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Production of Cotton Without Postemergence Cultivation or Hand Hoeing

VERNON C. HARRIS¹

The production of certain row crops without cultivation has been tested in many experiments in the past. With the advent of suitable selective herbicides in recent years, the idea was reactivated. In 1950 an experiment was initiated at Mississippi State University to evaluate the efficiency of current preemergence and post emergence herbicides in controlling weeds in cotton without cultivation. Preliminary reports were made in 1951.² The experiments were conducted each year through the 1963 season except in 1960. This is the report on the 13 years of experimentation.

The objectives were (1) to control weeds in cotton without postemergence cultivation or hand-hoeing; and (2) to evaluate selected herbicides alone and in combination applied in the field pre- and postemergence to the crop and weeds. Weed control, type of weed, cost of weed control, and cotton yields were emphasized.

Materials and Methods

The experiment was conducted on Houlika clay loam at Mississippi State University, State College.

A herbicidal oil,³ 4,6-dinitro-o-sec-butylphenol (DNBP), isopropyl N-(3-chlorophenyl) carbamate (CIPC), and 3-(3,4-dichlorophenyl)-1, 1-dimethylurea (diuron) were the initial herbicides evaluated. In 1959 N-(3,4-dichlorophenyl) methylacrylamide (dicryl) was used in combination with diuron and CIPC. In 1961 disodium monomethylarsonate (DMA) was used in combinations with diuron and dicryl. In 1962 and 1963, 2,4-bis (isopropylamino) - 6 - methylmercapto-atriazine (prometryne) and alkylarylpolyoxyethylene glycols, free fatty acid isopropanol (X-77 surfactant) were employed in the experiment.

Herbicides were used as preemergent, postemergent, or in combination of pre- and post emergent, as shown in Table 1.

Land preparation was virtually the same each year. Cotton stalks were cut in the fall, and the land was disked or flat broken with a mouldboard plow. In the spring a mixed fertilizer (1,000 lb/A) was applied broadcast on the area and disked into the soil. The seed-bed was prepared flat. Before the cotton was planted the seed-bed was disked shallow to give loose soil for covering the cotton seeds. No further cultivation was done during the season.

The cotton seeds were planted 1" deep with a one-row tractor and planting equipment. They were hill-dropped 8 to 10 seeds per hill and spaced 10" apart in the drill. In 1962 and 1963 the hill-drop attachments were removed and replaced with a drill-type attachment. Quantity of cotton seeds per acre was the same. Row spacing varied from 26" to 40". Empire Coker, Delfos 9169, Delta and Pine Land, Fox, Rex, and Stoneville cot-

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²Harris, Vernon C. Weed control in cotton without the aid of cultivation. Proc. SWC 4: 85-86. 1951, and Mississippi Farm Research Vol. 15, No. 2, 1-3.

³LHO-1—a herbicidal oil with a boiling range of 305-410°F, aromatics 22-24%, maximum aniline point 128°.

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Table 1.—Weed control in cotton without postemergence cultivation or hand-hoeing over a 13-year period.

No.	Treatment		Year	Seasonal weed control rating	Cost of herbicide or hand-hoeing per acre (\$)	Seed cotton yield (lb/A)	Return (\$)	
	Pre-emergence	Postemergence					Gross	Less weed control cost
1	DNBP	Herbicidal oil	1950	9	\$19.45	3750	\$499.50	\$480.05
2								
3		Cult. and hoeing		9	21.00	2010	280.70	259.70
1	DNBP	Herbicidal oil	1951	9	23.50	2792	362.40	338.90
2								
3		Cult. and hoeing		9	25.00	3610	468.80	443.80
1	DNBP	Herbicidal oil	1952	9	22.50	2555	280.26	257.76
2	CIPC	Herbicidal oil		9	35.00	2383	261.41	226.41
3		Cult. and hoeing		9	32.10	2020	221.70	189.60
1	DNBP	Herbicidal oil	1953	9	22.50	2842	312.62	290.12
2	CIPC	Herbicidal oil		9	27.20	3038	334.18	306.98
3		Cult. and hoeing		9	26.40	2300	253.20	226.80
1	CIPC	Herbicidal oil	1954	9	22.20	1740	191.40	169.20
2	Diuron	Herbicidal oil		9	20.00	1700	187.00	167.00
3		Cult. and hoeing		9	18.40	1830	201.30	182.90
1	CIPC	Herbicidal oil	1955	9	19.50	3016	331.76	312.26
2	Diuron	Herbicidal oil		9	14.00	2509	275.99	261.99
3		Cult. and hoeing		9	26.60	2500	275.00	248.40
1	Diuron	Herbicidal oil	1956	8	11.00	3555	354.78	343.78
2	CIPC	Herbicidal oil		7	19.50	3084	307.78	288.28
3		Cult. and hoeing		9	17.50	2520	251.50	234.00
1	Diuron	Herbicidal oil	1957	8	11.50	2590	284.90	273.40
2	CIPC	Herbicidal oil		7	27.00	2586	284.46	257.46
3		Cult. and hoeing		9	15.00	1800	198.00	185.00
1	Diuron	None	1958	7	9.50	2410	265.10	255.60
2	CIPC	None		6	25.00	2000	220.00	195.00
3		Cult. and hoeing		9	13.00	1900	209.00	196.00
1	Diuron	Dicryl	1959	9	9.50	2620	340.00	330.50
2	CIPC	Dicryl		8	25.00	2570	332.30	307.30
3		Cult. and hoeing		9	14.50	2070	267.80	253.30
1	Diuron	DMA + Dicryl	1961	8	13.00	2300	253.00	240.00
2								
3		Cult. and hoeing		9	20.50	1220	242.00	229.60
1	Diuron	Diuron + X-77	1962	9-11 ¹	16.00	2560	281.60	265.60
2	Prometryne	Prometryne + X-77		8	11.00	2500	275.00	240.00
3		Cult. and hoeing		9	12.40	2200	134.20	113.70
1	Diuron	Diuron + X-77	1963	9	12.00	2992	329.12	317.12
2	Prometryne	Prometryne + X-77		8	14.00	2720	299.20	285.20
3		Cult. and hoeing		9	13.80	2312	254.32	240.52
13-YEAR AVERAGE (1950-63)								
1.	No cult.-herbicide weed control		1950-63	8.7	16.29	2748	314.35	298.02
3.	Cultivation and hand-hoeing		1950-63	9.0	19.70	2176	250.55	231.02
	Difference in 1 and 3			0.3	3.41	572	63.80	67.00

ton varieties were used over the thirteen years.

DNBP was the first potential pre-emergence herbicide, followed by CIPC, diuron, and prometryne. LHO-1 was the only postemergence herbicide known to be worth testing until 1959. Dicryl showed postemergence herbicidal potential in

1959 and was incorporated in the test. In 1961 DMA was brought in focus as a herbicide by the work of Jack T. Thompson⁴ in Georgia. Prometryne and diuron with the addition of a surfactant

⁴Thompson, Jack T. Weed control activity of dicryl enhanced in mixture. Proc. SWC 14: 48-49. 1961.

applied as postemergence herbicides were included in the tests in 1962-1963.

Preemergence herbicides were applied broadcast immediately after planting with a pull-type sprayer equipped with a boom-type applicator. Postemergence treatments were applied with a 3-gallon compressed air sprayer. The postemergence treatments were applied on a broadcast basis. The spray was directed to the cotton plants at a 45° angle. Insecticide applications averaged ten per year.

The size of the plots varied from year to year but they were at least eight or more rows each 150 feet long. The plots were randomized and replicated three or more times.

Weather conditions were mostly favorable each year at the time of planting. Rain occurred between planting and emergence of the cotton 11 of the 13 years. Four years were dry and hot, five were nearly normal, and three had excessive rainfall in the spring and fall.

Weed-control and crop-plant data were taken several times during the season. Weed control ratings were based on values of 0-10, with 0 equalling no weed control and 10 perfect weed control. Data given is the mean average of the replicates of each treatment. Yields of seed cotton per acre were obtained by computing the means from all the replicates.

Results and Discussion

The row spacing of 28" to 30" apart was the most satisfactory. Row spacing was restricted because of type of cotton planter used. In order to vary all the row widths satisfactorily, special equipment would have been required.

Cotton plant populations per acre varied from 66,000 to 100,000 plants according to the row widths planted. Approximately 85,000 cotton plants per acre resulted in best weed control and yields. The 30" row spacing resulted in 85,000 plants per acre. In the years of ex-

cessive rainfall during the harvest season, the cotton rotted where 100,000 cotton plants per acre were present.

The cotton plants on non-cultivated plots produced blossoms 4 to 5 days earlier than those on the cultivated plots. In dry years the cotton plants on the non-cultivated plots did not show moisture deficiency as soon as those on the cultivated. The difference was 10 to 12 days. Some of the cotton plants on the non-cultivated and cultivated plots were dug up during one of the dry years; in the non-cultivated plots the roots were 1 to 2 feet deeper in the soil than on the cultivated plots.

The herbicidal treatments in Table 1 project the current promising herbicides in a particular year. No herbicide used caused severe injury to cotton plants. Some minor injuries such as the discoloration of the cotyledons and first true leaves resulted from some of the treatments. DMA, diuron, and prometryne caused some yellow discolorations of the cotyledons and primary leaves. These discolorations disappeared in 10 to 14 days and did not become evident again during the season. Dicryl caused stunting of the cotton plants and a light green color of the sprayed leaves.

Weed control by herbicides was very satisfactory and in most years was equal or superior to that in the cultivated and hand-hoed check. In the 13-year averages on weed control shown in Table 1 Treatments 1. (Chemical) and 3 (hand hoed) were rated only 0.30 apart, based on a scale of 0 to 10. Data in Table 1 show that diuron applied as pre-emergence treatment and diuron plus a surfactant applied as a postemergence treatment were the most satisfactory treatments. The weed-control ratings were made on annual weeds, not on perennials such as nutsedge and Johnson-grass. No herbicide used in the experiments controlled these two weeds. The experiment was conducted at another

location on plots infested with *Cyperus rotundus* L. (nutsedge), and the weed completely took over the area in 3 years. Cultivation plus hand-hoeing was not rated 10 in weed-control, because the cotton choppers did not do a perfect job of hoeing.

The average annual cost of weeding the cotton with herbicides was \$16.29 per acre and \$19.70 for cultivation and hand-hoeing. Thus the use of herbicides resulted in an average per acre saving of \$3.41. When the cost of weed-control for each pound of seed cotton produced was calculated the herbicide cost was 6 cents per pound and cultivation plus hand-hoeing was 9 cents per pound. Weed-con-

trol with herbicides returned \$6.58 more per dollar invested in weed-control than cultivation plus hand-hoeing.

Variations in yields from year to year were mainly due to the season and insect populations. The mean yield of seed cotton produced without cultivation was 2748 pounds per acre and with cultivation plus hand-hoeing was 2176 pounds. The no-cultivation plots yielded 572 pounds more seed cotton than the cultivated and hand-hoed. The analyses of variance in Tables 2 and 3 show the mean yield and mean net returns for 13 years to be highly significant at the 1% level of probability.

Table 2.—Yield of seed cotton produced in pounds per acre without cultivation and with cultivation plus hand-hoeing.

Year	No cultivation (Treatment 1)	Cultivated (Treatment 3)
1950	3750	2010
1951	2792	3610
1952	2555	2020
1953	2842	2300
1954	1740	1830
1955	3016	2500
1956	3555	2520
1957	2590	1800
1958	2410	1900
1959	2620	2070
1961	2300	1220
1962	2560	2200
1963	2992	2312

L.S.D. .05 = 362 .01 = 508

Table 3.—Returns in dollars per acre above weed control cost of cotton produced without cultivation and cotton produced with cultivation plus hand-hoeing.

Year	No cultivation (Treatment 1)	Cultivated (Treatment 3)
1950	480.05	259.70
1951	338.90	443.80
1952	257.76	189.60
1953	290.12	226.80
1954	169.20	182.90
1955	312.26	248.40
1956	343.78	234.00
1957	273.40	185.00
1958	255.60	196.00
1959	330.50	253.30
1961	240.00	229.60
1962	265.60	113.70
1963	317.12	240.52

L.S.D. .05 = 46.9 01 = 65.8

Summary

Annual weeds were satisfactorily controlled in non-cultivated cotton by a broadcast application of a pre-emergence and postemergence herbicide.

The cost of weed control by herbicides without cultivation was \$3.41 less per acre than the cost of weed control by cultivation and hand-hoeing. Weed control with herbicides without cultivation returned \$6.58 more per dollar invested in weed control than was the case with cultivation plus hand-hoeing.

Cotton weeded with pre- and post-emergence herbicides without cultivation produced 572 pounds per acre more seed cotton than that weeded with cultivation and hand-hoeing. The non-cultivated cotton plants fruited earlier and withstood drought longer than the cultivated cotton plants.

Mean yields and mean net returns per acre for 13 years of weeding with herbicides with no cultivation were significant at the 1% level of probability when compared to the weeding with cultivation and hand-hoeing of cotton.