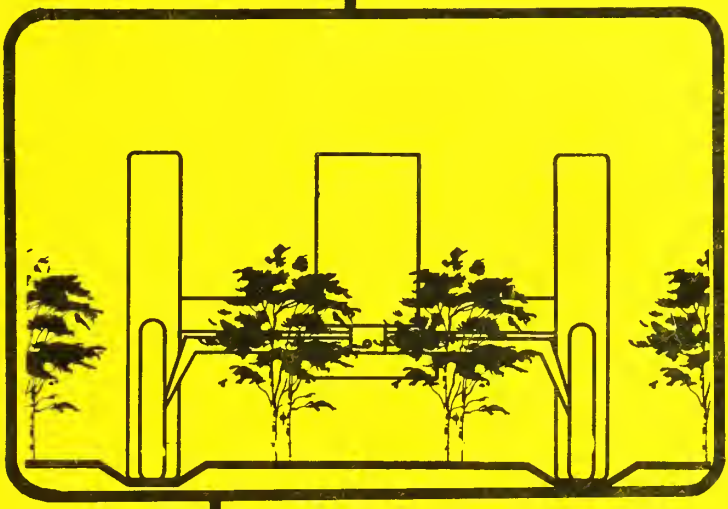
Bulletin 805 August 1973

Stoneville Wide-Bed Cultural Systems



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Stoneville Wide-Bed Cultural Systems

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Table of Contents

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Rising costs for production items s h as labor, equipment, and materials c ntinue to concern cotton farmers in t Mississippi Delta. As an efficient f mer adapts new experiment station c velopments to his own farm, he often a lizes that increased costs for a terials and equipment have wiped o t the gains obtained from the im- oved technology. Declining profit is o t corrected if rising costs for some put items offset the new technology. Advancements that result in real i creases in profits are often slow in d veloping. The subject to be discussed this article is the result of p oximately 10 years of fundamental search, engineering, and testing at the elta Branch Experiment Station at oneville, Mississippi. Final testing is n derway and these results will be a ailable for use in a practicable form by 974.

Wide-Bed Concept

Results from studies of both minimum tillage and skip-row cultural systems have led to a proposed wide-bed ultural technique that is based on one gnificant principle—that the use of ewer linear feet of row per acre could esult in substantial production savings n labor, equipment, and materials. Additional support for the proposed ultural system was provided by Dr. A.W. Cooper (reference 3) in his uggestion to include "zone-tillage" or trench tillage" in the program. The ystem is an unbalanced pattern (Fig. 1) of rows planted alternately 40 inches apart and 60 inches apart (average row width is then 50 inches). This row arrangement requires only 10,455 linear feet of row per acre, compared with 13,068 feet of row per acre for conventional 40-inch spacing, or a reduction of 20 percent in the linear feet of row per acre.

If refinement of the experimental cultural system will allow cotton yields per acre to equal or exceed those obtained with conventional 40-inch row spacing (solid-planted cotton), then each operation normally performed along the row will require less time and material input per acre, and net returns can be improved. Costs of broadcast treatments that cannot be readily modified for application along the row may not be affected. These broadcast treatments would include any full-coverage tillage practice, broadcast fertilizer or herbicide application, and all aerial applications for insect control and defoliation.

The experimental cultural system was originally assigned the code name "WF" (wide-flange), which in engineering terms describes a wider, stronger structural beam than those of standard width and thickness that is capable of withstanding greater stresses. Applied to agriculture, WF could describe a similar beam, if soil can be considered to be the "beam of agriculture". In this usage, the term could denote beds wider than the standard, that support unbalanced rows, yet have greater strength—this greater strength permitting more efficient, more

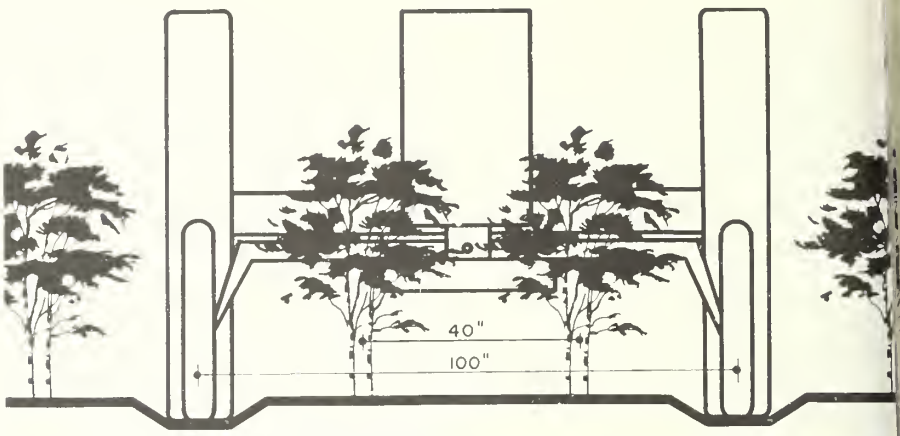

Figure 1. A transverse view of the wide-bed cultural pattern. Furrows ar 100 inches apart, paired rows 40 inches apart.

economical, and more timely manipulation of soils, machines, and men in the total farm system.

Wide-Bed Research

In 1962, the first "wide-bed" treatment was evaluated at the Delta Station. This treatment was one of several evaluated in a minimum tillage study on heavy clay soils that was designed to improve drainage, tilth, and trafficability. These beds were 80 inches wide and were bounded by deep (8 to 10 inches), permanent furrows, which were often referred to as "watermelon beds" in this very early work (Fig. 2). Cotton grew well under this particular arrangement for 2 years, but no outstanding improvements were noted to offset the increased costs of establishing and maintaining the deep furrows throughout a production season. In 1963 wide beds with furrows 120 inches apart were tried. Tractors available at that time were limited in tread width adjustment to about 88 inches; consequently, all machines were forced to travel on the sloping shoulders of the bed, and not in the furrows. Tractors with wide, adjustable front-ends were used, however, to preserve untrafficked zones within the beds.

The concept of deep and permaner furrows was revised into the wide-be concept, and a new research progra was initiated in the fall of 1963. Th program had as its primary objective (1) to reduce production costs and (2) t obtain yields of cotton that would equa or exceed the level being obtained wit 40-inch solid planting. Small-scale fiel plot techniques (two-row equipment 100-foot plots) were used to evaluate th wide-bed cultural system in 1965 an 1966, and again in 1970 and 1971. Th studies were expanded to include six row equipment in 1972 and 1973. Results from the studies on Bosket very fine sandy loam in 1965 and 1966 and or Dubbs silt loam in 1970 and 1971 are shown in Table 1.

As more powerful tractors and wide cultural tools became available, objective 1, the reduction of production inputs, was readily accomplished. However, the yields per acre did not reach an acceptable level until 1971. Preliminary results of expanded studies have confirmed the probability that yields resulting from use of the wide-bed cultural system may equal or exceed the level obtained with solid-planted cotton for a given soil type. Erratic yield results suggest, however, that an optimum

Figure 2. Preparation of "watermelon beds" on Tunica silty clay soil.

Table 1. Effect of WF cultural patterns on yield of cotton, Field 7, Delta Branch Experiment Station, Stoneville, Mississippi, 1965-66, 1970-71.

Cultural pattern	Yield				
	1965[1]/	1966[1]/	1970[2]/	1971[2]/	Average all years
	Pounds of seed cotton per acre of land				
Conventional 40"	3,240	2,500	2,060	1,500	2,310
Wide-bed 80"	2,740	2,210	---	---	---
WF (or wide-bed) 100"	3,000	2,230	1,840	1,820	2,220

[1]/Bosket very fine sandy loam, average of 4 replications.

[2]/ Dubbs silt loam, 4 replications. Other treatments also included, but not shown.

pattern remains to be determined for each soil type. Wide-bed culture, therefore, may not always be limited to the 40-60 inch pattern.

In general, cultural recommendations for a conventional cotton program were followed in all of the years for which yield data are reported. These included subsoiling in the fall and chisel plowing once or twice in the spring, followed by bedding. Eighty to one hundred pounds of nitrogen per acre were applied at bedding in most years. A stubble mulch procedure was followed for conventional 40-inch patterns, and a modified minimum tillage program was used in the wide-bed pattern in 1971.

Although large-scale studies have not been conducted to evaluate the effects of conventional wheel tread spacings in

wide beds, it is of apparent value to note that the pairs of 40-inch rows can be "straddled" with any of several standard machines, including tractors and sprayers, without undue damage to the crop. Culitvation, other tillage, and spraying operations appear to require only (1) a slightly longer toolbar or boom, (2) slightly larger sweeps in the wide-middles (see Fig. 1), and (3) a respacing of pest control apparatus.

Wider (larger) tires have also been used in conjunction with tillage studies for the wide-bed concept (Fig. 3). Objectives of research on this tillage sub-system were to improve the prime-mover floatation and traction possible under adverse field conditions. Satisfactory results in this respect would aid in increasing the number of days that field work could be done. Well-drained fields likely would not require the use of a larger tire. It has already been demonstrated that when a field is well drained a 7-to 10-day advantage is gained in possible field-working da following rainy periods. Wide-t studies were discontinued in 1966 af the success of these tires w demonstrated in a primary tilla program for wider beds. At this tin soil compaction in the nontilled zor was not considered economica important, but the additional da available for field work by havi additional traction and floatation w considered very important. The wid spread use of dual rear tires h generally diminished the need f special, "wide," low-pressure tire Both, however, are adaptable to th wide-bed cultural system and may b used under severe soil conditions fo either tillage, spraying, cultivating, c harvesting operations. The wide middles of this cultural system (Fig. 4 allow almost unlimited field traffic, a needed, yet are limited enough to perm cotton plants on good soils to produc at maximum levels.

Figure 3. Large floatation-type tires used in early wide-bed studies with a 60-horsepower tractor.

igure 4. A six row plot consists of three 100-inch beds, each with two paired 0-inch rows of cotton. Here a two-row plot unit cultivates the central wide ed of a six-row plot; tractor wheels travel only in the wide middles.

It is generally agreed that onventional tapered spindle pickers erform very efficiently in harvesting igh-yield cotton, with an upper limit of apacity, in low gear, of about 4 bales er acre. The highest yield levels in the Mississippi Delta as yet do not threaten he efficiency of the spindle picker, but ow yields do, because: (1) picker fficiency is reduced as yields decline nd (2) costs are about the same whether).115 pounds per foot of row (one bale er acre, 40-inch rows) is harvested or).230 pounds per foot of row (two bales er acre, 40-inch rows).

One of the objectives of wide-bed esearch at Stoneville has been to nature and harvest 25% more seed otton per linear foot of row than has een accomplished with 40-inch rows. This objective will be accomplished when wide-bed (average, 50 inches per row) yields per acre are equal those of 40-inch solid-planted cotton, or 0.144 pounds per foot of row for one bale per acre and 0.288 pounds per foot of row for two bales per acre. Skip-row patterns may also offer the advantage of greater picking efficiencies, but yields per acre generally decline with all skip-row patterns. For instance, yields on the 2 x 1 pattern average 33 percent more per planted acre, but fall short of established yields for solid-planted cotton by about 12 percent per acre.

Two-row plot-size equipment with a 60 h.p. tractor was used in these studies. This procedure allows many important principles of equipment mechanics to be investigated prior to their more costly and sometimes less accurate integration into a full-scale production system. Two-row plot results have been adjusted in the following economic

analyses to reflect expected responses in systems using six- and eight-row equipment.

Research plans to develop and evaluate the full-scale wide-bed system were fully supported by Agricultural Research Service and Mississippi Agricultural and Forestry Experiment Station in 1972. Intense State-Federal cooperation to fully determine the inherent economic advantages of this cultural system is in progress. Forms of tillage and conservation programs involving soil, water, and man-made materials are receiving due attention with principles governing these areas beginning to surface.

As was indicated in the major transition from solid planted to skip-row cotton, additional constraints (adaptations necessary for proper weed control, seeding pattern, fertilizer level, harvesting and tillage program intensity) are placed on any new cultural system. None appear to be serious constraints to efficient use of a wide-bed cultural system at the present state of development, but all must be fully evaluated to avoid the ever present threat of "dollar-swapping," (or allowing economic gains over one system to be replaced by increased costs in another system.

Some Possible Economic Effects of the Stoneville Wide-bed System

The major objective of the Stoneville wide-bed system of cotton production is to reduce production costs and increase returns to cotton farmers. What effects will this system have on production costs? What effect will this system have on returns?

To examine these questions, we must look at the input costs associated with production methods which might be used to produce cotton on 100-inch beds. At present, in the Mississippi River Delta areas of Mississippi and Arkansas, three general groups of production practices are used in producing cotton on commercial cotton farms. T first group, which will be referred to "usual farm practices," is the one m commonly used on cotton farms in t Delta area of Mississippi. Table presents the inputs and costs associat with this group of practices.

A smaller group of farmers u another group of practices whi involves slightly fewer inputs and low costs, but produces yields comparat to those obtained by farmers who follc the usual farm practices. This group practices will be referred to as "more e ficient practices." Table 3 presents the inputs and associated costs.

Table 4 presents inputs and costs fo third group of practices, which a similar to those in Table 3. However, t land preparation methods reflect a d velopment of the cotton Systen Research Group at the Delta Branch the Mississippi Agricultural an Forestry Experiment Station. This lan preparation system has been calle modified stubble planting or limite tillage. This group of practice represents the lowest-cost system c cotton production currently recom mended in the area and is being used b few farmers. This group of practices wi be referred to as "limited tillag practices."

To analyze the impact of a 100-inch bed cotton production system, it mus be compared with present productio systems. Usual farm practices, more ef ficient practices, and limited tillage practices were used as inputs to develop production budgets for 100-inch beds. To develop a detailed budget for 100-inch beds, it was necessary to synthesize inputs, as the results of relatively small plot work do not permit collection of proper measurements to develop a budget.

To synthesize the inputs for the 100-inch beds, the cost of all "in-row" items such as seed, fertilizer, banded herbicides, and ground-applied insecticides were assumed to be 80% of those for 40-

Table 2. Cotton production costs per acre on sandy soils, 6-row equipment, solid planted, and usual farm practices, Delta area of Mississippi.[1/]

Operation	Tractor costs		Equipment costs		Labor costs	Materials costs
	Direct	Fixed	Direct	Fixed		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	5.63
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	5.25	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	2.43
Cultivate	.22	.14	.07	.12	.21	---
Cultivate & postemerge	.28	.18	.10	.19	.27	2.90
Hand weed control	---	---	---	---	3.75	---
Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 4 (custom air)	---	---	2.80	---	.16	5.20
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Chisel	.47	.29	.08	.17	.45	---

Table 2 *(continued)*

Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Disk	.22	.14	.17	.29	.21	---
Bed	.20	.13	.11	.18	.20	---
Rebed & fertilize	.25	.16	.21	.35	.24	4.74
Totals	6.85	4.83	19.43	27.53	21.69	34.65
Total specified costs excluding ginning	$114.98					

1/ **"Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J. M. Anderson, and Arthur M. Heagler. Miss. Agri. and Forestry Exp. Station Bulletin 794, July 1972.**

Table 3. Cotton production costs per acre on sandy soil, 6-row equipment, solid planted, and more efficient practices, Delta area of Mississippi. 1/

Operation	*Tractor costs*		*Equipment costs*		*Labor costs*	*Materials costs*
	Direct	*Fixed*	*Direct*	*Fixed*		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	4.85
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	5.25	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	.81
Hand weed control	---	---	---	---	2.75	

Hand weed control

Table 3 *(continued)*

Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Bed & fertilize	.25	.16	.21	.35	.24	4.74
Totals	5.93	4.24	17.58	26.75	20.72	26.75
Total specified costs excluding ginning	$101.97					

1/ "Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J. M. Anderson, and Arthur M. Heagler. Miss. Agri. and Forestry Exp. Station Bulletin 794, July 1972.

Table 4. Cotton production costs per acre on a sandy soil, 6-row equipment, limited tillage, and more efficient practices, Delta area of Mississippi.[1/]

Operation	Tractor Costs Direct	Tractor Costs Fixed	Equipment Costs Direct	Equipment Costs Fixed	Labor Costs	Materials Costs
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.28	0.18	0.17	0.36	0.27	---
Plant & preemerge	.28	.18	.21	.43	.54	4.85
Tractor & trailer	.10	.12	.06	.13	.40	---
Cultivate	.33	.21	.10	.18	.32	---
Poison thrips	---	---	.18	.21	.15	.34
Cultivate & postemerge	.37	.24	.14	.25	.36	.43
Cultivate & postemerge	.37	.24	.14	.25	.36	2.43
Hand weed control	---	---	---	---	6.00	---
Cultivate & postemerge	.28	.18	.10	.19	.27	1.93
Cultivate & postemerge	.28	.18	.10	.19	.27	.81
Hand weed control	---	---	---	---	3.75	---
Poison x 5 (ground)	---	---	.90	1.05	.75	6.50
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.18	.21	.15	2.12
Harvest	---	---	7.81	12.84	2.50	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.96	8.15	1.58	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.47	.29	.03	.09	.45	---
Subsoil	1.01	.64	.18	.27	.98	---
Bed	.20	.13	.11	.18	.20	---
Bed & fertilizer	.25	.16	.21	.35	.24	4.74
Totals	4.97	3.65	17.36	26.30	20.56	26.75
Totals specified costs excluding ginning			$99.59			

[1/] **"Crop Budgets and Planning Data for Major Farm Enterprises in the Yazoo-Mississippi Delta" by Fred T. Cooke, Jr., J.M. Anderson, and Arthur M. Heagler. Miss. Agr. and Forestry Exp. Station Bulletin 794, July 1972, (referred to as stubble planting in this publication).**

Table 5. Potential cotton production costs per acre on [illegible] farm practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

Operation	Tractor costs		Equipment costs		Labor costs	Materials costs
	Direct	*Fixed*	*Direct*	*Fixed*		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	4.50
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	.19	4.20	---
Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	1.94
Cultivate	.19	.12	.10	.18	.18	---
Cultivate & postemerge	.20	.13	.11	.19	.20	2.32
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 4 (custom air)	---	---	2.80	---	.16	5.20
Defoliate	---	---	.14	.17	.12	1.70
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	08	.17	.45	---

Table 5 *(continued)*

Disk	.22	.14	.17	.29	.21	---
Disk	.22	.14	.17	.29	.21	---
Bed	.19	.12	.18	.29	.18	---
Rebed & fertilize	.19	.12	.18	.29	.18	3.79
Totals	5.80	4.21	17.55	24.43	17.89	28.74
Total specified costs excluding ginning		$98.62				

Table 6. Potential cotton production costs per acre on sandy soil, 6- and 8-row equipment, 100-inch beds, and more efficient practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

Operation	*Tractor costs*		*Equipment costs*		*Labor costs*	*Materials costs*
	Direct	*Fixed*	*Direct*	*Fixed*		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	3.88
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	---	4.20	---
Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	.65
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60

Defoliate	---	---	.17	...	80	5.20
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Chisel	.47	.29	.08	.17	.45	---
Chisel	.47	.29	.08	.17	.45	---
Disk	.22	.14	.17	.29	.21	---
Bed & fertilize	.19	.12	.18	.29	.18	3.79
Totals	5.00	3.70	15.59	23.29	17.04	21.91
Total specified costs excluding ginning		$86.53				

Table 7. Potential cotton costs per acre on sandy soils, 6- and 8-inch row equipment, 100-inch beds, limited tillage, and more efficient practices, Stoneville Triplex Subsoiler, Delta area of Mississippi.

Operation	*Tractor costs*		*Equipment costs*		*Labor costs*	*Materials costs*
	Direct	*Fixed*	*Direct*	*Fixed*		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Row condition	0.23	0.17	0.20	0.42	0.18	---
Plant & preemerge	.19	.17	.25	.51	.36	3.88
Tractor & trailer	.08	.10	.05	.10	.32	---
Cultivate	.25	.16	.13	.24	.24	---
Poison thrips	---	---	.14	.17	.12	.27
Cultivate & postemerge	.28	.18	.15	.27	.27	.34
Cultivate & postemerge	.28	.18	.15	.27	.27	1.94
Hand weed control	---	---	---	---	4.80	---

Table 7 *(continued)*

Cultivate & postemerge	.20	.13	.11	.19	.20	1.54
Cultivate & postemerge	.20	.13	.11	.19	.20	.65
Hand weed control	---	---	---	---	3.00	---
Poison x 5 (ground)	---	---	.72	.84	.60	5.20
Poison x 2 (custom air)	---	---	1.40	---	.08	2.60
Defoliate	---	---	.14	.17	.12	1.70
Harvest	---	---	6.72	10.73	2.15	---
Haul	.60	.72	.30	.78	.75	---
Harvest	---	---	4.27	7.01	1.36	---
Haul	.15	.18	.08	.19	.19	---
Cut stalks	.38	.23	.02	.07	.36	---
Subsoil	.81	.51	.14	.22	.78	---
Bed	.19	.12	.18	.29	.18	---
Rebed & fertilize	.19	.12	.18	.29	.18	3.79
Totals	4.03	3.10	15.44	22.95	16.71	21.91
Total specified costs excluding ginning		$84.14				

ch rows to reflect the reduction in row ngth per acre which occurs with 100-ch beds. All broadcast application sts were assumed to be the same as for -inch rows on one acre. Applicable achinery performance rates were termined by factoring 8-row equip-ent. Equipment costs were deter-ined from costs for 8-row equipment. arvesting costs were based on a 14% nprovement in performance of the cker, rather than 20%, to allow for rning time, dump time, and other rn-row time. All practices, except ubsoiling were assumed to be the same r usual and more efficient practices on 0-inch and 100-inch beds. For limited llage, practices other than subsoiling ere assumed to be the same for both 0-inch and 100-inch beds. It was ssumed that the Stoneville Triplex ubsoiler was used for all tillage ractices on 100-inch beds. This ubsoiler was developed especially for eds this width and offers a cost saving f at least $0.45 per acre for subsoiling.

With these synthesized budgets Tables 5, 6, and 7), it is possible to dentify potential cost reductions when he costs of 100-inch beds are compared vith the cost of 40-inch beds (Tables 2, , and 4). Table 8 presents summary udgets that show cost comparisons etween 40- and 100-inch beds. This table indicates that *every component* of production costs may be reduced if 100-inch beds instead of 40-inch beds are used with usual farm practices. A small portion of the reduction in production costs is attributable to the use of eight-row equipment, rather than six-row equipment, for bedding, row-conditioning, planting, cultivating, and applying post emergence herbicides. The cost reduction directly attributable to using eight-row equipment instead of six-row equipment is $1.53 per acre for usual farm practices. These cost savings assume as many hours of use for wide-bed equipment as for six-row equipment. If the hours are less, then fixed costs would increase and the magnitude of savings will be less. This saving would be smaller for more efficient practices and limited tillage practices, as fewer trips are made through the field with eight-row equipment when these practices are used. As shown in Table 8, total specified costs may be reduced $16.36, or 14.2 percent. Table 9 compares 40-inch and 100-inch beds, using more efficient practices. Total specified costs may be reduced $15.44 per acre, or 15.1 percent. Table 10 indicates a cost-saving potential when 100-inch beds are compared with 40-inch beds and limited tillage practices are used in both systems. Total speci-

Table 8. Comparison of costs per acre to produce 40- and 100-inch beds of cotton on sandy soil in the Delta area of Mississippi, using usual farm practices.

Costs	*40-inch beds*	*100-inch beds*	*Differences*
	Dollars	Dollars	Dollars
Tractor costs			
Direct	6.85	5.80	-1.05
Fixed	4.83	4.21	-.62
Equipment costs			
Direct	19.43	17.55	-1.88
Fixed	27.53	24.43	-3.10
Labor costs	21.69	17.89	-3.80
Materials costs	34.65	28.74	-5.91
Totals	114.98	98.62	-16.36

Table 9. Comparison costs per acre to produce 40- and 100-inch beds of cotto on sandy soil in the Delta area of Mississippi, using more efficient practic

Costs	40-inch beds	100-inch beds	Differen
	Dollars	Dollars	Dolla
Tractor costs			
Direct	5.93	5.00	-.
Fixed	4.24	3.70	-.
Equipment costs			
Direct	17.58	15.59	-1.
Fixed	26.75	23.29	-3.
Labor costs	20.72	17.04	-3.
Materials cost	26.75	21.91	-4.
Totals	101.97	86.53	-15.

fied costs may be reduced $15.45 per acre, or 15.5 percent. Further analysis of 100-inch beds indicates that costs could be reduced $30.84 per acre, or 26.8 percent if limited tillage practices on 100-inch beds are compared with conventional 40-inch beds and usual farm practices.

No analysis of cotton is complete unless all costs of production are included. A farmer must pay ginning costs, land charges, and general farm overhead. Table 11 presents these costs for the three groups of practices for both 40- and 100-inch beds. Yields are assumed to be 700 pounds of lint for usual and more efficient practices for both 40- and 100-inch beds. Delta area cotton yields on most cotton soils other than heavy clay generally average about 700 pounds of lint per acre. Yields of 749 pounds of lint per acre are assumed for both 40- and 100-inch beds for limited tillage practices. From total costs it is then possible to determine the cost of producing 1 pound of lint with each of the three groups of practices. The Stoneville wide-bed system would appear to reduce total production costs by 2.0 cents per pound with limited tillage practices and 2.3 cents per pound with usual farm practices. A 5.5 -cent-per-pound saving might be achieved by using limited tillage practices and 100-inch beds instead of usual farm practic and 40-inch beds. These levels of poss ble cost reductions indicate tha intensive investigation of the Stonevill wide-bed system could result in signif cant savings for cotton farmers.

The final step in comparing variou production systems is to calculate ne returns or profit from the systems bein studied. To consider returns, it i necessary to look at yields. Table indicated that 100-inch bed yields hav varied from 10.8 percent less than 40 inch row yields (1966) to 21.3 percen greater than 40-inch row yields. Wit the use of limited tillage in 1971, yield moved up dramatically in wide-bec tests. Preliminary analysis of 1972 yields, not yet published, are also very promising. If yields for wide beds are much lower than for 40-inch beds, then all cost savings could be lost through reduced income.

What would the possible net returns be from 1 acre of cotton, assuming a price of 26 cents a pound for lint and $50 a ton for cottonseed? Table 12 presents income, costs, and returns from 1 acre of cotton for the various practices on 40- and 100-inch beds, with two yield levels given for 100-inch beds. In this table, yields for 100-inch beds were assumed to be either 100 percent of 40-inch beds or 95 percent of 40-inch beds. No Govern-

Table 10. Comparison of costs to produce 40- and 100-inch beds of cotton on sandy soil in the Delta area of Mississippi, using limited tillage practices.

Costs	40-inch beds	100-inch beds	Difference
	Dollars	Dollars	Dollars
Tractor costs			
Direct	4.97	4.03	-0.94
Fixed	3.65	3.10	-.55
Equipment costs			
Direct	17.36	15.44	-1.92
Fixed	26.30	22.95	-3.35
Labor costs	20.56	16.71	-3.85
Materials costs	26.75	21.91	-4.84
Totals	99.59	84.14	-15.45

ment subsidy payments for cotton were considered in these calculations. An increase in income of $16.35 per acre for the wide bed over 40-inch beds appears to be possible if usual farm practices are used and yields are equal. Additional returns of $15.43 and $15.45 per acre should be possible with the use of more efficient practices and limited tillage practices, respectively, on 100-inch beds if yields equal those on 40-inch beds.

If yields from 100-inch beds are only 95 percent of those from 40-inch beds, the added returns by using 100-inch beds instead of 40-inch beds would be $7.10 per acre for usual practices, $6.15 per acre for more efficient practices, and $5.15 per acre for limited tillage practices.

At some yield below the 95 percent level, all cost savings would be cancelled by the loss of income associated with the yield reduction.

Conclusions

Yield response is the most critical factor in the evaluation of 100-inch beds. Cost reduction is usually of little value unless net incomes are held constant or increased. It is doubtful whether many farmers would adopt a practice which reduced their costs but had no effect on income if yields are reduced by that practice.

The Stoneville wide-bed cultural system offers great potential for reducing the costs of cotton production. The principal question which must be answered is whether this system will produce yields which will maintain or increase income and reduce labor requirements. Research must determine the yield responses with this system and the practices associated with those yield responses before the system can be fully evaluated.

There are many other questions which must also be answered. On what soil types are acceptable yield levels possible? Will it be necessary to vary the size of the wide middles to get acceptable yields on different soil types? What will the year-to-year yield variability be with this system when it is compared with that for 40-inch rows and the more common skip-row systems currently used by farmers?

More intensive research will facilitate the development of tools and practices which could further reduce production costs for this system and result in even greater yield response to the wide-bed production system. Certainly it would appear that some form of limited tillage production system may have its greatest impact in wide-bed cotton culture.

Table 11. Total costs of producing one acre of cotton, 40-inch and 100-inch beds, various production packages.

Item	Specified costs	Ginning at $3.50/ 100# lint	Land (1970)*	General overhead (1970)*	Total costs	Cost per pound of lint
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
40-inch bed						
Usual practices	114.98	24.50[1]/	26.99	15.86	182.33	.260
More efficient practices	101.97	24.50[1]/	26.99	15.86	169.32	.242
Limited tillage practices with 7% yield response	99.59	26.22[2]/	26.99	15.86	168.66	.225
100-inch bed						
Usual practices	98.62	24.50[1]/	26.99	15.86	165.97	.237
More efficient practices	86.53	24.50[1]/	26.99	15.86	153.88	.220
Limited tillage practices with 7% yield response	84.14	26.22[2]/	26.99	15.86	153.21	.205

*"Cost of Producing Upland Cotton in 1970—An Interim Report." March 1971. USDA, ERS, FPED.

[1]/ Assume 700 pounds of lint per acre.

[2]/ Assume 749 pounds of lint per acre.

Table 12. Costs and returns for 40- and 100-inch beds with various production practices and yield responses.[1]/

Item	Income			Total costs	Returns
	Cotton lint	Cotton-seed	Total		
	Dollars	Dollars	Dollars	Dollars	Dollars
40-inch beds					
Usual practices[2]/	182.00	27.48	209.48	182.33	27.15
More efficient practices[2]/	182.00	27.48	209.48	169.32	40.16
Limited tillage practices[3]/	194.74	29.40	224.14	168.66	55.48
100-inch beds					
Usual practices[2]/	182.00	27.47	209.47	165.97	43.50
More efficient practices[2]/	182.00	27.47	209.47	153.88	55.59
Limited tillage practices[3]/	194.74	29.40	224.14	153.21	70.93
100-inch beds—95% of expected yield					
Usual practices[4]/	172.90	26.10	199.00	164.75[6]/	34.25
More efficient practices[4]/	172.90	26.10	199.00	152.69[6]/	46.31
Limited tillage practices[5]/	185.12	27.93	213.05	151.92[6]/	61.13

[1]/ Lint values at 26¢ per pound and cotton seed at $50 per ton (2.5¢ per pound).
[2]/ 700 pounds lint per acre and 1,099 pounds cottonseed per acre.
[3]/ 749 pounds lint per acre and 1,176 pounds cottonseed per acre.
[4]/ 665 pounds lint per acre and 1,044 pounds cottonseed per acre.
[5]/ 712 pounds lint per acre and 1,117 pounds cottonseed per acre.
[6]/ From Table 11 with a change in ginning costs to reflect yield at 95% of those used in Table 11.

Analysis of wide-bed cotton production research clearly indicates that significant additional research inputs are justified and could lead to an excellent payoff to cotton producers.

Summary

The Stoneville wide-bed cultural system has evolved over a period of approximately 10 years. The basic principle of the wide-bed system is that there are fewer linear feet of row per acre in the wide-bed system. Therefore, the input cost of all operations associated with row application should be reduced. This system is supported by results from early tillage experiments and earlier skip-row investigations.

No improvement in yields per acre has been consistently demonstrated in small plots and was not an objective in the development of this cultural system. However, at least one year's results (1971) on Dubbs silt loam soil indicated a solid yield advantage in favor of the wide-bed pattern, or the 40 by 60 spacing of rows. In earlier studies—1965, 1966, and 1970, there was an apparent reduction in yield per acre from using this pattern. Care must be exercised in selecting the width of the wide middles, sometimes referred to as "skips." If row width is increased 25% (from an average of 40 inches to an average of 50 inches), yields per linear foot of row must be increased by a like amount to obtain the yield levels per acre obtained with 40-inch rows.

This analysis indicates that the Stoneville wide-bed system of cotton production may offer opportunities for real cost reductions in cotton production, regardless of the practices used. It also indicates that wide-bed systems coupled with limited tillage practices would have the greatest impact in reducing the cost of producing cotton. In addition to cost reduction opportunities, the Stoneville wide-bed cotton production system offers opportunities for improvement in net income if acceptable yield levels can be maintained, but further research will be necessary before the system can be recommended.

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