EFFECT OF POST EMERGENCE HERBICIDES ON COTTON YIELD AND FIBER QUALITY

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INTRODUCTION

Weeds are estimated to cause losses of over $4\frac{1}{2}$ billion dollars to agriculture each year in the United States. In Oklahoma alone, weeds are responsible for an annual 17 million dollar loss to row crop agriculture. The proper use of herbicides can greatly reduce these heavy losses. For instance, in cotton herbicides can reduce the man hours needed to produce a crop from 30 to 12 and lower the cost of weed control from about $20 to $10 or less per acre (26). Cotton is exceeded only by corn in the total acres chemically treated for the removal of weeds. The investigations reported here are primarily concerned with herbicides applied after the crop has emerged (post emergence). These herbicides appear to have a particular value in Oklahoma for the following reasons:

1. Herbicides applied before the crop emerges (pre emergence) may fail due to the lack of adequate moisture the first few critical weeks after application.
2. Usually there is less herbicide applied at one treatment with post emergence treatments. This will allow for subsequent retreatments if necessary and reduces the risk of soil residue problems.
3. Some farmers plant their cotton in a furrow and apply herbicides at the same time. Rain may then carry the herbicide to the furrow bottom and concentrate it directly over the seed. When the seedlings emerge, they may be injured by the herbicides.

4. Delaying the treatment until the producer is sure of a cotton and weed stand enables him to better evaluate his particular situation. Careful inspection of the problem allows the producer to more selectively choose the best weed control treatment.

A good herbicide not only removes the undesirable competitors, but does it selectively by causing little damage to the crop plant involved. The purposes of these studies were to evaluate several potential post emergence herbicide treatments for possible use in Oklahoma, to determine the best time in the cotton crop's life cycle to apply them, and to determine whether various varieties react differently to the herbicides.

REVIEW OF LITERATURE

Elliot believes "in order for complete mechanization to move ahead, the chemical and mechanical control of grass and weeds in cotton must catch up with mechanical harvesting as soon as possible" (8). Post emergence herbicides may serve a great part to help the producer reach this goal. A herbicide or system to kill seedling and established weeds and prevent the development of weeds from seed in the soil would help weed control catch up with mechanical harvesting (19).

Hand labor has been accounted as attributable for 60 to 70 percent of the total production labor in growing cotton under mechanized conditions (17). Over 533,000 acres of cotton were treated post emergence in 1959 as opposed to nearly twice as much pre emergence. By 1962, 3,365,000 acres were being treated at planting time with 2,068,000 acres receiving treatments after the cotton and weeds had emerged (26).

The prime requisite for satisfactory post emergence control of weeds is an actively growing plant at treatment time, usually not over one half to two inches in height (5). Larger weeds or those enduring physiological stress are drastically more tolerant to chemical poisons. Several workers have reported on the effectiveness of dicryl and dicryl-DSMA mixtures on small weeds (12, 14, 28). A diuron-surfactant mixture has proven very effective on young annual weeds with rates as low as .2 pound per acre and one half percent wetting agent on a per volume basis (18, 28). These materials and others show several distinct advantages over the other methods of controlling weeds that are growing along with the crop.

The stage of cotton growth and its maturity also causes primary concern when applying chemicals. Bingham and Porter found dicryl applied to cotton foliage reduced cotyledon weight of five and six day old plants (2). This is understandable as young leaves are much more penetrable (4). Drake et. al. states cotton three inches or smaller is damaged by diuron and the treatment is potentially dangerous on the crop up to a height of six inches (5). Everson and Arle applied varying rates of monuron to several cotton growth stages and found the greatest damage to plants in the seedling stage receiving from one half to four pounds of the herbicide per acre (9). Dicryl proved non-injurious when applied as a directed spray to cotton from three inches tall to bloom stage (12). According to Holstun and Bingham several of the s-triazines lacked selectivity on younger cotton but possessed promise for older stages of maturity (19). Johnson's data showed dicryl at four and eight pounds per acre to delay maturity of cotton from the two leaf to the young boll stage (20). Porter et. al. indicated cotton in the early and mid-bloom stages of growth to be the most susceptible to phenoxy herbicides (24). Wiese et. al. report the safe use of diuron and prometryne at .2 pound per acre on 3, 4, 6 and 9 inch cotton (30).

Pre emergence applications of monuron in excess of 2 pounds per acre reduced the boll weight, fiber length and fineness in irrigated cotton (9). In studies conducted by Foy and Miller dalapon treatments did not produce any significant difference in fiber analysis (11).

Recently there has been question as to the degree a plant's genotype may influence its tolerance to herbicides. Wheat, barley and oats have been found to vary between varieties in response to herbicides (16, 27). Genetic factors are held responsible for corn and sorghum reaction to the s-triazines (1, 15, 23). Grogan et. al. found a recessive gene to control the tolerance to atrazine and simazine in a susceptible inbred line of normally resistant corn (13). Eastin et. al. used sucrose and glucose to prevent these toxic effects (6). Data has yet to show the same is true with cotton. Waddle et. al. employed several cotton varieties having varying seedling characteristics in an effort to determine any differences in susceptibility to pre emergence herbicides (29). Diuron, CIPC and DNBP caused no more stand reduction than the controls. Foy postulates the lysigenous glands to function in detoxifying and storing herbicides (10).

Palmer and Ennis give penetration of the cuticle or surface and reaction with the protoplasm or cell structure as the processes involved in the toxicity of a herbicidal oil (22). Post emergence naptha will not injure cotton one to five weeks old but was found to reduce yields of 27 to 59 day old cotton (18). This is primarily a result of the cork cracks forming in the stems due to secondary growth of the cork cambium (periderm). These openings provide a site of accumulation and a point of entry (22). This is in direct agreement with Ratcliff et. al. as they also believe loss of the waxy cuticle to be the most important factor in an oil's herbicidal activity (25).

The contrary is true with flame weeding as it is much safer when the crop is taller than 10 inches but unreliable in smaller cotton (18). Edwards cites evidence proving flame to reduce yields in cotton six inches or less in height (7). Larson emphasizes the necessity for several applications as a distinct disadvantage when burning off weeds

(21). Brown lists flame only as a supplement to chemical and mechanical weed control attaching the main problem to timeliness and the necessity of direction (3).

The success of post emergence weed control depends on several factors and interaction of their relationships. Points of prime consideration are herbicide rate and formulation, timeliness and direction of treatment, surfactant, and crop growth stage and genotype.

MATERIALS AND METHODS

The herbicides studied in these investigation are ametryne (2-methylmercapto-4-ethylamino-6-isopropylamino-s-triazine), dicryl /N-(3,4-dichlorophenyl) methylacrylanilide/, diuron /N-(3,4-dichlorophenyl) -1,1-dimethylurea/, DSMA (disodium methanearsonate), paraquat dichloride (1,1'-dimethyl-4,4'-dipyridylium cation), and prometryne /2-methylmercapto-4,6-bis(isopropylamino)-s-triazine/. Rates listed for all herbicides are in pounds active ingredient applied per treated acre.

A surface active agent (surfactant) was used in combination with all herbicides except dicryl. One-half percent on a volume basis was used with ametryne, prometryne, and diuron. This rate was also used with paraquat in 1963. However, in 1964, the amount for paraquat was changed to one-tenth percent on a volume basis. With DSMA one percent of the total solution was surfactant. The commercial surfactants "Multi-film X-77" and "Surfactant WK" were used interchangeably. Both are non-ionic surfactants.

All treatments in the Stillwater area were applied with an experimental plot tractor sprayer. High clearance commercial spray tractors were used at Altus and Chickasha.

In all instances treatments were applied in forty gallons total solution per acre. In all studies the cotton was pl nted in 40 inch rows. Field applications were directed to the base of the cotton plant in an effort to treat only the lower 1.0 to 1.5 inches of the stem. A band width seven inches on either side of the cotton row was always used.

The studies involving cross flaming were treated with an Arkansas Foundry Company (AFCO) flame weeder equipped with Stoneville burners.

The Response of Cotton at Various Growth Stages to Four Post Emergence Herbicides.

In 1963 at the Paradise research station, a dryland study was established to evaluate the response of various cotton growth stages to diuron, prometryne, paraquat and DSMA. Parrott variety of cotton was used. The experimental design was a randomized complete block in a split plot arrangement with four replicates. The growth stage of cotton at treatment served as main blocks, and herbicide treatments consituted the two row by 50 foot subplots. The first growth stage was treated when the crop was three inches tall. Subsequent heights were treated at three inch intervals until the last stage of fifteen inches tall.

The Response of Cotton Varieties to Applications of Four Post Emergence Herbicides.

Part of these studies were conducted in the greenhouse in the winter of 1963. The varieties tested were Pima S-2, Acala 4-42 glanded, Lankart 57, Coker and Paymaster 101 A. Each variety was treated as a separate randomized complete block with five replications. The cotton was seeded in flats (12" X 8" X 4") containing a sandy loam soil, allowed to emerge to a stand, then thinned to ten plants. Treatments were foliar applications with a small experimental bicycle type plot sprayer. Ten days after treatment the plant material was harvested and weighed.

In 1964, a field study was conducted at the Perkins research station to compare responses of the five varieties tested in greenhouse studies plus Parrott, Verden and Acala 4-42 glandless. A randomized complete block split plot design was utilized with the varieties planted as main blocks and herbicides as subplots. Subplot size was two rows by thirty feet long. The first treatment was applied when the crop was twelve to fifteen inches in height. After the cotton grew approximately five inches more a second treatment was applied. The plots were overhead irrigated as needed to maintain the plants in an active growing condition. Ten plants selected at random from each plot were harvested. Only one harvest was made and samples were taken from these for fiber quality determinations. Fiber quality was measured as micronaire (micrograms per inch), stelometer 1/8" gage (strength) and 2.5 span length.

Cotton and Weed Response to Several Post Emergence Weed Control Treatments.

These studies were located at Altus and Chickasha to study not only crop reaction to post emergence herbicides, but efficiency in weed control as well. They were designed as randomized complete blocks with four replicates. Plots four rows by 100 feet in length were used. Initial treatments were applied at both locations when the crop was six to nine inches tall and weeds were 1.0 to 1.5 inches tall. The varieties planted at Altus were Western Stormproof in 1963, and Deltapine Smoothleaf in 1964. Lankart 57 was used at Chickasha both years. Both locations were furrow irrigated. The weeds found at Chickasha were the pigweeds (*Amaranthus retroflexus* and *A. hybridus*), hairy crabgrass (*Digitaria sanguinalis*), green foxtail (*Setaria viridis*), puncture vine (Tribulus terrestris) and red sprangletop (Leptochloa filiformis). Weeds present at Altus were the pigweeds, hairy crabgrass and coloradograss or texas panicum (Panicum texanum).

Comparison of Flame Weeding to Three Post Emergence Herbicides.

This experiment was established at the Perkins research station in 1964, to compare the effectiveness of flame weeding to diuron, prometryne, and to paraquat in controlling emerged weeds in the cotton rows. The study was designed as a randomized complete block with four replications. The plots were two rows by 100 feet in length planted with Parrott variety of cotton. Weeds present were the pigweeds, crabgrass and johnsongrass (Sorghum halepense).

Crop response data collected at Altus and Chickasha was yield, injury ratings and stand counts. Weed control data was taken as counts per square foot and percent control on a visual rating basis. A 100 foot row was hoed in the treated area to compare treatments as to their effectiveness in reducing labor costs.

RESULTS AND DISCUSSION

The Response of Cotton at Various Growth Stages to Four Post Emergence Herbicides.

When used as a post emergence directed spray diuron proved safe to cotton over three inches in height (Table I). Although the low rate did not result in a significant yield reduction, the plants treated in the cotyledon or three inch stage suffered some foliar burn. Treatment, even with the low rate, seemed potentially hazardous on plants less than six inches tall.

Paraquat at .25 pound per acre caused both foliar and stem burn in the three, six and nine inch stages. The plants over nine inches in height suffered only minor stem damage. The low rate resulted in the most damage when applied to the fifteen inch stage. After the plants had made nine to twelve inches growth, the waxy stem cuticle disappeared and cracks began to appear in the cork cambium. The cracks evidently provided an opening for rapid entry into the plant. A low concentration apparently did not kill stem cells upon contact and the plant was able to transport more material systemically.

The high rates of paraquat burned the stem and leaf tissue of all stages. Only cotton twelve inches or taller when treated escaped yield reduction. The data indicates the .5 pound rate to be safe on plants over three inches tall. However, these figures are probably misleading. Plants up to twelve inches tall that received either .5 or 1.0 pound

TABLE I

RESPONSE OF COTTON AT VARIOUS GROWTH STAGES TO FOUR POST EMERGENCE HERBICIDES

		Plant Height at Treatment				
Herbicide	lb./A.	3"	6"	9"	12"	15"
		Yield in Pounds Lint Cotton per Acre				
Diuron	0.20	345 bc	300 a	350 abc	369 a	405 d
Diuron	0.40	302 c	366 a	391 ab	357 a	353 bcd
Paraquat	0.25	389 abc	321 a	350 abc	337 a	148 e
Paraquat	0.50	158 d	282 a	349 abc	330 a	268 ab
Paraquat	1.0	49 e	104 b	281 cd	314 a	283 abc
DSMA	2.5	446 d	336 a	243 d	347 a	369 cd
DSMA	5.0	336 bc	389 a	329 bcd	367 a	359 abc
Prometryne	1.0	321 bc	358 a	406 ab	387 a	325 abcd
Prometryne	2.0	332 bc	326 a	372 abc	373 a	251 a
Untreated Check		415 ab	336 a	439 a	369 a	340 abcd

Means followed by the same letter are not significantly different at the .05% level.
Commercial surfactant was applied with all herbicides.

paraquat per acre suffered extensive stem burn in the one to 1.5 inch treated area. The burned stem portion failed to undergo subsequent expansion and growth, developing a girdled affect. The girdled area evidently still maintained capacity for nutrient and water transport since the plants continued their life cycle. When the cotton became laden with fruit; the weakened portion of the stem was inadequate to support the top growth and extensive lodging was the consequence. The fruit matured, opened and was harvested even though it lay on the ground. Most, if not all, of this material would probably have been lost had conventional stripper harvesting machinery been used.

DSMA caused a deep reddening of the cotton petiole and stems regardless of plant size. Visually, no detrimental effects were encountered at any stage of maturity. However, yield was reduced by both rates in cotton nine inches tall (Table I). This particular point in the crop's life cycle seemed to be a transitional one. The waxy cuticle was disappearing and periderm formation began. Treating a stem undergoing this change may have facilitated entry and movement of DSMA.

Prometryne caused marginal leaf burn on all stages up to twelve inches in height, however, no yield loss occurred (Table I). In general, it appeared that application of prometryne before the cotton reached six inches tall could result in cotton damage.

The Response of Cotton Varieties to Applications of Four Post Emergence Herbicides.

Paraquat was the only herbicide to reduce plant and leaf weights in the greenhouse regardless of variety (Table II). Acala 4-42 glanded and Pima S-2 appeared most resistant to prometryne, diuron and DSMA.

TABLE II

PLANT WEIGHTS (GMS.) OF FIVE COTTON VARIETIES TREATED WITH FOUR POST EMERGENCE HERBICIDES IN THE GREENHOUSE

		Acala 4-42 Glanded		Lankart 57		Paymaster 101 A		Coker		Pima S-2
Herbicide	lb./A.	Plant	Leaf	Plant	Leaf	Plant	Leaf	Plant	Leaf	Plant
Paraquat	0.25	2.1 a	.33 b	1.8 b	.19 b	1.7 b	.26 c	1.6 d	.19 c	1.4 b
Prometryne	2.0	2.4 a	.40 ab	1.8 b	.18 b	1.8 b	.35 b	3.1 a	.47 a	2.4 a
DSMA	5.0	2.4 a	.44 ac	2.7 a	.52 a	2.1 b	.40 a	2.4 bc	.39 a	2.4 a
Diuron	0.40	2.5 a	.46 c	2.2 ab	.42 a	3.9 a	.52 b	2.1 cd	.38 a	2.4 a
Untreated Check		2.2 a	.41 ac	2.7 a	.52 a	2.7 a	.41 a	3.0 ab	.45 ab	2.5 a

Means followed by the same letter are not significantly different at .05% level. Commercial surfactant was applied with all herbicides.

Paraquat and prometryne were most damaging to Lankart 57. Prometryne caused severe leaf burn but no stem damage. Paraquat was injurious to both stems and foliage. Diuron was the only herbicide that did not injure Paymaster 101 A. The diuron treatment was, however, detrimental when applied to the foliage of Coker variety. Foliar applied DSMA stunted Paymaster 101 A but apparently did not damage any other variety.

On the basis of the field experiments the varieties have been divided into two groups based on herbicide susceptibility. Pima S-2, Parrott, the Acalas and Verden appeared most resistant while Coker, Lankart 57 and Paymaster 101 A constituted the susceptible group.

All treatments except prometryne at 1.5 pounds significantly reduced the yield of Paymaster 101 A (Table III). Although Paymaster 101 A was found unharmed by foliar applied diuron in the greenhouse, its yield was reduced from field applications. Diuron and prometryne caused severe chlorosis and symptoms lingered for approximately two weeks after other affected varieties had recovered. Paraquat treated plants suffered stem and leaf burn especially at the high rates. The result was stunted plants of very low vigor.

The low rate of prometryne and the high rate of paraquat caused a significant yield reduction in the Coker variety (Table III). However, diuron at both rates did not significantly lower the yield. Prometryne caused the plants to become chlorotic and recovery was much slower than in the resistant group. Diuron caused slight chlorosis but recovery was rapid and no reduction in yield resulted.

Lankart 57 yield was reduced by DSMA, paraquat and prometryne. Prometryne caused extensive chlorosis and paraquat severely burned the stems.

TABLE III

SEED COTTON YIELD (LBS.) PER TEN PLANT SAMPLE OF EIGHT COTTON VARIETIES

AFTER TREATMENT WITH FOUR POST EMERGENCE HERBICIDES

Herbicide	lb./A.	Pima S-2	Parrott	Acala 4-42 Glanded	Acala 4-42 Glandless	Verden	Coker	Paymaster 101 A	Lankart 57
Diuron	0.40	0.9	2.0	2.1	2.6	1.9	2.0 abc	2.1 bc	2.8 ab
Diuron	0.80	1.0	2.1	1.9	2.6	1.6	2.1 abc	2.0 bc	3.0 ab
Prometryne	0.75	1.0	1.9	2.1	2.1	1.8	1.3 b	2.2 bc	2.6 b
Prometryne	1.5	1.2	2.4	1.9	2.7	2.0	2.4 ac	2.5 ab	2.9 ab
Paraquat	0.12	1.0	2.2	1.9	2.6	2.0	2.0 abc	1.8 bc	2.8 ab
Paraquat	0.25	1.0	1.8	1.8	2.7	1.7	1.7 ab	1.6 c	2.4 b
DSMA	2.5	1.0	2.2	1.5	3.0	1.8	2.6 c	1.9 bc	2.5 b
DSMA	5.0	1.1	2.4	1.6	2.3	1.5	2.0 abc	2.2 bc	2.7 ab
Untreated Check		0.9	2.4	1.8	2.4	1.8	2.3 c	3.1 a	3.5 a

Means followed by the same letter are not significantly different at the .05% level. Columns without letters have not significant difference. Commercial surfactant was applied with all herbicides.

Pima, Parrott, Acala 4-42, glanded and glandless, and Verden were completely unaffected by DSMA. Prometryne and diuron did cause slight chlorosis but recovery was very rapid. Pima and Verden stems were slightly burned from paraquat but the foliage was not affected.

The only fiber quality determination that was unchanged by the herbicides in all varieties was fiber length (Table V).

Fiber coarseness of Parrott and Acala 4-42 glanded was unaffected (Table IV). However, prometryne at the low rate caused finer fibers in Acala 4-42 glandless. Fibers from prometryne treated Pima plants were significantly more coarse than the check. All of the herbicides resulted in finer fibers when applied to Paymaster 101 A. Prometryne at .75 pound and paraquat at .25 pound per acre appeared to reduce coarseness while DSMA at five pounds seemed to increase the coarseness of fibers from Lankart variety.

Fiber strength of Pima, Parrott and Paymaster were not significantly reduced by the herbicides as compared to the check (Table VI). Neither glanded nor glandless Acala 4-42 had fiber strength changed as compared to the untreated plants. DSMA and paraquat at the low rates had significantly stronger fibers than did those from the check plants in Verden variety. DSMA at five pounds per acre had weaker fibers than did untreated Coker plants. Paymaster 101 A escaped change in fiber strength from any of the herbicide treatments. Only prometryne at 1.5 pounds per acre significantly changed the strength of Lankart 57 fibers.

TABLE IV

THE EFFECT OF FOUR POST EMERGENCE HERBICIDES ON THE FIBER COARSENESS OF EIGHT COTTON VARIETIES

Herbicide	lb./A.	Pima S-2	Parrott	Acala 4-42 Glanded	Acala 4-42 Glandless	Verden	Coker	Paymaster 101 A	Lankart 57
				Micronaire Readings (Mcgm/inch)					
Diuron	0.40	2.9 ab	4.2	3.9	3.1 a	4.3 ab	3.6 a	4.5 b	4.1 a
Diuron	0.80	3.1 ab	4.0	4.1	3.3 a	4.6 b	4.0 abc	3.7 c	4.2 ab
Prometryne	0.75	3.0 ab	3.8	3.8	2.8 b	4.4 ab	4.1 bc	4.2 b	3.1 d
Prometryne	1.5	3.6 c	4.0	4.0	3.1 ab	4.6 b	3.9 abc	4.1 b	4.3 ab
Paraquat	0.12	3.3 bc	4.1	4.0	3.2 a	4.5 ab	4.1 bc	4.3 b	4.5 ab
Paraquat	0.25	3.3 bc	4.1	4.0	3.5 ab	4.2 ab	3.7 ab	4.2 b	3.5 c
DSMA	2.5	2.8 a	4.2	4.1	3.2 a	4.1 a	4.2 c	4.1 b	4.3 ab
DSMA	5.0	2.7 a	4.2	4.0	3.4 a	4.5 ab	3.7 ab	4.2 b	4.6 b
Untreated Check		3.1 ab	4.1	4.2	3.2 a	4.5 ab	3.9 abc	5.0 a	4.1 a

Figures followed by the same letter are not significantly different at the .05% level. Columns without letters have not significant differences. Commercial surfactant was applied with all herbicides.

TABLE V

THE EFFECT OF FOUR POST EMERGENCE HERBICIDES ON THE FIBER LENGTH OF EIGHT COTTON VARIETIES

Herbicide	lb./A.	Pima S-2	Parrott	Acala 4-42 Glanded	Acala 4-42 Glandless	Verden	Coker	Paymaster 101 A	Lankart 57
				Length as 2.5 Span Length (inches)					
Diuron	0.40	1.27	1.00	1.13	1.11	1.07	1.13	1.00	1.06
Diuron	0.80	1.25	1.00	1.13	1.09	1.07	1.11	1.01	1.05
Prometryne	0.75	1.27	1.01	1.12	1.10	1.09	1.12	1.01	1.04
Prometryne	1.50	1.30	0.99	1.11	1.13	1.06	1.16	0.99	1.04
Paraquat	0.12	1.27	0.97	1.15	1.12	1.06	1.12	0.98	1.04
Paraquat	0.25	1.31	0.99	1.15	1.13	1.06	1.16	1.00	1.07
DSMA	2.5	1.28	1.00	1.14	1.14	1.09	1.14	1.00	1.06
DSMA	5.0	1.28	0.97	1.13	1.13	1.11	1.15	0.99	1.08
Untreated Check		1.28	0.97	1.12	1.12	1.06	1.15	0.98	1.09

No significant differences at the .05% level within varieties. Commercial surfactant was applied with all herbicides.

TABLE VI

THE EFFECT OF FOUR POST EMERGENCE HERBICIDES ON THE FIBER

STRENGTH OF EIGHT COTTON VARIETIES

Herbicides	lb./A.	Pima S-2	Parrott	Acala 4-42 Glanded	Acala 4-42 Glandless	Verden	Coker	Paymaster 101 A	Lankart 57
				Stelometer 1/8" Gage (gms/grex) Readings					
Diuron	0.40	2.92 a	2.03	2.79 b	2.57 ab	2.22 ab	2.25 ac	2.32	2.18
Diuron	0.80	3.09 b	1.88	2.73 ab	2.44 a	2.19 ab	2.20 ab	2.25	2.03 ac
Prometryne	0.75	3.09 ab	1.98	2.77 ab	2.61 ab	2.27 ab	2.29 ac	2.33	2.14 ac
Prometryne	1.5	3.07 ab	2.05	2.62 ab	2.65 b	2.27 ab	2.35 ac	2.27	1.73 b
Paraquat	0.12	2.93 a	1.94	2.71 ab	2.48 ab	2.16 ab	2.30 ac	2.21	2.05 ac
Paraquat	0.25	3.13 ab	1.98	2.74 ab	2.55 ab	2.29 b	2.40 c	2.29	2.03 ac
DSMA	2.5	2.96 ab	1.93	2.70 ab	2.53 ab	2.29 b	2.27 ac	2.24	1.98 a
DSMA	5.0	2.96 ab	2.00	2.60 a	2.56 ab	2.21 ab	2.05 b	2.26	2.05 ac
Untreated Check		2.96 ab	1.96	2.70 ab	2.59 ab	2.09 a	2.34 ac	2.33	2.13 ac

Stelometer 1/8" gage is a measure of fiber strength and stretch. Numbers followed by the same letters are not significantly different at the .05% level. Columns without letters had no significant differences. Commercial surfactant was applied with all herbicides.

Cotton and Weed Response to Several Post Emergence Weed Control Treatments.

Paraquat at .5 and 1.0 pound per acre reduced cotton yield in tests conducted at Chickasha in 1963 (Table VII). Fiber strength, micronaire and length were unaffected. In 1964, paraquat and surfactant concentrations were reduced and yield reduction was prevented (Table VIII). Stand, as reflected in yield, was not affected by the treatments. Injury ratings revealed the flame weeder to be the most injurious to the cotton plants although yield reduction did not result.

All treatments reduced the time necessary to remove the weeds by hoeing as compared to the untreated check (Table VIII). This was evidently accomplished by the removal of the grassy weeds since all treatments significantly reduced the numbers as compared to the check. DSMA, ametryne and the flame weeder failed to adequately control the broadleaves. Hoe time and control ratings indicated the dicryl-DSMA combinations to be the least effective in overall weed control. Diuron and prometryne seemed most effective in controlling both grassy and broadleaf species. Although ametryne and flame weeding failed to significantly reduce broadleaf numbers, they both proved effective in overall weed control. Diuron and DSMA at the low rates ended the season with over 70 percent weed control as did prometryne and ametryne at one pound per acre.

Although ametryne reduced the stand at Altus in 1964, the yields were unaffected (Table IX). Hoe time and control ratings indicated all treatments except paraquat at .12 pound per acre were equally effective in weed removal. The low rates of diuron, prometryne, DSMA and paraquat

TABLE VII

LANKART 57 VARIETY RESPONSE TO SEVERAL

POST EMERGENCE HERBICIDES AT CHICKASHA IN 1963

Herbicide	lb./A.	Lint Yield per Acre	Fiber Quality* Micronaire	Strength	Length
Diuron	0.20	732 cd	3.76	3.45	.994
Diuron	0.40	755 cdef	3.87	3.43	.970
Dicryl + DSMA	1 + 2	1,006 h	4.13	3.44	.979
Prometryne	0.5	733 cde	3.90	3.44	.986
Prometryne	1.0	708 c	3.93	3.59	.969
Paraquat	0.5	304 b	3.73	3.56	.999
Paraquat	1.0	47 a	3.53	3.61	.975
DSMA	3.5	835 g	3.97	3.63	.985
DSMA	5.0	829 g	3.83	3.65	1.006
Untreated Check		746 cdef	3.93	3.63	.976

Means followed by the same letter are not significantly different at the .05% level. Columns without letters have no significant differences. Commercial surfactant was applied with all treatments.

*Strength as stelometer 0" gage (grams/grex), length as 2.5 span length and fineness as Micronaire (Mcgm/inch) readings.

TABLE VIII

COTTON AND WEED RESPONSE TO SEVERAL POST EMERGENCE

HERBICIDES AT CHICKASHA IN 1964

Herbicide	lb./A.	Lint Yield per Acre*	Cotton Plants per Row Foot	Injury Rating**	Hoe Time Hrs./A.	Weeds per Square Foot Grasses	Weeds per Square Foot Bdlvs.	Percent Control Grasses	Percent Control Bdlvs.	Percent Control End of Season All
Days after Treatment			15	15	20	15	15	15	15	120
Diuron	0.20	693	1.0	0	2.6 b	2.5 bc	0 b	85	88	70
Diuron	0.40	720	1.5	0	1.6 bcd	2.3 bc	0 b	85	88	49
Prometryne	3.5	824	1.3	.3	2.2 de	.8 de	0 b	85	85	54
Prometryne	1	728	1.5	.3	3.3 bc	2.3 bc	0 b	60	70	88
DSMA	2.5	784	1.3	0	2.6 bcd	2.3 bc	.3 b	45	88	75
DSMA	2.5	740	1.0	.3	3.5 def	3.3 bc	1.0 ab	85	25	20
Ametryne	2.5	700	1.3	0	4.1 cd	2.3 bc	0 b	78	83	64
Ametryne	1.0	739	1.0	.3	2.8 efg	2.5 bc	2.0 a	48	45	80
Dicryl + DSMA	1 + 1	762	1.3	0	2.7 bcd	2.0 bc	0 b	78	75	67
Dicryl + DSMA	1 + 2	599	1.5	0	6.2 h	5.5 b	.3 b	15	18	45
Paraquat	.12	645	2.0	0	4.5 fg	5.0 b	.3 b	28	30	10
Paraquat	.25	683	1.0	.3	5.1 g	2.5 bc	0 b	68	73	36
Flame Weeder		729	1.0	3.3	1.6 bc	.8 c	2.0 a	95	98	5
Untreated Check		657	1.0	0	7.3 i	11.8 a	2.0 a	0	0	0
Clean Cultivated Check		739	1.0	0	1.1 a	.3 c	.8 c	100	100	85

Means followed by the same letter are not significantly different at the .05% level. Commercial surfactant was applied with all herbicides.

*No significant differences between treatments.

**0 means no injury, 10 means complete kill.

TABLE IX

COTTON AND WEED RESPONSE TO SEVERAL POST EMERGENCE

HERBICIDES AT ALTUS IN 1964

Herbicide	lb./A.	Lint Yield per Acre*	Cotton Plants per Row Foot	Hoe Time Hrs./A.	Weeds per Square Foot Grasses	Weeds per Square Foot Broadleaves	Percent Control Grasses	Percent Control Broadleaves
Days After Treatment			12	26	12	12	12	12
Diuron	0.20	802	4.3 abc	3.8 b	7.8 ab	2.3 ab	56	65
Diuron	0.40	722	5.0 abc	3.9 b	1.5 bc	.8 b	75	88
Prometryne	3.50	771	5.3 ab	4.3 b	4.5 abc	.3 b	75	88
Prometryne	1.0	736	5.0 abc	4.2 b	2.8 bc	.3 b	78	88
DSMA	2.5	789	4.0 abc	4.3 b	4.5 abc	2.3 ab	70	60
DSMA	3.5	757	6.5 a	4.3 b	2.0 bc	.8 b	75	85
Ametryne	.5	853	2.3 c	4.2 b	3.5 bc	.5 b	68	73
Ametryne	1.0	799	3.8 abc	3.8 b	3.3 bc	.3 b	83	75
Dicryl + DSMA	1 + 1	769	5.0 abc	4.6 b	3.0 bc	2.5 ab	75	70
Dicryl + DSMA	1 + 2	793	3.5 bc	5.0 b	4.8 abc	1.8 ab	73	80
Paraquat	.12	778	3.3 bc	7.7 a	5.3 abc	2.8 ab	75	65
Paraquat	.25	748	5.8 ab	5.1 b	2.0 bc	.8 b	73	85
Untreated Check		717	5.4 ab	8.2 a	10.0 a	3.5 a	0	0

Means followed by the same letter are not significantly different at the .05% level. Commercial surfactant was applied with all herbicides.

*No significant differences between treatments.

failed to reduce grass numbers. Paraquat, DSMA and diuron at the low rates did not reduce the number of broadleaves. The dicryl-DSMA combination did not give good control of either grasses or broadleaves. It had the highest hoe time and as at Chickasha appeared to be the most ineffective treatment.

Comparison of Flame Weeding to Three Post Emergence Herbicides.

Flame weeding was found to be less injurious to cotton than directed applications of paraquat (Table X). Cotton plants in the flamed plots were burned on the lower leaves but no stem damage could be detected. None of the treatments reduced cotton yields and the flame weeded plots yielded slightly higher than the untreated cotton. The flame weeder was more effective than either diuron or prometryne at the low rates in reducing grass numbers. All treatments significantly reduced the number of broadleaf weeds and the hoe time required to remove all weeds.

TABLE X

COMPARISON OF FLAME WEEDING WITH THREE POST EMERGENCE COTTON HERBICIDES

Treatment	lb./A.	Lint Yield per Acre	Crop Damage Rating*	Weeds per Sq. Foot		Percent Control		Hoe Time Hrs./A.
				Grasses	Bdlvs.	Grasses	Bdlvs.	
Flame Weeder		770 ab	1	.5 b	.5 b	75	90	1.5 ab
Diuron	0.20	850 ab	1	2.0 ab	.3 b	93	98	1.3 a
Diuron	0.40	989 b	1	2.3 ab	0 b	98	100	2.3 ab
Prometryne	.75	713 a	1	3.3 ab	.3 b	93	95	1.7 ab
Prometryne	1.5	850 ab	0	.8 b	0 b	100	100	1.4 a
Paraquat	.25	762 ab	2	.8 b	0 b	100	98	2.3 ab
Paraquat	.50	665 a	4	1.0 b	.3 b	100	100	1.6 ab
Untreated Check		668 a	0	5.0 a	4.0 a	0	0	3.7 c

Columns followed by the same letter are not significantly different at the .05% level. Commercial surfactant was applied with all herbicides. Weed counts, control ratings and damage ratings were taken eight days after treatment. Hoe data was taken 12 days after treatment.

*0 means no injury, 10 means complete kill.

SUMMARY

A study was conducted on dryland Parrott cotton to determine the growth stage at which the crop is most susceptible to prometryne, diuron, DSMA and paraquat. All treatments were directed at the base of the cotton stem. Up to .4 pound diuron per acre and two pounds prometryne was used on cotton six inches or more in height without reducing the yield. DSMA at a rate of five pounds per acre was injurious only to cotton nine inches in height. The nine inch cotton was forming periderm tissue which may account for its susceptibility. Only .25 pound per acre of paraquat appeared safe for use, and then only if the cotton was nine to twelve inches tall. Higher rates caused stem burn extensive enough to result in severe lodging even in plants up to nine inches tall. The .25 pound rate applied to cotton that had formed extensive cork cracks entered the plant easily causing a reduction in yield.

An experiment involving eight cotton varieties showed Pima S-2, Parrott, Verden and Acala 4-42, glanded and glandless varieties most resistant to diuron, prometryne, DSMA and paraquat. Lankart 57 yields were reduced by paraquat and prometryne. Coker yields were reduced by paraquat and diuron. All four herbicides caused a significant yield reduction in Paymaster 101 A.

Prometryne caused a more coarse fiber in Pima S-2 and finer fibers in glandless Acala 4-42. Prometryne, paraquat and DSMA treated plants of Coker variety had more coarse fibers than did the untreated checks. All treatments resulted in finer fibers when applied to

Paymaster 101 A. Lankart 57 when treated with the low rates of paraquat and prometryne had finer fibers, while those plants receiving five pounds of DSMA had significantly more coarse fibers than the checks.

Fiber length was unaffected by the herbicide treatments. The strength of fibers from Pima S-2, Parrott, Acala 4-42, glandless and glanded, and Paymaster 101 A was not significantly reduced as compared to the checks. DSMA and paraquat had significantly stronger fibers than the untreated plants of the Verden variety. DSMA caused significantly weaker fibers than the untreated plants of Coker variety. Prometryne at 1.5 pounds per acre caused weaker fibers in Lankart 57. Fiber strength of Paymaster variety was not affected by the herbicide treatments.

Studies were conducted to compare several post emergence herbicides in both weed control effectiveness and selectivity. Diuron and prometryne were very effective when used with surfactant on weeds 1.0 to 1.5 inches tall. DSMA was effective for use in grass infestations but almost useless for broadleaf control. Ametryne performed very well but resulted in more cotton damage than did prometryne. Dicryl-DSMA combination without surfactant did not result in as complete weed control as did the other treatments. Flame was very effective but extreme care had to be taken in directing the treatment.

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