can be performed on them. Excellent control of planting depth is achieved in the smooth, non-cloddy seedbed.

(5) At planting, existing vegetation must be removed. This can be done with a variety of individual chemicals or combinations of chemicals applied at or near planting. Residual herbicides can also be applied.

(6) There are indications that the weed spectrum may change with continued use of this limited tillage system. Therefore, the weed control options, both tillage and chemical methods, should remain flexible on a year-to-year basis. This system should not be considered practical in fields where perennial weeds, such as Johnsongrass, are a recurring problem. Also, adequate surface drainage is a necessity.

Methodology

Agronomic. The specific production inputs for each year are outlined in previous reports (Heatherly, 1984; Heatherly and Elmore, 1986). Soybeans were planted in the untilled, stale seedbed between May 11 and May 17 of 1979 through 1982. At this time, areas assigned the conventionally prepared seedbed treatment were disked to kill existing vegetation. This tillage created a cloddy seedbed that was not suitable for planting until a subsequent rainfall. Planting of these areas was necessarily delayed until late May or early June. These later plantings each year were preceded by a disk and/or springtooth harrow for seedbed preparation. Bedford, a Group V (early) variety, and Bragg or Braxton, Group VII (late) varieties, were planted each year at a rate of 10 seeds per foot of 40-inch row.

Weeds present in the untilled seedbed of the mid-May plantings were killed with a tank mix of either linuron or metribuzin plus dinoseb applied broadcast immediately after planting. The 1980, 1981, and 1982 study areas received a disk-incorporated application of trifluralin in either November, January, or February. The conventional seedbed plantings had linuron or metribuzin applied to them immediately after planting. All plantings received cultivation plus postemergence applications of over-the-top or post-directed herbicides as needed for control of weeds throughout the growing season.

Irrigation treatment each year was either nonirrigated (NI) or irrigated (I), with irrigation started at beginning of bloom and continued for the remainder of the growing season. Water was applied by the furrow method whenever soil water potential at the 12-inch soil depth dropped to between -50 and -100 centibars. All plots were harvested when they matured, and yields were converted to 13% seed moisture content.

Economic. Production practices represent actual practices applied by treatment. Estimated costs of production practices and materials used in each treatment were obtained from annual budget publications issued by the Department of Agricultural Economics, Mississippi State University and Mississippi Agricultural and Forestry Experiment Station (Parvin et al., 1979, 1980, 1981; Hamill, 1982), and represent estimated annual production costs associated with the respective treatments (Appendix Tables 1-8). Irrigation costs represent estimated costs of using a gated pipe system to apply the respective amounts of irrigation water to each treatment and variety as indicated in Appendix Table 9. Irrigation costs do not include land forming costs which should be considered if land forming is necessary. Estimated costs of a gated pipe system are presented in Appendix Table 10.

Seed yield was measured for each treatment and variety combination (Appendix Table 11). Soybean prices used in this report were the seasonal average received for the year as reported by the Mississippi Crop and Livestock Reporting Service (Appendix Table 12). Annual budgets were prepared for the nonirrigated and irrigated treatments and variety combinations of each year. Based on these budgets, estimated costs and returns were developed (Tables 1-4).

Table 1. Seed yield and estimated costs and returns of irrigated (I) and nonirrigated (NI) soybeans planted in stale and conventionally tilled seedbeds on Sharkey clay at Stoneville, MS in 1979.

		Stale seedbed				Conventional seedbed			
		Bedford		Bragg		Bedford		Bragg	
Item	Unit	NI	I	NI	I	NI	I	NI	I
Seed yield	bu/acre	50.90	48.50	55.20	58.10	47.40	41.60	54.30	55.10
Price[1]	$/bu	6.37	6.37	6.37	6.37	6.37	6.37	6.37	6.37
Gross revenue	$/acre	324.23	308.95	351.62	370.35	301.94	264.99	345.89	350.99
Estimated direct costs									
Production costs[2]	$/acre	42.04	42.04	42.04	42.04	37.67	37.67	37.67	37.67
Irrigation costs[3]	$/acre	0.00	21.90	0.00	17.49	0.00	21.17	0.00	18.52
TOTAL	$/acre	42.04	63.94	42.04	59.53	37.67	58.84	37.67	56.19
Return above direct costs	$/acre	282.19	245.01	309.58	310.57	264.27	206.15	308.22	294.80
Estimated fixed costs									
Production costs[4]	$/acre	11.84	11.84	11.84	11.84	13.50	13.50	13.50	13.50
Irrigation costs[5]	$/acre	0.00	24.44	0.00	24.44	0.00	24.44	0.00	24.44
TOTAL	$/acre	11.84	36.28	11.84	36.28	13.50	37.94	13.50	37.94
Total specified costs	$/acre	53.88	100.22	53.88	95.81	51.17	96.78	51.17	94.13
Return to land, management, and general farm overhead	$/acre	270.35	208.73	297.74	274.29	250.77	168.21	294.72	256.86

[1] Seasonal average price received in 1979 (Appendix Table 12).
[2] Itemized in Appendix Tables 1 and 2.
[3] Estimated direct costs per acre inch of water (Appendix Table 10) multiplied by the amount of water applied (Appendix Table 9).
[4] See Appendix Tables 1 ($53.88–$42.04=$11.84) and 2 ($51.17–$37.67=$13.50).
[5] See Appendix Table 10.

Table 2. Seed yield and estimated costs and returns of irrigated (I) and nonirrigated (NI) soybeans planted in stale and conventionally tilled seedbeds on Sharkey clay at Stoneville, MS in 1980.

		Stale seedbed				Conventional seedbed			
		Bedford		Bragg		Bedford		Bragg	
Item	Unit	NI	I	NI	I	NI	I	NI	I
Seed yield	bu/acre	14.70	40.60	19.80	52.40	17.20	46.80	22.60	44.30
Price[1]	$/bu	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
Gross revenue	$/acre	113.93	314.65	153.45	406.10	133.30	362.70	175.15	343.33
Estimated direct costs									
Production costs[2]	$/acre	55.91	55.91	55.91	55.91	61.87	61.87	61.87	61.87
Irrigation costs[3]	$/acre	0.00	61.45	0.00	79.82	0.00	56.15	0.00	54.10
TOTAL	$/acre	55.91	117.39	55.91	135.73	61.87	118.02	61.87	115.97
Return above direct costs	$/acre	58.02	197.26	97.54	270.37	71.43	244.68	113.28	227.36
Estimated fixed costs									
Production costs[4]	$/acre	17.04	17.04	17.04	17.04	22.25	22.25	22.25	22.25
Irrigation costs[5]	$/acre	0.00	24.44	0.00	24.44	0.00	24.44	0.00	24.44
TOTAL	$/acre	17.04	41.48	17.04	41.48	22.25	46.69	22.25	46.69
Total specified costs	$/acre	72.95	158.87	72.95	177.21	84.12	164.71	84.12	162.66
Return to land, management, and general farm overhead	$/acre	40.98	155.78	80.50	228.89	49.18	197.99	91.03	180.67

[1] Seasonal average price received in 1980 (Appendix Table 12).
[2] Itemized in Appendix Tables 3 and 4.
[3] Estimated direct costs per acre inch of water (Appendix Table 10) multiplied by the amount of water applied (Appendix Table 9).
[4] See Appendix Tables 3 ($72.95–$55.91 = $17.04) and 4 ($84.12–$61.87 = $22.25).
[5] See Appendix Table 10.

Table 3. Seed yield and estimated costs and returns of irrigated (I) and nonirrigated (NI) soybeans planted in stale and conventionally tilled seedbeds on Sharkey clay at Stoneville, MS in 1981.

		Stale seedbed				Conventional seedbed			
		Bedford		Braxton		Bedford		Braxton	
Item	Unit	NI	I	NI	I	NI	I	NI	I
Seed yield	bu/acre	14.60	41.30	15.30	48.70	15.60	35.30	25.20	43.70
Price[1]	$/bu	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Gross revenue	$/acre	91.25	258.13	95.63	304.38	97.50	220.63	157.50	273.13
Estimated direct costs									
Production costs[2]	$/acre	56.67	56.67	56.67	56.67	58.94	58.94	58.94	58.94
Irrigation costs[3]	$/acre	0.00	37.19	0.00	48.66	0.00	22.64	0.00	33.96
TOTAL	$/acre	56.67	93.86	56.67	105.33	58.94	81.58	58.94	92.90
Return above direct costs	$/acre	34.58	164.27	38.96	199.05	38.56	139.05	98.56	180.23
Estimated fixed costs									
Production costs[4]	$/acre	21.51	21.51	21.51	21.51	26.07	26.07	26.07	26.07
Irrigation costs[5]	$/acre	0.00	24.44	0.00	24.44	0.00	24.44	0.00	24.44
TOTAL	$/acre	21.51	45.95	21.51	45.95	26.07	50.51	26.07	50.51
Total specified costs	$/acre	78.18	139.81	78.18	151.28	85.01	132.09	85.01	143.41
Return to land, management, and general farm overhead	$/acre	13.07	118.32	17.45	153.10	12.49	88.54	72.49	129.72

[1] Seasonal average price received in 1981 (Appendix Table 12).
[2] Itemized in Appendix Tables 5 and 6.
[3] Estimated direct costs per acre inch of water (Appendix Table 10) multiplied by the amount of water applied (Appendix Table 9).
[4] See Appendix Tables 5 ($78.18–$56.67 = $21.51) and 6 ($85.01–$58.94 = $26.07).
[5] See Appendix Table 10.

Table 4. Seed yield and estimated costs and returns of irrigated (I) and nonirrigated (NI) soybeans planted in stale and conventionally tilled seedbeds on Sharkey clay at Stoneville, MS in 1982.

		Stale seedbed				Conventional seedbed			
		Bedford		Braxton		Bedford		Braxton	
Item	Unit	NI	I	NI	I	NI	I	NI	I
Seed yield	bu/acre	14.50	33.40	15.00	40.40	13.10	24.80	17.60	34.90
Price[1]	$/bu	5.55	5.55	5.55	5.55	5.55	5.55	5.55	5.55
Gross revenue	$/acre	80.48	185.37	83.25	224.22	72.71	137.64	97.68	193.70
Estimated direct costs									
Production costs[2]	$/acre	46.32	46.32	46.32	46.32	52.93	52.93	52.93	52.93
Irrigation costs[3]	$/acre	0.00	33.96	0.00	45.28	0.00	33.96	0.00	33.96
TOTAL	$/acre	46.32	80.28	46.32	91.60	52.93	86.89	52.93	86.89
Return above direct costs	$/acre	34.16	105.09	36.93	132.62	19.78	50.75	44.75	106.81
Estimated fixed costs									
Production costs[4]	$/acre	23.66	23.66	23.66	23.66	33.06	33.06	33.06	33.06
Irrigation costs[5]	$/acre	0.00	24.44	0.00	24.44	0.00	24.44	0.00	24.44
TOTAL	$/acre	23.66	48.10	23.66	48.10	33.06	57.50	33.06	57.50
Total specified costs	$/acre	69.98	128.38	69.98	139.70	85.99	144.39	85.99	144.39
Return to land, management, and general farm overhead	$/acre	10.50	56.99	13.27	84.52	(13.28)[6]	(6.75)	11.69	49.31

[1] Seasonal average price received in 1982 (Appendix Table 12).
[2] Itemized in Appendix Tables 7 and 8.
[3] Estimated direct costs per acre inch of water (Appendix Table 10) multiplied by the amount of water applied (Appendix Table 9).
[4] See Appendix Tables 7 ($69.98–$46.32=$23.66) and 8 ($85.99–$52.93=$33.06).
[5] See Appendix Table 10.
[6] Numbers in parentheses indicate a net loss.

Weather Summary

Moderate temperatures and frequent rainfall characterized the 1979 growing season (Table 5). Only 14 days (14%) of the June 11 to Sept. 20 period had maximum temperatures of 95°F or greater, and the longest consecutive period at this level was the July 1 to July 6 period when all varieties were still in vegetative development. The longest period without significant rainfall (>0.5-inch) during May through August was 13 days. No significant rainfall fell from Sept. 5 through Sept. 20, which corresponded to the podfill period of Bragg.

In 1980, a majority of the days (76%) in the June 11 to Sept. 20 period had a maximum temperature of 95°F or greater, and the maximum exceeded 100°F on 30 days (38%) from June 30 to Sept. 16. Between June 30 and July 18 (bloom period of Bedford), all daily temperatures went above 100°F. These extremely high temperatures, coupled with the low 3.1 inches of rain that fell between July 1 and Sept. 30, created an extreme moisture deficit condition during most of the 1980 growing season.

In 1981, 44 (43%) of the days between June 11 and Sept. 20 had maximum temperatures of 95° or greater, but only 4% had maximums of 100°F or greater. Between June 30 and July 30, the period when all varieties had at least started blooming, only 13 days had temperatures exceeding 95°F. The remainder of the days with these temperatures were split about evenly between the vegetative periods and the postbloom periods. The July 1 to Aug. 30 period received 5.3 inches of evenly distributed rainfall, and this brought periods of cooler days

Table 5. Total rainfall and average maximum temperature for 10- or 11-day intervals from May 1 to Sept. 30, 1979–1982, at Stoneville, MS.

	Rainfall (inches)				Temperature (°F)			
Period	1979	1980	1981	1982	1979	1980	1981	1982
May 1–10	3.78	0.70	0.88	0.15	79	77	77	79
May 11–20	0.85	4.02	3.09	0.35	82	80	76	87
May 21–31	3.27	1.18	0.64	1.19	79	84	85	91
June 1–10	1.05	0.00	2.81	0.68	86	86	88	91
June 11–20	0.34	0.52	0.06	2.04	92	93	94	86
June 21–30	2.24	1.91	0.00	3.00	88	94	94	88
July 1–10	1.78	0.00	2.02	0.00	94	102	88	94
July 11–20	1.11	0.68	0.24	0.00	91	103	96	96
July 21–31	3.52	1.09	0.82	1.74	92	92	94	93
Aug. 1–10	0.68	0.30	0.42	0.00	93	97	95	92
Aug. 11–20	1.16	0.09	0.88	1.18	90	98	92	91
Aug. 21–31	1.12	0.98	0.91	0.35	90	94	92	95
Sept. 1–10	2.21	0.00	1.70	0.31	87	96	84	89
Sept. 11–20	0.08	0.00	1.95	2.28	80	96	81	88
Sept. 21–31	3.38	4.51	0.00	0.00	82	78	90	78

interspersed among the days with high maximum temperatures. The longest period with no significant rainfall (>0.5-inch) was the June 7 to June 30 period, when all varieties were still vegetative and had adequate soil moisture for growth.

The June 11 to Sept. 20 period of 1982 had only 32 days (31%) with temperature maximums of 95°F or greater; however, 18 of these fell between June 30 and July 30, the period when all varieties had at least started to bloom. Most of the remainder occurred during the last days of August when all varieties were in the seed-filling stage. The July 1 to July 26, July 31 to Aug. 14, and Aug. 16 to Sept. 2 periods of 1982 all received no significant rainfall (>0.5 inch) and the total for the July 1 to Aug. 30 period was only 3.3 inches.

Results

Yields, production and irrigation costs, and estimated returns for each method of seedbed treatment for irrigated and nonirrigated soybeans are presented in Tables 1-4. Yield data are from plots of each treatment and variety in each of the 4 years (Appendix Table 11). The differences in annual estimated costs for each treatment are due to differences in the amounts of irrigation water applied in a given year. Differences in annual returns are attributed to different yields and irrigation costs associated with the method of seedbed treatment and variety, and irrigation vs. nonirrigation of a treatment.

Estimated returns above direct costs for each variety in each year are summarized in Table 6. Average returns above direct costs for the stale seedbed plantings of Bedford that were irrigated were more than $17 per acre higher ($177.91 vs. $160.16) than from the conventional seedbed plantings that were irrigated. When the data from the extremely hot and dry year of 1980 are eliminated, the irrigated stale seedbed plantings of Bedford averaged $39.48 more than the irrigated conventional plantings. In 1980, the earlier planting that resulted from use of a stale seedbed was more adversely affected by the hot, dry weather during bloom and pod set. Average returns above direct costs for the nonirrigated treatments of Bedford were similar ($102.24 vs. $98.51) for both seedbed treatments. Therefore, the stale seedbed treatment that resulted in earlier planting increased average returns above estimated direct costs for Bedford only if irrigation was used.

Average returns above direct costs for the stale seedbed plantings of Bedford that were irrigated were $75.67 more per acre than for the stale seedbed plantings that were not irrigated. Average returns from the irrigated conventional seedbed treatment were $61.65 more per acre than from the nonirrigated conventional treatment (Table 6).

For Bragg or Braxton, average returns above direct costs for the stale seedbed plantings that were irrigated were $25.85 more per acre than returns from the conventional seedbed plantings that were irrigated. Without irrigation, the conventional seedbed treatment returned $20.45 more per acre than did the stale seedbed treatment. Hence, average returns above direct costs for Bragg or Braxton favor the stale seedbed treatment when irrigation is used, but favor the conventional seedbed treatment in the absence of irrigation. This trend was consistent across all 4 years of the study.

Average returns above direct costs for the stale seedbed plantings of Bragg or Braxton that were irrigated were $107.40 more

Table 6. Annual, total, and average estimated returns above estimated direct costs for irrigated (I) and nonirrigated (NI) soybeans planted with stale and conventional seedbed preparation on Sharkey clay.

Seedbed	Irrigation treatment	Variety	Year 1979	1980	1981	1982	4-year Total	4-year Av.
			$/acre					
Stale	I	Bedford	245.01	197.26	164.27	105.09	711.63	177.91
		Braxton	310.57	270.37	199.05	132.62	912.62	228.15
		AVERAGE	281.36	233.82	181.66	115.86	812.70	203.17
	NI	Bedford	282.19	58.02	34.58	34.16	408.95	102.24
		Braxton	309.58	97.54	38.96	36.93	483.01	120.75
		AVERAGE	295.88	77.78	36.77	35.54	445.98	111.50
Conventional	I	Bedford	206.15	244.68	139.05	50.75	640.63	160.16
		Braxton	294.80	227.36	180.23	106.81	809.20	202.30
		AVERAGE	250.48	236.02	159.64	78.78	724.92	181.23
	NI	Bedford	264.27	71.43	38.56	19.78	394.04	98.51
		Braxton	308.22	113.28	98.56	44.75	564.81	141.20
		AVERAGE	286.24	92.36	68.76	32.26	479.62	119.91

per acre than returns to the stale seedbed plantings that were not irrigated (Table 6). Average returns from the irrigated conventional seedbed treatment were $61.10 more per acre than from the nonirrigated conventional treatment.

Average returns above total specified costs are presented by variety in Table 7. The irrigated stale seedbed treatment using Bedford returned an average of $134.96 per acre above total costs compared to $112.00 per acre for the irrigated conventional seedbed treatment. For the nonirrigated treatments, returns above total costs averaged $83.73 per acre for the stale seedbed treatment and $74.79 for the conventional seedbed treatment. Thus, irrigation of the stale seedbed plantings of Bedford resulted in an average increase in returns of $22.96 per acre more than irrigation of the conventional seedbed plantings. For the nonirrigated stale seedbed planting, returns averaged only $8.94 per acre more than returns from the nonirrigated conventional seedbed treatment. These results indicate that use of the stale seedbed concept with plantings of Bedford that are irrigated will be more profitable than conventional seedbed plantings that are irrigated; however, only a slight advantage existed for the stale seedbed system over the conventional seedbed treatment under nonirrigated conditions.

Returns above total specified costs from the stale seedbed planting of Bedford averaged $134.96 per acre for the irrigated portion and $83.73 per acre for the nonirrigated plots, or a $51.23 advantage for irrigation. For the conventional seedbed treatment, the irrigated beans returned $112.00 compared to $74.79 per acre for the nonirrigated treatments, or $37.21 more per acre when irrigation was used.

Returns above estimated total costs when Bragg or Braxton were used averaged $185.20 and $154.14 per acre for the irrigated stale and conventional seedbed treatments, respectively, a difference of $31.06 per acre. For the nonirrigated treatments, returns averaged $102.24 per acre from the stale seedbed planting and $117.48 from the conventional seedbed plantings. Thus, results from the irrigated treatments favor the stale seedbed concept and results from the nonirrigated treatments favor the conventional seedbed planting of Bragg or Braxton.

The difference in planting dates resulting from the different seedbed treatments probably contributed to this differing response between the irrigated and nonirrigated portions with the later-maturing varieties. This differing pattern of estimated returns between the irrigated and nonirrigated treatments is contrary to the pattern observed with Bedford, and points out that the relative maturity of a variety is a factor to be considered when evaluating yield and economic response of the crop to both planting date and irrigation.

Average returns from the stale seedbed planting of Bragg or Braxton were $185.20 and $102.24 per acre from the irrigated and nonirrigated treatments, respectively, or a difference of $83.79 in favor of the irrigated treatment. For the conventional seedbed treatment, returns averaged $154.14 and $117.48 per acre for the irrigated and nonirrigated treatments, respectively, or a difference of only $36.66 in favor of irrigation. The reverse trend in yield difference between the two plantings (Appendix Table 11) under irrigated and nonirrigated conditions resulted in this $47.13 difference in net returns.

Table 7. Annual, total, and average estimated returns above estimated total costs for irrigated (I) and nonirrigated (NI) soybeans planted with stale and conventional seedbed preparation on Sharkey clay.

Seedbed	Irrigation treatment	Variety	Year 1979	1980	1981	1982	4-year Total	4-year Av.
			$/acre					
Stale	I	Bedford	208.73	155.78	118.32	56.99	539.82	134.96
		Braxton	274.29	228.89	153.10	84.52	740.80	185.20
		AVERAGE	245.09	192.34	135.71	65.76	638.90	159.73
	NI	Bedford	270.35	40.98	13.07	10.50	334.90	83.73
		Braxton	297.74	80.50	17.45	13.27	408.96	102.24
		AVERAGE	284.05	60.74	15.26	11.89	371.94	92.99
Conventional	I	Bedford	168.21	197.99	88.54	(6.75)	447.99	112.00
		Braxton	256.86	180.67	129.72	49.31	616.56	154.14
		AVERAGE	212.54	189.33	109.13	21.28	532.28	133.07
	NI	Bedford	250.77	49.18	12.49	(13.28)	299.16	74.79
		Braxton	294.72	91.03	72.49	11.69	469.93	117.48
		AVERAGE	272.75	70.11	42.49	(0.80)	384.54	96.14

Conclusions

The results of this study indicate an average advantage of $23 to $31 per acre for the stale seedbed concept under irrigated conditions. Results from the nonirrigated portions indicate only a slight advantage for the stale seedbed treatment with Bedford, and reduced returns with Bragg or Braxton. In all cases, the Group VII varieties Bragg or Braxton produced higher average estimated returns than did the Group V variety Bedford. This is because Bragg or Braxton always produced greater yields with only slightly higher specified costs per acre due to more irrigation water being applied. Evidently the later pod-filling period of Bragg or Braxton (September) compared to that of Bedford (August) resulted in more efficient utilization of rain and irrigation water in the presence of cooler September temperatures.

In general, the stale seedbed concept results in a shift of resources or inputs in the production of soybeans. For example, costs for chemicals will be higher and costs for machinery lower than those of the conventional seedbed concept of soybean production (Appendix Tables 1-8). Consequently, only slight reductions, or in some cases no reduction, in the cost of producing soybeans occur when changing to the stale seedbed concept. Since cost differences between the conventional and stale seedbed concepts are negligible, yield differences must occur for an economic advantage to be realized. In the nonirrigated plantings, no such yield difference occurred; thus, no real economic advantage for either concept was measured when water was a limiting factor. On the other hand, timely planting that may result from the use of the stale seedbed concept, coupled with irrigation, will result in higher yields and greater net returns. This indicates that the adoption of the stale seedbed concept can lead to a consistent increase in returns to the soybean grower who uses irrigation efficiently.

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Appendix Tables

Appendix Table 1. Production practices and estimated direct and total production costs associated with soybeans planted in a stale seedbed on Sharkey clay at Stoneville, MS in 1979.

	Direct costs					Fixed costs		
Operation	**Tractor**	**Equipment**	**Labor**	**Materials**	**Total**	**Tractor**	**Equipment**	**Total**
	$/acre							
Disk–28 ft.	0.40	0.45	0.29	0.00	1.14	0.57	0.88	2.59
Plant and preemerge	0.45	0.30	0.64	30.25[1]	31.64	0.63	0.71	32.98
Cultivate early	0.65	0.22	0.46	0.00	1.33	0.92	0.46	2.71
Cultivate late	0.40	0.16	0.29	0.00	0.85	0.57	0.34	1.76
Combine–20 ft.	0.00	4.15	0.92	0.00	5.07	0.00	6.76	11.83
Total specified	1.90	5.23	2.60	30.35	40.03	2.69	9.15	51.87
Interest on oper. capital[2]					2.01			2.01
Total including interest					42.04			53.88

[1] Preemerge alachlor plus linuron plus dinoseb plus seed.
[2] 11% annual interest rate.
Source: Parvin, et al., 1979.

Appendix Table 2. Production practices and estimated direct and total production costs associated with soybeans planted in a conventionally tilled seedbed on Sharkey clay at Stoneville, MS in 1979.

	Direct costs					Fixed costs		
Operation	**Tractor**	**Equipment**	**Labor**	**Materials**	**Total**	**Tractor**	**Equipment**	**Total**
	$/acre							
Disk–28 ft.	0.40	0.45	0.29	0.00	1.14	0.57	0.88	2.59
Disk–28 ft.	0.40	0.45	0.29	0.00	1.14	0.57	0.88	2.59
Field cultivate–21 ft.	0.40	0.23	0.29	0.00	0.92	0.57	0.55	2.04
Plant and preemerge	0.45	0.30	0.64	24.89[1]	29.28	0.63	0.71	27.62
Cultivate early	0.65	0.22	0.46	0.00	1.33	0.92	0.46	2.71
Combine–20 ft.	0.00	4.15	0.92	0.00	5.07	0.00	6.76	11.83
Total specified	2.30	5.80	2.89	24.89	35.88	3.26	10.24	49.38
Interest on oper. capital[2]					1.79			1.79
Total including interest					37.67			51.17

[1] Seed plus alachlor plus linuron.
[2] 11% annual interest rate.
Source: Parvin, et al., 1979.

Appendix Table 3. Production practices and estimated direct and total production costs associated with soybeans planted in a stale seedbed on Sharkey clay at Stoneville, MS in 1980.

Operation	Direct costs					Fixed costs		Total
	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	Total
	$/acre							
Disk and incorporate–28 ft.	0.97	0.62	0.40	6.30[1]	8.29	0.88	1.14	10.41
Field cultivate–21 ft.	0.75	0.23	0.31	0.00	1.29	0.68	0.57	2.54
Plant and preemerge	0.99	0.41	0.82	31.05[2]	33.27	0.89	0.99	35.15
Cultivate early	1.20	0.24	0.50	0.00	1.94	1.08	0.52	3.54
Cultivate late	0.75	0.15	0.31	0.00	1.21	0.68	0.32	2.21
Combine–20 ft.	0.00	6.23	0.92	0.00	7.15	0.00	9.19	16.34
Total specified	4.66	7.88	3.26	37.35	53.15	4.21	12.83	70.19
Interest on oper. capital[3]					2.76			2.76
Total including interest					55.91			72.95

[1] Preplant incorporated trifluralin.
[2] Seed plus alachlor plus linuron plus dinoseb.
[3] 12% annual interest rate.
Source: Parvin, et al., 1980.

Appendix Table 4. Production practices and estimated direct and total production costs associated with soybeans planted in a conventionally tilled seedbed on Sharkey clay at Stoneville, MS in 1980.

Operation	Direct costs					Fixed costs		Total
	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	Total
	$/acre							
Disk and incorporate–28 ft.	0.97	0.62	0.40	6.30[1]	8.29	0.88	1.24	10.41
Field cultivate–21 ft.	0.75	0.23	0.31	0.00	1.29	0.68	0.57	2.54
Disk–28 ft.	0.75	0.45	0.31	0.00	1.51	0.68	0.91	3.10
Field cultivate–21 ft.	0.75	0.23	0.31	0.00	1.29	0.68	0.57	2.54
Field cultivate–21 ft.	0.75	0.23	0.31	0.00	1.29	0.68	0.57	2.54
Plant and preemerge	0.99	0.41	0.82	25.69[2]	27.91	0.89	0.99	29.79
Cultivate and post early	1.44	0.43	0.60	3.66[3]	6.13	1.30	0.92	8.35
Cultivate and post late	0.97	0.29	0.40	2.29[4]	3.95	0.88	0.62	5.45
Combine–20 ft.	0.00	6.23	0.92	0.00	7.15	0.00	9.19	16.34
Total specified	7.37	9.12	4.38	37.94	58.81	6.67	15.58	81.06
Interest on oper. capital[5]					3.06			3.06
Total including interest					61.87			84.12

[1] Preplant incorporated trifluralin.
[2] Seed plus alachlor plus linuron.
[3] Bentazon.
[4] Acifluorfen.
[5] 12% annual interest rate.
Source: Parvin, et al., 1980.

Appendix Table 5. Production practices and estimated direct and total production costs associated with soybeans planted in a stale seedbed on Sharkey clay at Stoneville, MS in 1981.

Operation	Direct costs					Fixed costs		Total
	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	
	$/acre							
Disk and incorporate–28 ft.	1.20	0.70	0.44	6.57[1]	8.91	1.12	1.49	11.52
Plant and preemerge	1.51	0.68	1.33	25.00[2]	28.52	1.40	1.80	31.72
Cultivate early	1.47	0.31	0.54	0.00	2.32	1.37	0.71	4.40
Cultivate and post late	1.20	0.34	0.44	2.84[3]	4.82	1.12	0.79	6.73
Cultivate late	0.92	0.19	0.33	0.00	1.44	0.86	0.44	2.74
Combine–20 ft.	0.00	6.13	1.03	0.00	7.16	0.00	10.41	17.57
Total specified	6.30	8.35	4.11	34.41	53.17	5.87	15.64	74.68
Interest on oper. capital[4]					3.50			3.50
Total including interest					56.67			78.18

[1] Preplant incorporated trifluralin.
[2] Seed plus linuron plus dinoseb.
[3] Linuron plus 2,4-DB
[4] 14% annual interest rate.
Source: Parvin, et al., 1981.

Appendix Table 6. Production practices and estimated direct and total production costs associated with soybeans planted in a conventionally tilled seedbed on Sharkey clay at Stoneville, MS in 1981.

Operation	Direct costs					Fixed costs		Total
	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	
	$/acre							
Disk and incorporate–28 ft.	1.20	0.70	0.44	6.57[1]	8.91	1.12	1.49	11.52
Field cultivate–21 ft.	0.92	0.33	0.33	0.00	1.58	0.86	0.86	3.30
Disk–28 ft.	0.92	0.50	0.33	0.00	1.75	0.86	1.06	3.67
Plant and preemerge	1.51	0.68	1.33	23.10[2]	26.62	1.40	1.80	29.82
Cultivate early	1.47	0.31	0.54	0.00	2.32	1.37	0.71	4.40
Cultivate and post late	1.77	0.51	0.65	2.84[3]	5.77	1.65	1.18	8.60
Cultivate late	0.92	0.19	0.33	0.00	1.44	0.86	0.44	2.74
Combine–20 ft.	0.00	6.13	1.03	0.00	7.16	0.00	10.41	17.57
Total specified	7.79	8.85	4.65	32.51	55.55	8.12	17.95	81.62
Interest on oper. capital[4]					3.39			3.39
Total including interest					58.94			85.01

[1] Preplant incorporated trifluralin.
[2] Seed plus linuron plus dinoseb.
[3] Linuron plus 2,4-DB.
[4] 14% annual interest rate.
Source: Parvin, et al., 1981.

Appendix Table 7. Production practices and estimated direct and total production costs associated with soybeans planted in a stale seedbed on Sharkey clay at Stoneville, MS in 1982.

	Direct costs					Fixed costs		
Operation	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	Total
	$/acre							
Disk and incorporate–28 ft.	1.90	0.87	0.66	8.19[1]	11.62	1.81	1.95	15.38
Plant and preemerge	1.05	0.61	0.44	15.69[2]	17.79	0.99	1.72	20.50
Cultivate early	1.40	0.31	0.58	0.00	2.29	1.32	0.77	4.38
Cultivate late	0.87	0.20	0.36	0.00	1.43	0.83	0.48	2.74
Cultivate late	0.87	0.20	0.36	0.00	1.43	0.83	0.48	2.74
Combine–20 ft.	0.00	7.64	1.09	0.00	8.73	0.00	12.64	21.37
Total specified	6.09	9.83	3.49	23.88	43.29	5.62	18.04	66.95
Interest on oper. capital[3]					3.03			3.03
Total including interest					46.32			69.98

[1] Preplant incorporated trifluralin.
[2] Seed plus metribuzin plus dinoseb.
[3] 16% annual interest rate.
Source: Hamill, 1982.

Appendix Table 8. Production practices and estimated direct and total production costs associated with soybeans planted in a conventionally tilled seedbed on Sharkey clay at Stoneville, MS in 1982.

	Direct costs					Fixed costs		
Operation	Tractor	Equipment	Labor	Materials	Total	Tractor	Equipment	Total
	$/acre							
Disk and incorporate–28 ft.	1.90	0.87	0.66	8.19[1]	11.62	1.81	1.95	15.38
Disk–28 ft.	1.05	0.68	0.36	0.00	2.09	1.01	1.53	4.63
Disk–28 ft.	1.05	0.68	0.36	0.00	2.09	1.01	1.53	4.63
Field cultivate–34 ft.	0.84	0.57	0.29	0.00	1.70	0.80	1.57	4.07
Plant and preemerge	1.05	0.61	0.44	13.92[2]	16.02	0.99	1.72	18.73
Roll	0.79	0.06	0.36	0.00	1.21	0.76	0.25	2.22
Cultivate early	1.40	0.31	0.58	0.00	2.29	1.32	0.77	4.38
Cultivate early	1.40	0.31	0.58	0.00	2.29	1.32	0.77	4.38
Cultivate late	0.87	0.20	0.36	0.00	1.43	0.83	0.48	2.74
Combine–20 ft.	0.00	7.64	1.09	0.00	8.73	0.00	12.64	21.37
Total specified	10.35	11.93	5.08	22.11	49.47	8.85	23.21	82.53
Interest on oper. capital[3]					3.46			3.46
Total including interest					52.93			85.99

[1] Preplant incorporated trifluralin.
[2] Seed plus metribuzin plus dinoseb.
[3] 16% annual interest rate.
Source: Hamill, 1982

Appendix Table 9. Record of irrigation of two soybean varieties planted on two dates at Stoneville, MS 1979-1982.

Year	Bedford				Bragg or Braxton			
	May planting		June planting		May planting		June planting	
	Date	Amount	Date	Amount	Date	Amount	Date	Amount
		(in.)		(in.)		(in.)		(in.)
1979	July 20	1.75	Aug. 20	3.40	Aug. 17	2.55	Aug. 17	2.30
	Aug. 10	2.80	Sept. 19	3.80	Sept. 12	3.40	Sept. 19	4.00
	Aug. 30	2.90	TOTAL	7.20	TOTAL	5.95	TOTAL	6.30
	TOTAL	7.45						
1980	July 9	3.15	July 31	3.70	July 28	3.85	Aug. 11	3.85
	July 18	3.70	Aug. 13	3.85	Aug. 6	3.35	Aug. 22	3.85
	July 31	2.85	Aug. 25	3.85	Aug. 14	4.70	Sept. 3	3.00
	Aug. 13	3.85	Sept. 9	3.85	Aug. 22	3.85	Sept. 12	3.85
	Aug. 22	3.85	Sept. 18	3.85	Sept. 3	3.70	Sept. 22	3.85
	Sept. 3	3.50	TOTAL	19.10	Sept. 12	3.85	TOTAL	18.40
	TOTAL	20.90			Sept. 22	3.85		
					TOTAL	27.15		
1981	July 22	4.95	July 31	3.85	July 20	5.00	July 30	3.85
	Aug. 3	3.85	Aug. 19	3.85	Aug. 3	3.85	Aug. 19	3.85
	Aug. 20	3.85	TOTAL	7.70	Aug. 20	3.85	Sept. 14	3.85
	TOTAL	12.65			Sept. 14	3.85	TOTAL	11.55
					TOTAL	16.55		
1982	July 21	3.85	July 29	3.85	July 21	3.85	July 29	3.85
	Aug. 11	3.85	Aug. 25	3.85	Aug. 9	3.85	Aug. 25	3.85
	Aug. 30	3.85	Sept. 8	3.85	Aug. 27	3.85	Sept. 8	3.85
	TOTAL	11.55	TOTAL	11.55	Sept. 8	3.85	TOTAL	11.55
					TOTAL	15.40		

Appendix Table 10. Estimated costs of a gated-pipe system irrigating 160 acres, Mississippi Delta, 1983.

Item	Investment	Estimated life	Annual costs
FIXED COSTS			
Engine	$ 6,500	15	$ 433.53
Well, pump, gearhead	13,500	20	675.00
Fuel tank and lines	1,000	20	50.00
8-inch gated pipe at $3.00/ft.	7,920	15	528.00
Total investment	$28,920		
Average annual interest			2,024.40
Insurance			200.00
Total annual fixed costs			$3,910.73
Annual fixed cost per acre			$ 24.44
DIRECT COSTS		4 inches per acre	Approximate costs per acre-inch
Engine repairs at 70% of new costs		$ 0.50	$0.13
Diesel fuel at $1.15/gallon		6.98	1.75
Oil at $4.00/gallon		0.04	0.01
Tractor fuel at $1.15/gallon (25 hours of operation)		0.36	0.09
Labor at $4.40/hour		2.85	0.71
Pipe replacement (2% of original pipe investment)		0.99	0.25
Total direct costs		$11.73	$2.94

Appendix Table 11. Yield of irrigated and nonirrigated soybeans planted on two dates on Sharkey clay at Stoneville, MS 1979-1982.

Year	Planting date	Nonirrigated			Irrigated		
		Variety			Variety		
		Bedford	Bragg or Braxton	Average	Bedford	Bragg or Braxton	Average
		bu/acre					
1979	May 17	50.9	55.2	53.0	48.5	58.1	53.3
	June 11	47.4	54.3	50.8	41.6	55.1	48.4
	AVERAGE	49.2	54.8	52.0	45.0	56.6	50.8
1980	May 12	14.7	19.8	17.2	40.6	52.4	46.5
	June 3	17.2	22.6	19.9	46.8	44.3	45.6
	AVERAGE	16.0	21.2	18.6	43.7	48.4	46.0
1981	May 13	14.6	15.3	15.0	41.3	48.7	45.0
	June 4	15.6	25.2	20.4	35.3	43.7	39.5
	AVERAGE	15.1	20.2	17.7	38.3	46.2	42.2
1982	May 12	14.5	15.0	14.8	33.4	40.4	36.9
	May 28	13.1	17.6	15.4	24.8	34.9	29.8
	AVERAGE	13.8	16.3	15.1	29.1	37.6	33.4

Appendix Table 12. Seasonal yearly average price received per bushel of soybeans in Mississippi, 1979-1982[1].

Year	Seasonal price
	$/bu
1979	6.37
1980	7.75
1981	6.25
1982	5.55

[1] Source: Mississippi Crop and Livestock Reporting Service, *Mississippi Agricultural Statistics*, selected issues.