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Influence of Postemergence Herbicides on the Fiber Quality of Selected Cotton Varieties[1]

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POSTEMERGENCE HERBICIDES are of particular interest for weed control in subhumid areas where rainfall may be insufficient for action of many preemergence herbicides. It has repeatedly been found that cotton yield was not influenced by postemergence herbicides, assuming the plants were treated at a safe stage, but fiber quality was not analyzed. However, many workers have reported yield reduction and crop injury from misapplication of herbicides (1, 2, 3, 5, 6, 8). Johnson[3] showed N-(3,4-dichlorophenyl)-methylacrylanilide (dicryl) to delay maturity in cotton, which could influence fiber quality. Everson and Arle (3) found that preemergence applications of 3-(p-chlorophenyl)-1,1-dimethylurea (monuron) in excess of 2 pounds per acre reduced boll weight, fiber length, and fiber coarseness. Scifres et al. (7) found that 1,1'-dimethyl-4,4'-dipyridinium cation (paraquat) did have some influence on cotton fiber quality, particularly fiber coarseness. On the other hand, Foy and Miller (4) reported that 2,2-dichloropropionic acid (dalapon) treatments did not influence fiber quality. However, no report was found on the influence of the most widely used postemergence cotton herbicides on fiber quality.

Research was conducted in the field to determine the influence of five postemergence herbicides on cotton fiber length, strength, fineness, and seed germination. Five genetically different upland cotton varieties were used in the analysis because genotype may have some influence on herbicide phytoxicity.

MATERIALS AND METHODS

Five upland cotton varieties ('Parrott,' 'Acala 4-44,' 'Verden,' 'Paymaster 101A,' and 'Lankart 57') were seeded in a split plot design with four replicates in a loam soil near Stillwater, Okla., in 1964 and 1965. When the plants were at least 20 cm tall, the herbicides were applied at the normally recommended rate and at double that rate. The herbicides and rates used were 3-(3,4-dichlorophenyl)1,1-dimethyl urea (diuron), 0.44 and 0.89 kg/ha; disodium methanearsonate (DSMA), 2.8 and 5.6 kg/ha; 2,4-bis-(isopropylamino)-6-methylmercapto-s-triazine (prometryne), 0.85 and 1.7 kg/ha; 2(m-triflouromethylphenyl)-1,1-dimethyl urea (C-2059), 2.2 kg/ha; and 3,4 dichlorobenzyl-N-methylcarbamate (UC 22463), 4.4 kg/ha. Diuron, prometryne, and DSMA were used at two rates both years. The other two herbicides were used at only one rate in 1965 only. A nonionic surface active agent (surfactant — in this case, surfactant WK) was used in combination with all herbicides at a rate of ½% on a volume basis.

The herbicides were applied as directed sprays in such a way that only the bottom 4 cm of the cotton stem was wetted. This is the normal application procedure for postemergence cotton herbicides. The plants were treated twice, when 25 and 50 cm tall in 1964 and when 20 and 40 cm tall in 1965. All treatments were applied in 372 liters of water per hectare.

Composite fiber samples were collected from 20 plants selected at random from each plot. The fiber was ginned on a saw gin and fiber quality determinations made, each sample being subsampled and analyzed twice. Fiber coarseness was determined on a micronaire and is expressed as micronaire readings in μg/cm. Fiber strength was determined on a stelometer and was expressed as the 1/8 gauge reading in g/grex. G/grex times 386.89 equals g/m^2. Fiber length was determined on digital fibergraph and is given as the 2.5 span length in centimeters. Twenty-five seeds in each of four replications were germinated in a Da-Lite Jr. germinator.

RESULTS AND DISCUSSION

Variation in fiber coarseness was found between the varieties in 1965 but not in 1964 (Table 1). In general, the Acala variety was finer than the other varieties. Some possible influence of the herbicide on coarseness was noted in 1964 in that all treated plots were finer than the untreated check of the Paymaster variety. However, this did not hold true in 1965.

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[3] Johnson, J. W. 1961. The physiological effects of different rates of N(3,4-dichlorophenyl) methylacrylamide on cotton. MS. Thesis, Oklahoma State University.

Table 1. Influence of several postemergence herbicides on the fiber coarseness of three cotton varieties.

Herbicide used		Fiber coarseness, micronaire (mcg/cm)					
Name	kg/ha	Acala 4-44		Paymaster 101A		Lankart 57	
		1964	1965	1964	1965	1964	1965
Diuron	0.44	1.5	1.9	1.8b	2.1	1.6b	2.0
Diuron	0.89	1.6	1.9	1.5a	2.0	1.7b	2.0
Prometryne	0.85	1.5	1.8	1.7b	2.0	1.2a	2.0
Prometryne	1.7	1.6	1.8	1.6b	2.1	1.7b	2.1
DSMA	2.8	1.6	1.8	1.6b	2.0	1.7b	2.0
DSMA	5.6	1.6	1.8	1.7b	1.9	1.8b	2.1
C-2059	2.2	-	1.8	-	2.0	-	2.1
UC 22463	4.4	-	1.9	-	2.0	-	2.0
(Check)	-	1.7	1.9	2.0c	1.9	1.6b	2.0

* Figures followed by different letters within a variety and year are significantly different from each other at the 1% level of significance; the absence of letters indicates that there is no significant difference.

Table 2. Influence of postemergence herbicides on the length of cotton fibers of different varieties.

Herbicide used		Fiber length, cm at 2.5 span length					
Name	kg/ha	Acala 4-44		Paymaster 101A		Lankart 57	
		1964	1965	1964	1965	1964	1965
Diuron	0.44	0.44	0.44	0.39	0.39	0.42	0.41
Diuron	0.89	0.44	0.45	0.40	0.38	0.41	0.40
Prometryne	0.85	0.44	0.45	0.40	0.40	0.41	0.42
Prometryne	1.7	0.43	0.43	0.39	0.40	0.41	0.41
DSMA	2.8	0.45	0.45	0.39	0.39	0.42	0.41
DSMA	5.6	0.44	0.44	0.39	0.38	0.43	0.40
C-2059	2.2	--	0.45	--	0.39	--	0.41
UC 22463	4.4	--	0.43	--	0.40	--	0.42
(Check)	-	0.44	0.44	0.38	0.39	0.43	0.41

Parrott and Verden varieties showed no influence of the herbicides on cotton fiber coarseness in either year.

Fiber length differences were found among the varieties, but no effects due to herbicide were found in any variety (Table 2). Year effects were small for all varieties. As shown with other fiber characteristics, fiber strength varied significantly between varieties (Table 3). However, in only two instances did a herbicide significantly affect strength. The low rate of prometryne appeared to reduce strength in Lankart 57 in 1964 and the high rate of DSMA reduced the strength of Paymaster 101A. However, the lack of confirmation of these differences in 1965 suggests that they are random variations. Acala, Parrott, and Verden showed no affect.

Seed germination was tested in 1965. As with the other characteristics, there was considerable variation in germination among varieties. However, no influence of the herbicides on seed germination within a variety could be detected.

Table 3. Influence of postemergence herbicides on the fiber strength of three cotton varieties.

Herbicide used		Fiber strength, g/grex (1/8 gauge readings)					
Name	kg/ha	Acala 4-44		Paymaster 101A		Lankart 57	
		1964	1965	1964	1965	1964	1965
Diuron	0.44	2.79	2.72	2.32	2.01b	2.18b	1.88
Diuron	0.89	2.73	2.56	2.25	1.98b	2.03b	1.89
Prometryne	0.85	2.77	2.59	2.33	2.18b	2.14b	1.86
Prometryne	1.7	2.62	2.64	2.27	2.02b	1.73a	1.96
DSMA	2.8	2.70	2.63	2.24	2.14b	1.98b	1.93
DSMA	5.6	2.60	2.59	2.26	1.73a	2.05b	1.88
C-2059	2.2	--	2.62	--	2.14b	--	1.90
UC 22463	4.4	--	2.55	--	2.11b	--	1.98
(Check)	-	2.70	2.52	2.33	2.11b	2.13b	1.89

* Figures followed by different letters within a variety and year are significantly different from each other at the 1% level of significance; the absence of letters indicates that there is no significant difference.

It is obvious that there is considerable difference between cotton varieties in fiber quality. When postemergence herbicides were used, they influenced neither the fiber length nor the seed germination after ginning of any of the five varieties. Fiber coarseness and strength were possibly affected in a few instances, but not consistently by any one herbicide. The variation appeared to be due to random chance rather than to the herbicides.

LITERATURE CITED

1. BINGHAM, S. W., and W. K. PORTER, JR. 1961. The influence of N-(3,4-dichlorophenyl) methacrylamide on early growth and development of cotton. Weeds 9(2):282-289.
2. DRAKE, D. C., A. W. WELCH, L. W. COWART, and H. C. OLSON. 1963. Selective post-emergence weed control with substituted ureas plus surfactant. Proc. S. Weed Conf., 16:79.
3. EVERSON, E. H., and H. F. ARLE. 1956. The effect of the application of varying rates of CMU at different stages of plant growth and fiber develpoment on the yield and fiber quality of irrigated upland cotton. Weeds 4(2):148-155.
4. FOY, CHESTER L., and JOHN H. MILLER. 1963. Influence of dalapon on maturity, yield and seed and fiber qualities of cotton. Weeds 11(1):31-36.
5. HOLSTUN, J. T., JR., and S. W. BINGHAM. 1960. Several triazines as selective post-emergence herbicides in cotton. Weeds 8(2):187-197.
6. PORTER, W. K., JR., C. H. THOMAS, and J. B. BAKER. 1959. A three year study on the effect of some phenoxy herbicides in cotton. Weeds 7(3):341-348.
7. SCIFRES, C. J., and P. W. SANTELMANN. 1966. Response of cotton and sorghum to post-emergence applications of Paraquat. Weeds 14(1):86-88.
8. WIESE, L. R., C. HARVEY, and E. B. HUDSPETH. 1964. Weed control in cotton with post-emergence herbicides. Proc. S. Weed Conf. 17:65-66.