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Chemical Weed Control
EXPERIMENTS
With Cotton
1951---1954

J. K. Leasure

THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
KNOXVILLE

INTRODUCTORY NOTE

The following recommendation is from the 1954 Research Report of the Southern Weed Conference. This report was prepared by agronomists from ten Southern cotton-producing states.

Control of Weeds in Cotton

"Under most environmental conditions, 6 to 10 pounds of CIPC (broadcast rate) will give satisfactory weed control for three or more weeks after planting. This chemical should be applied immediately behind the planter-press wheel or roller device and in a band (approximately 14 inches wide) centered on the drill. Since the soil type (in general light soils require less chemical than heavy soils) and the row width (36"-72") vary considerably over the cotton belt, no one exact rate for drill application can be given."

* * * * *

Acknowledgments—Some of the experiments reported herein were conducted at the USDA Cotton Field Station, Knoxville, Tennessee, in cooperation with Mr. D. M. Simpson and Mr. E. N. Duncan and at the West Tennessee Experiment Station, Jackson, Tennessee, in cooperation with Mr. J. R. Overton. Their cooperation and help is gratefully acknowledged.

Chemical Weed Control Experiments With Cotton, 1951-1954

J. K. Leasure

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In 1952 the Tennessee Agricultural Experiment Station reported in Bulletin 224 the results of experiments using chemicals as pre-emergence weed control sprays on cotton. In the early experiments, dinitro compounds¹ gave excellent weed control and were recommended for pre-emergence use on cotton although it was noted at this time that injury to the cotton could occur under certain conditions of soil moisture and air temperature.

CIPC — A WEED KILLER

Experiments since that time have covered a wide range of temperatures and soil moisture conditions. In some of these tests, a high percentage of the cotton was injured or killed by dinitro, while other chemicals did no apparent injury to cotton. These experiments have shown that it is possible to control weeds without injury to cotton by the use of a material known as CIPC.² Another group of materials³ (including Karmex-D and Karmex-W) show considerable promise but are still in the experimental stage. Rates high enough to provide good weed control often cause injury.

CIPC is an emulsifiable liquid usually formulated at 4 pounds of active ingredient per gallon. It forms a milky suspension (emulsion) when mixed with water, and is kept in suspension with only slight agitation. When properly applied, CIPC will keep the treated area essentially weed free for three to six weeks after planting. Figure 1 shows a treated row compared with an untreated row. These pictures were taken six weeks after treating.

¹The compound principally used was dinitro ortho secondary butyl phenol.

²This material is known chemically as isopropyl N(3-chlorophenyl) carbamate.

³These materials are chlorinated urea derivatives.

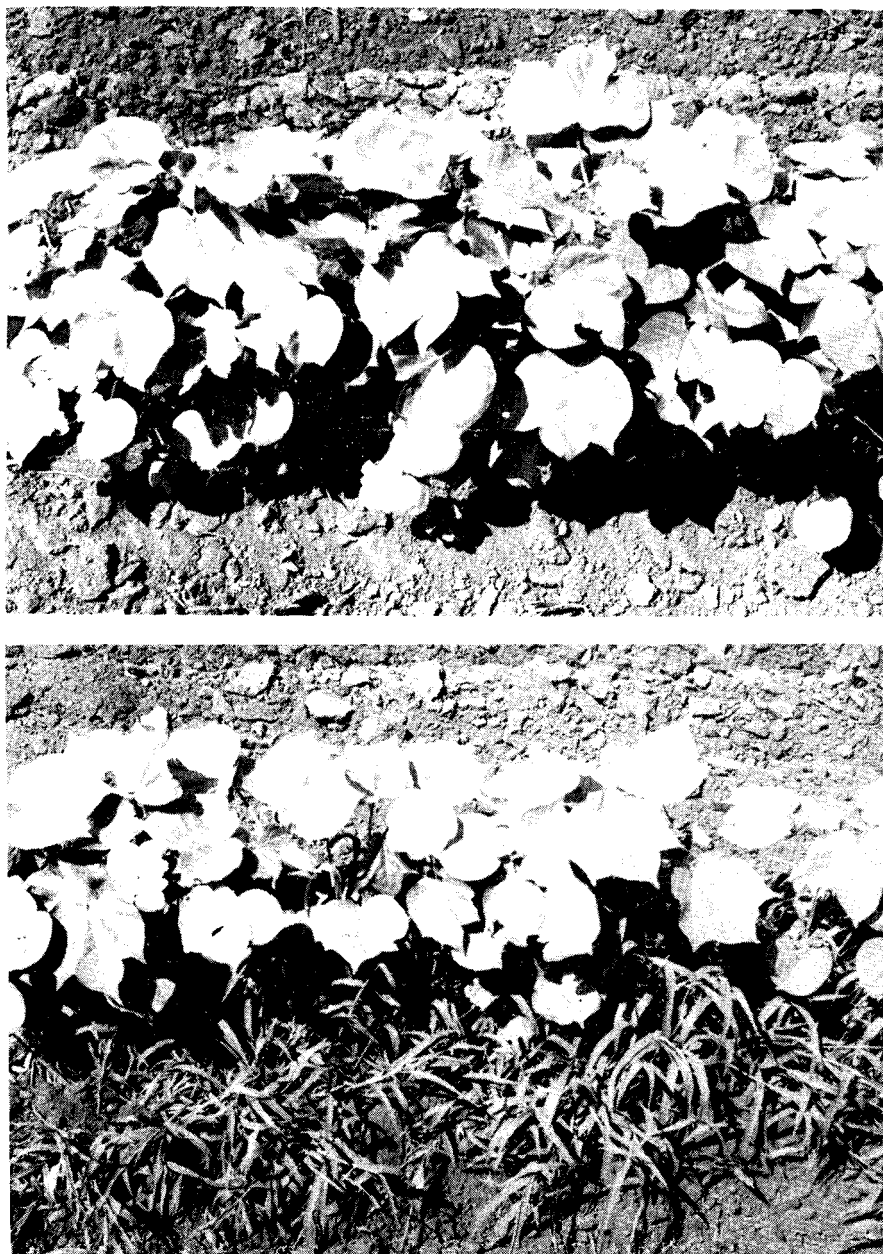


Figure 1.—The upper row was treated immediately after planting with CIPC at the rate of 9 pounds per acre. The lower row is an untreated check. Pictures were taken 6 weeks after treating.

Table 1 shows the results of tests over the past four years with CIPC, dinitro, and Karmex.

Table 1: *Percent weed control and percent stand with pre-emergence weed control treatments on cotton at Knoxville, Tennessee 1951-1954.*

Year	Treatment	% weed control 3 weeks after planting	% stand of cotton
1951	Dinitro 3 Lb./A	41	100
	Dinitro 6 Lb./A	76	100
	Dinitro 9 Lb./A	96	100
	CIPC 6 Lb./A	82	100
	CIPC 9 Lb./A	94	100
1952	Dinitro 6 Lb./A	91	45
	Dinitro 9 Lb./A	98	15
	Dinitro 12 Lb./A	100	2
	CIPC 6 Lb./A	93	100*
	CIPC 9 Lb./A	94	100*
	CIPC 12 Lb./A	99	100*
	Karmex-W 1 Lb./A	47	78
	Karmex-W 1½ Lb./A	84	79
Karmex-W 2 Lb./A	98	71	
1953	Dinitro 6 Lb./A	96	87
	Dinitro 9 Lb./A	99	79
	CIPC 9 Lb./A	98	100
	Karmex-W 2 Lb./A	89	83
	Karmex-D 2 Lb./A	91	82
1954	Dinitro 6 Lb./A	87	100
	Dinitro 9 Lb./A	98	100
	CIPC 6 Lb./A	93	100
	CIPC 9 Lb./A	96	100
	Karmex-D 1 Lb./A	83	96
	Karmex-D 2 Lb./A	94	81

* Some early injury was noted where cotton was planted too shallowly, but the plants recovered completely.

Generally speaking, CIPC (like other pre-emergence treatments) gives good control of annual grasses and most broadleaf weed seedlings but will not control established perennial grasses, weeds, and vines.

Table 2 shows the average number of grass and broadleaf weed seedlings growing in the treated band of cotton rows three weeks after planting and treating.

Table 2: *Numbers of grass and broadleaf weed seedlings per 6 feet of row 3 weeks after planting at Knoxville, Tennessee 1951-1954.*

Year	Treatment	Grass Seedlings	Broadleaf Seedlings
1951	Dinitro 3 Lb./A	56.1	34.8
	Dinitro 6 Lb./A	27.3	14.6
	Dinitro 9 Lb./A	6.1	0.3
	CIPC 6 Lb./A	16.1	17.2
	CIPC 9 Lb./A	5.2	4.6
	Check	117.6	58.7
	L.S.D. (5%)	10.9	5.9
1952	Dinitro 6 Lb./A	4.4	6.2
	Dinitro 9 Lb./A	1.8	1.2
	Dinitro 12 Lb./A	0.0	0.0
	CIPC 6 Lb./A	4.1	3.7
	CIPC 9 Lb./A	3.8	3.0
	CIPC 12 Lb./A	0.7	0.5
	Karmex-W 1 Lb./A	27.6	34.3
	Karmex-W 1½ Lb./A	12.1	6.8
	Karmex-W 2 Lb./A	1.7	0.2
	Check	55.2	60.6
	L.S.D. (5%)	6.1	6.7

1953	Dinitro 6 Lb/A	2.7	1.5
	Dinitro 9 Lb/A	1.7	0.0
	CIPC 9 Lb/A	1.3	2.1
	Karmex-W 2 Lb/A	7.9	4.3
	Karmex-D 2 Lb/A	6.3	4.7
	Check	69.4	47.2
	L.S.D. (5%)	5.8	5.9
1954	Dinitro 6 Lb/A	9.6	7.3
	Dinitro 9 Lb/A	1.3	0.6
	CIPC 6 Lb/A	5.9	2.4
	CIPC 9 Lb/A	0.7	3.8
	Karmex-D 1 Lb/A	11.3	9.7
	Karmex-D 2 Lb/A	4.5	2.8
	Check	71.6	57.9
		L.S.D. (5%)	8.3

A similar test at the West Tennessee Experiment Station, Jackson, Tennessee in 1954 gave the results shown in Table 3.

Table 3: Results of the pre-emergence weed control test at Jackson, Tennessee, 1954. Counts were made 5 weeks after planting.

Treatment	Number of weeds per 6 ft. of row	Percent weed control	Percent Stand of cotton
Dinitro 8 Lb A	2.0	93	86
CIPC 6 Lb/A	0.7	98	95
CIPC 9 Lb/A	0	100	95
CIPC 12 Lb/A	0	100	97
Karmex-D 2 Lb/A	0	100	36
Karmex-W 2 Lb/A	0.7	93	59
Check	27.3	0	100

These results show that CIPC gives weed control comparable with that obtained from the use of dinitro without the risk of serious injury such as was encountered with the use dinitro in 1952 and to a lesser extent in 1953. Similar injury to cotton by dinitro was reported at other places all across the cotton belt in 1952. The injury was particularly severe in the Mississippi Delta Region, and in several instances caused a total loss of the first planting. As a result, one major manufacturer has removed the recommendation for cotton weed control from the dinitro label.

The weed counts (Table 2) taken 3 weeks after treating show that excellent weed control was obtained for at least 3 weeks every year. Actually no hoeing or cultivating would have been required until the sixth week in 1952 and until the fourth week in 1953 and 1954. The number of weed seedlings counted in the rows treated with CIPC is somewhat misleading. Many of the small seedlings, although alive, never developed and eventually died. CIPC affects roots so that they thicken and remain very short. As a result of this extremely reduced root system, seedlings grow very slowly and usually die in a few weeks.

CIPC controls some species of weeds better than others. In general, this material will control crabgrass, purslane, carpet weed, and chick weed very well. It will usually give satisfactory control of morning glories, three seeded mercury and goosegrass. CIPC probably will not give good control of ragweed and pigweed and will not control Johnson-grass, Bermuda grass, nutgrass, cockleburrs or perennial vines.

Results quite similar to these were obtained by experiment stations in the other cotton-producing states. As a result of the general agreement

of these results, the Research Committee of the Southern Weed Conference, during the January 1955 meeting of the conference, reported that it had been unanimously agreed by the committee that, at present, CIPC was the most satisfactory material for region-wide use as a pre-emergence herbicide on cotton.

Regardless of the excellent results which can be obtained by using CIPC, it is recommended that a grower who has never used chemicals for pre-emergence weed control should not attempt to treat his entire acreage of cotton the first year. It is much better the first time to treat only a small portion of the total acreage and observe the results carefully. The grower can expand this treating program with confidence, once assured that the material is being applied properly and is performing satisfactorily.

WHAT CAN CIPC DO?

The proper use of CIPC can be very effective and can be valuable to the cotton grower. In addition to the early season weed control, some additional benefits may extend throughout the season.

1. CIPC is excellent insurance against grass during wet weather in the early season when cultivation would be difficult or impossible.
2. CIPC can reduce the time required for normal chopping or hoeing. In some cases this chopping time has been less than one quarter of the time required to chop untreated cotton. Savings of from \$10 to \$35 per acre have been reported.
3. Since early competition from weeds is greatly reduced, the cotton can make maximum use of available water and fertilizer.
4. Cotton may be cleaner and easier to pick because of fewer weeds in the row.

PROPER USE OF CIPC

For best results, CIPC should be applied on a firm, smooth seed bed, free of weeds and trash. It is best to plant and spray in one operation, since it is easier to keep the spray nozzle centered over the row if it is attached to the planter directly back of the press wheel. If necessary, spraying can be done as a separate operation after planting but care must be taken to assure that the spray nozzles are centered over the row.

It is more economical to spray only a band 12 to 14 inches wide centered over the row. This requires only about one-third as much chemical as spraying the whole field, and keeps the row area clean. The middles can be cultivated and kept clean in the usual manner.

RATE OF APPLICATION

CIPC is recommended at the following rates: For sandy loams and silt loams, treat at the rate of 6 to 8 pounds of CIPC per acre of surface actually treated. When spraying bands along the row, since only about one-third of the field is actually sprayed, only 2 to 2½ pounds (2 to 2½ quarts) of CIPC are needed per acre of cotton.

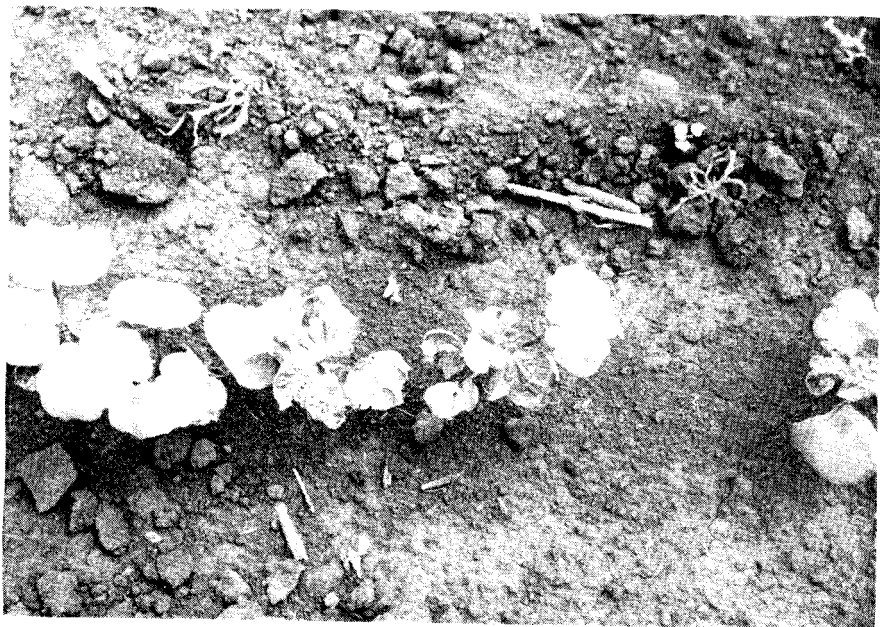


Figure 2.—The upper row was treated immediately after planting with 12 pounds of CIPC per acre. This cotton recovered completely and had a normal crop. The lower row was similarly treated with 24 pounds of CIPC per acre. This cotton died.

For clay loams, treat at the rate of 8 to 10 pounds of CIPC per acre of surface actually treated. For band spraying, this would require only 2½ to 3 pounds of CIPC per acre of cotton.

CIPC has proved less satisfactory on heavy clay soils. It is suggested, therefore, that its use on these soil types be limited to those fields which are free of perennial vines and weeds and where a firm, clod-free seedbed can be prepared.

MIXING AND SPRAYING

Since rate of application is important (too much may injure the cotton and too little will be useless) be sure that the sprayer is applying the proper amount per acre. An increase of 10 to 15 percent in rate will probably not have any effect on the cotton, but more than this will cause the young leaves to become puckered and very brittle. Cotton will recover from slight seeding injury, but can be killed by extremely heavy doses of CIPC. Figure 2 shows cotton which was injured by too much CIPC.

A simple method of calibration is to fill the sprayer tank with water, start the sprayer, and spray one acre. Measure the amount of water required to fill the tank to the original level.

Another way to determine sprayer output in a much shorter time is by the use of a calibration chart as given in Table 4. First measure off 300 feet along the edge of the field, and drive the sprayer rig over this 300 feet and carefully time exactly how long it takes. Then stop the rig and with one sprayer running, determine the time it takes to fill a quart can with the water being sprayed from one nozzle. Find the time it takes to drive 300 feet in the first column in Table 4, then move across that line to the time it takes to fill a quart jar under one nozzle. (If the exact time is not listed, use the time nearest to it, and the error will not be large enough to matter). Sprayer output in gallons per acre is given at the bottom of each column.

Table 4. *Sprayer calibration chart.*

Time to drive 300 ft.	Number of seconds to fill quart jar under one nozzle at different spray rates.									
45 sec.	70	61	55	50	46	43	40	38		
50	78	68	62	56	51	47	44	41		
55	86	75	68	62	57	52	49	45		
60	93	82	74	67	62	57	53	50		
65	101	89	80	73	67	62	58	54		
70	109	96	86	79	72	67	62	58		
75	117	103	93	84	78	71	67	62		
80	124	110	99	90	83	76	71	66		
Gallons per acre spray output	8	9	10	11	12	13	14	15		

For example, if it takes 58 seconds to drive the sprayer 300 feet, then 65 seconds to fill a quart jar under one nozzle, the table would be used as follows:

- (1) In the left hand column, pick 60 sec. (this is the closest number to driving time of 58 seconds).
- (2) Read across this line to 67 seconds (the closest number to filling time of 65 seconds).
- (3) At the bottom of this column read 11 gallons per acre spray output.

Having determined the actual spray output, it is now necessary only to mix the required amount of CIPC in the spray tank. Remember that for each quart of CIPC used, one quart less water will be used. Thus, if the sprayer is applying 11 gallons of water per acre and the rate of CIPC is 3 quarts per acre, 3 quarts of CIPC would be mixed with each 10 gallons and 1 quart of water to give 11 gallons of spray mixture.

Remember to use the same gear and throttle settings when planting and spraying as were used when calibrating the sprayer.

Each nozzle should be checked to insure that all are applying approximately the same rate per acre. If all nozzles are alike, all strainers clean, and all hoses straight and not kinked, no trouble should be encountered.

CULTIVATION

Band spraying will control weeds in the rows, but cultivation will be required to keep the middles clean. When cultivating the middles it is important to set the sweeps or shovels so that only the weedy middles are cultivated. If the treated band is disturbed, weeds will probably begin to grow. Also, if dirt is thrown into the row, live weed seeds will probably be thrown in with it. Do not "dirt the cotton" until weeds actually begin to grow in the row.

UNSATISFACTORY RESULTS

Seldom do all farmers succeed with any new practice. This is true, certainly, of chemical weed control. Some unsatisfactory results can be expected, usually for some of the reasons listed below:

- (1) CIPC is toxic to most seeds. If the cottonseed is not completely covered and is hit with the spray material, it will probably not grow. Be sure that the seed is planted properly.
- (2) Too much CIPC will injure the cotton. An overdose will cause the young leaves to be puckered and very brittle. The cotton will outgrow some early injury, but it is best to avoid it by careful calibration of the sprayer and proper application of the material. The amount of CIPC used per acre can vary as much as 10 to 15 percent from the recommended amount without danger.
- (3) Some weeds are resistant to CIPC. Ragweed, pigweed, cocklebur, Bermuda grass, nutgrass, Johnson grass and perennial vines will not be controlled.
- (4) Too low a rate of CIPC per acre will not control weeds. Careful calibration will provide the correct rate.
- (5) When the field is cloddy, the spray will not cover evenly. Weeds will grow around the edges of the clods.
- (6) Dirt from the middles contains live weed seed. Do not throw dirt to the rows until weeds have started to grow in the rows.

HAZARDS

CIPC is not dangerous or disagreeable to handle. Only normal precautions need to be taken. Avoid splashing the solution in the eyes, and wash the hands thoroughly with soap and water when mixing is finished.

Do not allow seeds or fertilizers to become contaminated with CIPC. This may cause crop injury.

CIPC is not harmful to most crops in small amounts. To clean a sprayer, two rinses with water should make the sprayer suitable for other uses. Empty CIPC containers should be washed thoroughly before using them for other purposes.

NEW MATERIALS AND PROCEDURES

Many experiments with chemical weed control methods are now in progress, both in various experiment stations and on commercial proving grounds, which may point the way toward either better chemicals or more efficient methods. It is entirely possible that the procedures outlined herein will be replaced by better ones within the next few years.

TO INSURE SUCCESS

1. Prepare a good seedbed; smooth, level, firm, and free of trash, clods and weeds.
2. Calibrate the sprayer carefully. Be sure all nozzles are delivering at about the same rate.
3. Plant carefully, being certain that the seed is properly covered.
4. Be sure that the spray band is centered over the row.
5. Cultivate carefully: do not disturb the treated band or throw dirt into it until weeds start to grow in the band.
6. Treat only a portion of the total acreage the first year, unless experienced in using pre-emergence weed control chemicals.