7-1-1977

Relationships of row spacings, nitrogen and seeding rates for cotton production in the Mississippi Delta

G. R. Tupper

J. M. Anderson

W. I. Spurgeon

Robert R. Bridge

Bulletin 857 July 1977

Relationships of Row Spacings, Nitrogen and Seeding Rates for Cotton Production in the Mississippi Delta

G. R. Tupper, Agricultural Engineer
J. M. Anderson, Former Agricultural Economist
W. I. Spurgeon, Agronomist
and **R. R. Bridge,** Agronomist MAFES Delta Branch

MAFES

MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
Louis N. Wise, Acting Director
Mississippi State University, Mississippi State, MS 39762

Mention of a trademark or proprietary product does not imply its approval or recommendation to the exclusion of other products.

Relationships of Row Spacings, Nitrogen and Seeding Rates for Cotton Production in the Mississippi Delta

Cotton traditionally has been grown in the Mississippi Delta on rows spaced from 38 to 42 inches apart. These row spacings originated when draft animals were used for pulling tillage equipment and remained in vogue after combustion engines were introduced to power farm tools, primarily because only limited quantitative evaluation of alternative row spacings had been accomplished. Some research at the MAFES Delta Branch in the 1950's evaluated cotton yields on 20-, 40-, 60- and 80-inch rows (13), but the predominance of traditional row widths continued. Bridge *et al* (7) reported that three commercial cotton varieties tested for three years (1971-73) averaged nine percent more lint on 30-inch rows and six percent more than 15-inch rows than on 40-inch rows. Hoskinson *et al* (14) reported that 10- and 20-inch rows yielded about 10 percent more lint than standard 40-inch rows in Tennessee tests. Parish *et al* (17) found that narrow-row cotton yields averaged about five percent more than conventional 40-inch rows in a three-year test in Arkansas. Grissom and Spurgeon (13) reported average yields for 40-inch rows about five percent above 20-inch rows in a four-year test in Mississippi.

Narrow-row cotton has been grown in tests on the Texas High Plains since 1954 (15). Early development of self-propelled finger-type strippers was reported by Tupper (2, 11, 21) and Kirk (15). These developments have led to increased efforts by researchers across the Cotton Belt to develop narrow-row cotton (8, 18, 19, 23 and 25).

The Texas High Plains area has been more successful than other areas in stripping cotton from both narrow-row and conventional row spacings, due to limited plant size and lower relative humidity at harvest time (16). Strippers have not been as successful in research evaluations in the Delta of Mississippi (9). Stripper harvesters using brushes or stripper rolls to remove bolls from cotton have met with limited acceptance in the southeast and Delta. Their use in the area is limited because of once-over harvest, tall cotton, and the high moisture generally prevailing throughout the area (14, 22).

Acceptance of spindle pickers in the more humid and irrigated areas has resulted from their ability to harvest cotton under a wide range of plant and weather conditions. The spindle picker can harvest a number of different varieties, with bolls that vary in size, shape, and storm resistance characteristics (20). However, they are expensive and complicated machines with a relatively low total seasonal capacity (about 200 hours are available for field work in the Delta area of Mississippi during a given harvest season) and high maintenance costs.

An experimental "cotton combine" was introduced in 1969 (12) and demonstrated across the Cotton Belt in 1970 (3) by the Ben Pearson Mfg. Co., Pine Bluff, Arkansas. This cotton combine uses a 13-foot wide combine header to cut the stalks and two tandemly-operated, horizontally-oriented spindle picking units to remove seed cotton from stalks as they are conveyed through the harvester (3). A rear-mounted stalk shredder chops the residue and distributes it over the field. The potential advantages of this machine have increased the technical feasibility of producing narrow-row cotton in the Mississippi Delta (4, 7, 16, and 17).

This study at the MAFES Delta Branch in 1970-73 was designed to develop a cultural system that would be compatible with the cotton combine.

Materials and Methods

Different row spacings were evaluated, using varying plant populations and nitrogen levels over a four-year period (1970-73). Row spacings used in 1970 were 10, 20, and 40 inches. Row spacings in the 1971-73 tests were 15, 30, and 40 inches. Seeding rates each year were 15, 30 or 45 pounds per acre of acid delinted 'Stoneville 213' seed and a 32 percent urea-ammonium nitrate solution was applied at either 40, 80, or 120 pounds of nitrogen per acre.

A split-plot factorial design with four replications was used each year. Nitrogen rates were main plots. Row spacings and seeding rates were subplots completely randomized within the main plots. The 1970 plot design was maintained in the next three years. The soil was a silt loam and all plots were 20 feet wide and 95 feet long.

The test area was land-formed in the spring of 1970 when soil was relatively wet. Seedbed preparation consisted of two chisel operations, one disking and two harrowing operations before planting, to provide a reasonably good seedbed for flat planting. The 40-inch rows were planted on May 6 with a Case double disk-opener planter. An International Number 100 press drill was used to plant the 10- and 20-inch rows on May 7.

The seedbed was very cloddy in 1970 as a result of land-forming when the soil was wet. Dry soil after planting did not permit full activation of the preemergence herbicide. Erratic seedling emergence resulted in plants of unequal size that required delaying post-emergence application about two weeks.[1]

The field was subsoiled at a 90° angle to row direction in fall 1970. The 40-inch rows were planted in 1971 with a Burch planter equipped with experimental "Foose" type openers. The 30-inch rows in 1971 were planted with the Burch planter set on 30-inch centers. The 15-inch rows were planted with the same planter by doubling back in the middles.[2]

Planting systems for the different row spacings in 1972 and 1973 were:

40-inch rows---planted with a Burch planter equipped with experimental "Foose" type openers.

30-inch rows---planted with eight John Deere 71-B flexi-planter units spaced 30-inches apart on a 2¼" x 2¼" toolbar.[3]

15-inch rows---planted with 15 John Deere 71-B flexi-planter units spaced 15 inches apart on the toolbar, with 20-inch spacings directly behind the tractor tires (front cover).[3]

Fluometuron was broadcast preemergence on the 10- and 20-inch rows in 1970. Trifluralin was incorporated preplant with a disk at ½ lb/A on the 15-inch rows in 1972 and 1973 and fluometuron was broadcast preemergence on the 15-inch rows in 1971, 1972 and 1973. Trifluralin was incorporated preplant with a disk at ½ lb/A on the 30-inch rows in 1973 and fluometuron was applied preemergence at 1 lb/A on a 20-inch band on the 30-inch rows in 1971, 1972 and 1973. Fluometuron was applied preemergence at 1 lb/A on a 20-inch band on the 40-inch rows all four years.

All plots were hoed once each year. All post-directed spray applications were ¼ lb. of diuron plus one pint of MSMA per acre.

The 10-inch rows were not cultivated and no post-dir ed spray was applied. The 20- ch rows were cultivated three t es and received a single broac st post-directed spray applica n. Row spacings of 20 inches res ed in reduced cultivator perform ce and cultivation was termin ed earlier than for 40-inch rows.

The 40-inch rows were cultiv ed from four to six times each yea d each treatment received tw to three post-directed sp y applications on a 20-inch b d. The 30-inch rows were cultiv ed five times each year and rece ed one to two post-directed s y applications on a 20-inch b d. Row spacings of 30 inches res ed in reduced cultivator perform ce and cultivation was termin ed earlier than for 40-inch rows.

The 15-inch rows were ot cultivated in any year of the t. They received one broadcast t-directed spray in 1972; two in 71 and 1973. The narrow row dire d-spray applicator (back cover) as patterned after one develope by Brashears *et al* (6).

Insecticides were applied b ir as needed throughout the gro g season and defoliants were ap d at maturity. All plots ce harvested with the experime al cotton combine (back cover). he plots fertilized with 80 and 1 lb N/A were harvested about he week and two weeks later, res c-tively, than the 40 lb N/A p lts because of later maturity resul g from the higher nitrogen rate .

Seed cotton samples ce collected from each plot. L ge sticks were removed by han so samples could be run through he small tower drier in the micro n. The samples were ginned on a 0-saw gin with a standard equip nt

[1] *The 10- and 20-inch row spacings were discontinued at the end of the 1970 season.*

[2] *A new system was developed for planting the 15-inch rows in 1972 and 1973.*

[3] *An irrigation corrugator was attached to the toolbar directly behind the tractor tires to cut a "V" o h about four inches wide and four inches deep for drainage in the early part of the season.*

equence.[4]

Costs and returns were based on put - output prices in the test eriod and do not necessarily flect current market conditions.

Equipment costs and methods of calculation have been reported for equipment currently in use in the Delta area (10). Supplementary calculations were made for the costs of owning and operating a cotton combine. Estimated performance rates of the cotton combine were based on limited field observations on a cooperating farm (24).

Results and Discussion

The 10-inch rows yielded gnificantly more lint than the 40-ch rows in 1970. However, the ress drill was not a satisfactory ethod of planting because of fficulty in obtaining a uniform anting depth. Also, directed stemergence spraying was not ssible without running over tton with the tractor wheels.

The Burch planter used for plant-g 15-inch rows in 1971 was tally inadequate. Yields of plots anted with the Burch planter set h 30-inch row spacing to obtain a -inch row pattern by doubling ack in the middles were lower an yields with other row pacings, because of soil compac-on and wilting of plants during y weather.

The John Deere 71-B flexi-anter was considered an ade-uate system for planting the 15-ch row plots in 1972 and 1973. anting depth control was im-roved, drainage of excess water fter planting was enhanced and rected postemergence herbicide pplication was accomplished with inimum plant damage.

Wilting was more severe on all lots in 1970 because of soil com-action from land-forming early in e spring and the inability to bsoil before planting. Cotton in e 10- and 20-inch rows matured arlier than in the 40-inch rows. he 10-, 20- and 40-inch rows veraged 57, 56 and 38 percent pen bolls, respectively, on eptember 25, 1970. Cotton in the -inch rows in 1971-73 displayed rought symptoms earlier than lots with 30- or 40-inch rows.

Analysis of variance revealed no significant third order interactions between variables (nitrogen rate x row spacing x seed rate) in the 1972 and 1973 tests (Tables 1 and 5). Second order interactions were: Lint yield was significantly higher for 30-inch rows with 120 lb N/A than for 15-inch rows with 120 lb N/A, 15- and 40-inch rows with 80 lb N/A and all three row spacings with 40 lb N/A. The 80 and 120 lb N/A treatments produced significantly more lint per acre than the 40 lb N/A treatments when averaged over all three row spacings and seeding rates (Table 2). Yields of plots receiving 40 lb N/A were significantly higher for 40- and 30-inch rows than for 15-inch rows (Table 1). Increasing nitrogen from 40 to 80 lb/A increased lint yields 143, 192, and 245 pounds per acre for 40-, 30-, and 15-inch rows, respectively.

Yields of plots seeded at different rates did not differ significantly for different row spacings or nitrogen rates (Table 2). However, the 1972-1973 average seed cotton yield was lower for the 15-pound per acre rate (data not reported in Tables).

Plant populations at harvest were highest for 15-inch rows in 1972 and 40-inch rows in 1973 (Table 3). Significantly higher plant populations were recorded for the 40 lb N/A treatments than in the 120 lb N/A treatments averaged over the two-year period.

Hoe labor requirements tended to be higher for low seeding and nitrogen rates, especially when they occurred together. Weed control apparently was enhanced by more shade pressure.

Lint percentage was not significantly affected by row spacing or nitrogen rate but was higher for the 15 lb/A seeding rate (Table 4).

Combine-harvested cotton samples were of lower grade due to more bark content than is generally experienced with the spindle picker. Higher nitrogen and seeding rates reduced lint grades of the combine-harvested samples. Row spacing had no significant influence on lint grades. Staple lengths were not significantly affected by nitrogen rates. The 40-inch rows produced cotton of shorter staple length than that from 30-inch rows in 1973. Staple length of cotton from the 30-pound seeding rate was shorter than that from the 15-pound rate in 1973.

Hand-removed sticks and stems harvested by the cotton combine were lowest for 40-inch rows in 1972, highest in 1973. Sticks harvested increased with increases in seeding rate in 1972. Lower nitrogen rates resulted in lower stick content of seed cotton.

Cotton shorter or taller than 2-1/2 to 3-1/2 feet was much more difficult to harvest with the cotton combine. The very short cotton in 15-inch rows with 40 lb N/A would not convey uniformly through the harvester because of low volume of stalks. The very tall cotton in 40-inch rows with 120 lb N/A would not convey uniformly through the harvester because of excessive volume of stalks.

Total cost of plots treated with 40 lb N/A was less than that for plots

[4]Cotton was ginned at the U.S. Cotton Ginning Laboratory at Stoneville, Mississippi and lint samples were raded by personnel of the Cotton Division of the Agricultural Marketing Service, Greenwood, Mississippi.

treated with 80 or 120 lb N/A (Table 6). Total cost of production for 15-inch rows was lower than for 40- or 30-inch rows. Each incremental increase in seeding rate resulted in sigificantly higher total costs.

Net returns were significantly lower from plots treated with 40 lb N/A and were also lower from 15-inch rows. The reduction in net returns for 15-inch rows was due mainly to the very poor performance at 40 lb N/A. Returns to management tended to be gre for 30-inch rows at 80 and 12 N/A than for either 40- or 15- rows (Table 5). Seeding rates not influence returns to man ment significantly (Table 6).

Study Limitations

Results of this study reflect research using the experimental cotton combine (back cover). Later changes, revisions, and improvements in the prototype harvester may not be reflected by the data in this report.

Simultaneous aerial application of insecticides and defoliants to all plots may have prevented the proper cut-off time of applying insecticides and timing of defoliants for individual plots. Differences in maturity and economic benefits cannot be measured fully with plots of the size used in our tests.

The requirement for once-over harvest as the only means of harvesting narrow row cotton is a serious limitation, given the normal growing season for current cotton varieties and the days available for harvesting operations in most years (5).

Successful once-over harvest with the cotton combine in Mississippi Delta will dep upon, (a) the development o mechanically dependa harvester, (b) adapted varie with earlier maturity than th now available, and (c) a cultu system and/or variety that produce smaller stalks than generally produced with the c mercial varieties and cultu systems now used.

Conclusions

Planting 10-inch rows with the press drill is not satisfactory because of difficulty in obtaining a uniform planting depth and because directed postemergence spraying is not possible without running over cotton with tractor wheels.

Planting 15-inch rows with the Burch planter set on 30-inch row spacing to obtain a 15-inch row pattern by doubling back in the middle is not satisfactory.

The John Deere 71-B flexiplanter is satisfactory for planting 15-inch rows.

Results of the 1972 and 1973 trials with 15-, 30- and 40-inch rows suggest that

(1) lint and cottonseed yields are adversely affected by 15-inch rows and low nitrogen levels, especially by low nitrogen levels, and by either low or high seeding rates,

(2) fifteen-inch rows are more sensitive to drought and soil c paction than are 30- and 40-i rows,

(3) lint yields and net retu tend to be higher for 30-inch row rates of 80 and 120 lb N/A than 15- or 40-inch rows fertilized w these rates of nitrogen,

(4) very short and very tall cot is much more difficult to harv with the cotton combine than cotton 2½ to 3½ feet tall.

Table 1. Cotton: Yield, by nitrogen rate, row spacing and seeding rate, Stoneville, Mississippi, 1970-1973.*

Row spacing	Seeding rate	Year 1970	1971	1972	1973	1972-73[1] Average
inches	lb/A	----------Pound lint per acre----------				
		40 lb N per acre				
40	15	734	725	869	687	778
	30	704	732	883	721	802
	45	735	698	877	697	787
	Average	724	718	876	702	789 c
30[2]	15	739	770	872	742	807
	30	695	710	876	632	754
	45	689	731	849	676	763
	Average	708	737	866	683	775 c
15[3]	15	774	493	790	510	650
	30	716	534	810	634	722
	45	704	485	793	520	656
	Average	731	504	798	555	677 d
		80 lb N per acre				
40	15	751	893	1008	878	943
	30	754	895	995	863	929
	45	820	938	1007	843	925
	Average	775	909	1003	861	932 b
30[2]	15	818	871	1036	875	955
	30	784	892	1058	862	960
	45	793	865	1084	888	986
	Average	798	876	1059	875	967 ab
15[3]	15	823	635	1051	750	900
	30	849	709	984	839	912
	45	777	669	1049	860	954
	Average	816	671	1028	816	922 b
		120 lb N per acre				
40	15	759	967	971	886	929
	30	775	979	1026	934	980
	45	743	960	1021	946	984
	Average	759	969	1006	922	964 ab
30[2]	15	756	924	1054	903	978
	30	815	908	1047	960	1003
	45	799	951	1104	968	1036
	Average	790	928	1068	943	1006 a
15[3]	15	865	723	1045	847	946
	30	856	750	1069	894	982
	45	813	705	997	855	925
	Average	845	726	1037	865	951 b
Interaction		NS	NS	NS	NS	NS

*Means in the same column followed by a different letter differ significantly ($P < .05$) as determined by Duncan's New Multiple Range Test.

[1]1972 and 1973 were the only years treated alike.

[2]Row spacing was 20 inches in 1970.

[3]Row spacing was 10 inches in 1970; 15 inches in 1971---planted with a Burch planter set on 30-inch spacing to obtain a 15-inch row pattern by doubling back in the middle.

Table 2. Cotton: Yield by nitrogen rate and seeding rate, row spacing and seeding rate, and seeding rate. Stoneville, Mississippi, 1972 and 1973.*

Nitrogen rate	Seeding rate	Year 1972	1973	1972-73 Average
lb/A	lb/A	-----Pounds lint per acre-----		
40	15	844	646	745
	30	856	662	759
	45	839	631	735
	Average	846 b	646 b	746 b
80	15	1032	834	933
	30	1012	855	934
	45	1047	863	955
	Average	1030 a	851 a	940 a
120	15	1023	879	951
	30	1048	929	989
	45	1040	923	982
	Average	1037 a	910 a	974 a
Interaction		NS	NS	NS
Row spacing	**Seeding rate**			
inches	lb/A			
40	15	949	817	883
	30	968	839	904
	45	968	829	899
	Average	962 b	828 a	895 a
30	15	987	840	914
	30	994	818	906
	45	1012	844	928
	Average	998 a	834 a	916 a
15	15	962	702	832
	30	955	789	872
	45	946	745	846
	Average	954 b	745 b	850 b
Interaction		NS	NS	NS
Seeding rate				
lb/A				
15 (Average all plots)		966	786	876
30 (Average all plots)		972	815	894
45 (Average all plots)		976	806	891

*Means in the same column followed by a different letter differ significantly ($P < .05$) as determined by Duncan's New Multiple Range Test.

Table 3. Cotton: Plant population and hoe labor requirement, by nitrogen rate, row spacing and seeding rate, Stoneville, Mississippi, 1972 and 1973.*

Treatment	Plant population			Hoe labor		
	1972	1973	1972-73 Average	1972	1973	1972-73 Average
Mean	----------No./A----------			----------hr/A----------		
Nitrogen rate-lb/A						
40	77,000 a	58,300	67,600 a	2.92 ab	1.72	2.32
80	68,700 b	64,200	66,400 ab	3.33 b	1.98	2.65
120	69,900 b	52,100	61,000 b	2.35 a	.90	1.63
Row spacing-inches						
40	53,700 c	66,800 a	60,300 b	1.50 a	1.08 a	1.29 a
30	73,700 b	54,600 b	64,200 b	4.53 c	1.33 a	2.93 b
15	88,100 a	53,200 b	70,700 a	2.57 b	2.18 b	2.38 b
Seeding rate-lb/A						
15	40,000 c	30,800 c	35,400 c	3.27	1.58	2.43
30	70,600 b	58,300 b	64,500 b	2.74	1.50	2.12
45	105,000 a	85,400 a	95,200 a	2.59	1.51	2.05

*Means in the same column followed by a different letter differ significantly (P < .05) as determined by Duncan's New Multiple Range Test.

Table 4. Cotton: Lint percent, lint grade, staple length and stick content, by nitrogen rate, row spacing and seeding rate, Stoneville, Mississippi, 1972 and 1973.*

Treatment	Lint			Lint grade			Staple length			Stick content		
	1972	1973	1972-73 Average	1972	1973	1972-73 Average	1972	1973	1972-73 Average	1972	1973	1972-73 Average
	------Percent-----			-----Index[1]-----			-----32nd inch-----			-----Percent-----		
Nitrogen rate-lb/A												
40	33.1	33.5	33.3	93.0 a	90.4 a	91.7 a	34.2	34.5	34.4	.68 a	.42 a	.55 a
80	31.9	32.3	32.1	89.0 b	86.7 b	87.9 b	34.4	34.2	34.3	.85 b	.74 b	.80 b
120	30.5	33.3	31.9	85.4 c	86.5 b	86.0 c	34.3	34.8	34.5	1.08 c	.46 a	.77 b
Row spacing-inches												
40	31.9	32.6	32.3	89.9	87.2	88.5	34.3	34.3 b	34.3	.75 a	.63 b	.69
30	31.7	33.2	32.5	88.6	87.9	88.3	34.3	34.6 a	34.4	.92 b	.51 a	.71
15	32.0	33.3	32.6	89.0	88.5	88.8	34.3	34.5 ab	34.4	.94 b	.48 a	.71
Seeding rate-lb/A												
15	32.2	33.5	32.8 a	89.4	88.9 a	89.1 a	34.3	34.6 a	34.4 a	.76 a	.55	.66
30	31.6	33.0	32.3 b	89.5	87.9 ab	88.7 ab	34.2	34.3 b	34.3 b	.89 ab	.56	.72
45	31.7	32.7	32.2 b	88.6	86.8 b	87.7 b	34.3	34.5 ab	34.4 a	.96 b	.51	.74

*Means in the same column followed by a different letter differ significantly (P < .05) as determined by Duncan's New Multiple Range Test.

[1]Composite grade index for white cotton: Strict low middling = 94; and Low middling = 85.

Table 5. Cotton: Total costs and net returns by nitrogen rate, row spacing and seeding rate, Stoneville, Mississippi, 1972 and 1973.

Row spacing	Seeding rate	Total costs			Net returns[1]		
		1972	1973	1972-73 Average	1972	1973	1972-73 Average
inches	lb/A	Dollars					
		40 lb N per acre					
40	15	164.46	143.05	153.76	109.25	197.79	153.52
	30	169.07	148.10	158.59	101.18	207.69	154.44
	45	173.25	151.85	162.55	99.03	191.32	145.18
	Average	168.93	147.66	158.30	103.15	198.93	151.04
30	15	172.31	145.79	159.05	78.68	222.18	150.43
	30	175.35	144.88	160.12	96.04	166.94	131.47
	45	177.49	151.08	164.29	99.17	178.17	138.67
	Average	175.05	147.25	161.15	91.30	189.10	140.20
15	15	155.47	134.65	145.06	89.25	116.36	102.81
	30	157.50	144.11	150.81	90.81	171.88	131.35
	45	160.74	142.93	151.84	85.40	113.99	99.70
	Average	157.90	140.56	149.23	88.49	134.08	111.29
		80 lb N per acre					
40	15	173.36	154.39	163.88	131.84	278.66	205.25
	30	177.57	157.55	167.56	119.74	269.47	194.61
	45	182.00	161.22	171.61	118.28	257.70	187.99
	Average	177.65	157.72	167.69	123.29	268.61	195.95
30	15	183.01	154.69	168.85	124.07	279.90	201.99
	30	186.16	160.79	173.48	131.87	264.42	198.15
	45	191.87	165.59	178.73	129.45	267.90	198.68
	Average	187.01	160.36	173.70	128.46	270.74	199.60
15	15	170.63	149.44	160.04	141.90	222.24	182.07
	30	171.93	154.92	163.43	123.06	260.69	191.88
	45	175.10	160.57	167.84	127.84	262.84	195.34
	Average	172.55	154.98	163.77	130.93	248.59	189.76
		120 lb N per acre					
40	15	175.09	157.09	166.09	106.05	279.45	192.75
	30	182.91	164.14	173.53	123.40	296.42	209.91
	45	186.19	168.82	177.51	111.26	296.71	203.99
	Average	181.40	163.35	172.38	113.57	290.86	202.22
30	15	183.43	158.38	170.91	125.36	284.97	205.17
	30	185.69	166.10	175.90	115.54	303.51	209.53
	45	193.97	170.18	182.08	127.16	308.15	217.66
	Average	187.69	164.89	176.29	122.68	298.88	210.78
15	15	169.46	152.08	160.77	130.80	267.27	199.04
	30	174.87	158.28	166.58	135.40	282.77	209.09
	45	179.01	161.76	170.39	110.49	256.86	183.68
	Average	174.44	157.37	165.91	125.56	268.96	197.26
Interaction		NS	NS	NS	NS	NS	NS

[1]Net return is return above specified costs and represents the return to land, management and general farm overhead.

Table 6. Cotton: Total costs and net returns by nitrogen rate and seeding rate, row spacing a seeding rate, and seeding rate, Stoneville, Mississippi, 1972 and 1973.*

		Total costs			Net returns[1]		
Nitrogen rate	Seeding rate	1972	1973	1972-73 Average	1972	1973	1972-7 Avera
lb/A	lb/A	Dollars per acre					
40	15	164.08	141.17	152.63	92.39	178.78	135.59
	30	167.30	145.69	156.50	96.01	182.17	139.09
	45	170.49	148.62	159.56	94.53	161.16	127.85
	Average	167.29 a	145.16	156.23 a	94.31	174.03 b	134.18
80	15	175.67	152.84	163.29	132.60	260.27	196.44
	30	178.55	157.75	168.15	124.89	264.86	194.88
	45	182.99	162.46	172.73	125.19	262.81	194.00
	Average	179.07 b	157.68	168.06 b	127.56	262.65 a	195.11
120	15	175.99	155.85	165.92	120.74	277.23	198.99
	30	181.15	162.84	172.00	124.78	294.23	209.51
	45	186.39	166.92	176.66	116.30	287.24	201.77
	Average	181.18 b	161.87	171.53 b	120.61	286.23 a	203.42
Interaction		NS	NS	NS	NS	NS	NS
Row spacing	**Seeding rate**						
inches	lb/A						
40	15	170.97	151.51	161.24	115.71	251.96	183.84
	30	176.52	156.59	166.56	114.77	257.86	186.32
	45	180.48	160.63	170.56	109.52	248.58	179.05
	Average	175.99 b	156.24 b	166.12 b	113.33	252.80 a	183.07
30	15	179.58	152.95	166.27	109.37	262.35	185.86
	30	182.40	157.26	169.83	114.48	244.96	179.72
	45	187.77	162.28	175.03	118.59	251.41	185.00
	Average	183.25 c	157.50 b	170.38 c	114.15	252.91 a	183.53
15	15	165.19	145.39	155.29	120.65	201.95	161.30
	30	168.10	152.43	160.27	116.42	238.45	177.44
	45	171.61	155.09	163.35	107.92	211.23	159.58
	Average	168.30 a	150.97 a	159.64 a	115.00	217.21 b	166.11
Interaction		NS	NS	NS	NS	NS	NS
Seeding rate							
lb/A							
15 (Average all plots)		171.91 a	149.95 a	160.93 a	115.24	238.76	177.00
30 (Average all plots)		175.67 b	155.43 b	165.55 b	115.22	247.08	181.16
45 (Average all plots)		179.96 c	159.33 c	169.65 c	112.00	237.07	174.54

*Means in the same column followed by a different letter differ significantly ($P < .05$) determined by Duncan's New Multiple Range Test.

[1]Net return is return above specified costs and represents the return to land, manageme and general farm overhead.

Literature Cited

. Anthony, W. S. 1972. Development of a model cotton ginning system. Presented to Southern Regional Meeting, ASAE, Richmond, VA.

. Arkansas Agricultural Engineering Newsletter 2(2):1. Nov. 1963.

. Barnes, H. H., Jr. 1971. Narrow-row high-population cotton. The Farm Quarterly 26(2):82-86. March-April.

. Barnes, H. H., Jr. 1972. Narrow-row systems - how they work, what to try in 72. The Farm Quarterly 27(1):48-49.

. Bolton, B., J. B. Penn, F. T. Cooke, Jr., and A. M. Heagler. 1968. Days suitable for field work Mississippi River Delta area. Dept. of Agr. Econ. Res. Rpt. No. 384, La. State Univ. Nov.

. Brashears, A. D. and D. T. Smith. 1971. Postemerge spray rig for narrow row cotton. Abstract. Twenty-fourth Ann. Meeting S. Weed Sci. Soc., p. 390.

. Bridge, R. R., J. F. Chism, and G. R. Tupper, 1975. The influence of row spacing on cotton variety performance. Miss. Agr. and Forest. Exp. Sta. Bul. 816.

. Briggs, R. E., and L. L. Patterson. 1969. Narrow-row spacings of cotton. Proc. 21st Ann. Cotton Impr. Conf., pp. 102-103.

. Colwick, R. F., G. L. Barker, J. A. Friesen, and K. E. Luckett. 1972. Stripper-type cotton harvest study. Miss. Agr. and Forest. Exp. Sta. Info. Sheet No. 1199. Sept.

10. Cooke, F. T. Jr., J. M. Anderson, and A. M. Heagler. 1972. Crop budgets and planning data for major farm enterprises in the Yazoo-Mississippi Delta. Miss. Agr. and Forest. Exp. Sta. Bul. 794. July.

11. Floyd, C. S. 1971. The big experiment narrow-row, hi-pop cotton. Implement and Tractor 86(22):18-19. Oct. 21.

12. Griffin, T. 1969. Producers eye narrow-row cotton as way to cut costs. Farm Week-Delta 2(44):1, 3. Nov. 6.

13. Grissom, P. H. and W. I. Spurgeon. 1963. Row spacing and nitrogen rates for cotton. Miss. Agr. and Forest. Exp. Sta. Info. Sheet No. 800.

14. Hoskinson, P. E., J. A. Mullins, and T. McCutchen. 1974. Narrow row cotton in Tennessee. Tenn. Agr. Exp. Sta. Bul. 535:1-22.

15. Kirk, I. W., E. B. Hudspeth, Jr., and D. F. Wanjura. 1964. A broadcast and narrow-row cotton harvester. Tex. Agr. Exp. Sta. Prog. Rpt. 2311. May 7.

16. Luckett, K. E., G. R. Tupper, and W. E. Garner. 1975. Evaluation of once-over harvesters in the Mississippi Delta. 1975 Proc. Beltwide Cotton Prod. Res. Conf., p. 114.

17. Parish, R. L., S. M. Brister, and D. E. Mermoud. 1973. Wide-bed narrow-row cotton: Preliminary research results. Ark. Farm Res. 22(2):4.

18. Ray, L. L. 1965. Breeding cotton varieties for broadcast method of cotton production. Proc. 17th Ann. Cotton Impr. Conf., pp. 89-92.

19. Taylor, P. A., J. Czech, and W. Read. 1971. C.S.I.R.O. developments in narrow-row cotton harvesting. Power Farming and Better Farming Digest 80(1).

20. Tupper, G. R., E. J. Matthews, and C. Hughes. (1961-63 Summary of spindle picker harvesting data) published in Ark. Agr. Exp. Sta. Mimeograph Series 114, 128 and 138.

21. Tupper, G. R., and C. Hughes. 1964. Broadcast cotton production? Ark. Farm Res. 8(1):12. Jan.-Feb.

22. Tupper, G. R. 1966. Stripper harvesting vs. spindle picking of open-boll and experimental stripper varieties of cotton. Transactions of ASAE 9(1):110, 111 and 113.

23. Tupper, G. R. 1966. New concept of stripper harvesting of cotton in Arkansas. Transactions of ASAE 9(3):306-308.

24. Tupper, G. R., J. M. Anderson, and W. I. Spurgeon. 1974. Harvesting cotton with an experimental combine. Miss. Agr. and Forest. Exp. Sta. Res. Highlights 37(7). July.

25. Wanjura, D. F., and E. B. Hudspeth, Jr. 1964. Broadcast planting - a method of producing cotton on the High Plains. Tex. Agr. Exp. Prog. Rpt. 2295.