

Effect of Weed Control Practices on Weed Density and Yield of Cotton (*Gossypium hirsutum* L)

Z.A.Cheema, M.Afzal and S. Ahmad*

ABSTRACT

A field trial to see the effect of three herbicides butam (N-benzyl-N-isopropyl trimethylacetamide), pendimethalin [N-(1-ethylpropyl) 3,4-dimethyl-2,6-dinitro benzenamine] and dalapon (2,2-dichloropropionic acid) and hand weeding on the growth and yield of cotton and weed population was carried out during 1983-84 on a loam soil. The results revealed that pre-emergence and pre-plant incorporation of pendimethalin (1.32 kg ai/ha) was most effective in controlling both broad-leaved and grassy weeds but was less effective against *Cyperus rotundus* L. where as application of dalapon (10.6 kg ai/ha) as directed (post-emergence) application was quite effective in reducing *Cyperus rotundus* L. density but failed to control broad-leaved weeds. Butam (5.18 kg ai/ha, Pre-emergence) gave good control of *Trianthema monogyna* L. and *Digitaria timorensis* (Kunth) Bal. The results showed that pendimethalin was better weedicide than dalapon and hand-weeding in controlling most of the cotton weeds. Pendimethalin and butam had no adverse effect on cotton germination and growth. Pre-plant incorporation and application at pre-emergen-

ce stage of pendimethalin (1.32 kg ai/ha) gave significantly higher seed cotton yield (2.18-2.10 t/ha) than directed post-emergence application of dalapon (10.6 kg ai/ha) and two hand-weedings (1.74 t/ha) but remained statistically at par with butam (5.18 kg ai/ha) 1.95 t/ha. all the treatments produced significantly higher yield than weedy control (1.28 t/ha).

INTRODUCTION

Weeds are a serious menace in crop production. They not only reduce crop yield but in many cases the quality of farm produce is also affected. They compete with crops mainly for light, nutrients, water and carbon dioxide (Anderson, 1983).

The damage caused by weeds through the loss of nutrients and water is a major cause of concern to the growers. Schwerzel and Thomas (1971) observed that weeds consumed three to four times more nitrogen, potassium and magnesium than a weed-free crop. They also noted that weeds removed more moisture from the soil than the cotton plants. Other competitive studies have also shown that weeds cause the greatest damage to cotton crop during first two months of its growth (Salome, 1982), and the maximum weed crop competition occurs between 4 to 10 weeks after crop emergence (Drennan and Tennings, 1977). They also observed that when weeds were left unchecked

*Department of Agronomy University of Agriculture, Faisalabad.

tremendous reduction (60 percent) occurred in seed cotton yield. Similarly, during several years investigations Jalil and Shah (1982) found that reduction in yield ranged from 12.53 to 41.29 percent due to the presence of weeds in cotton. They also observed that yield was increased from 14.53 to 70.34 percent when weeds were effectively controlled.

Weeds can be controlled quickly and effectively by using chemicals. Use of weedicides is getting popular among the farming community in Pakistan but in case of cotton, it is still in its infancy.

Certain pre and post-emergence herbicides have been used in different countries to control cotton weeds. In an evaluation of herbicides trial for cotton, Gursoy, (1978) observed that pendimethalin and trifluralin adequately controlled *Cyperus longus*, *Echinochloa crusgalli* (Linn.) Beauv., *Setaria verticillata* (Linn.) Beauv., *Amaranthus* spp., *Phalaris paradoxa* Linn., *Portulaca oleracea* Linn. and *Euphorbia prostrata* Ait. Dalapon was the only weedicide which controlled *Sorghum halepense* in addition to controlling the above-mentioned species, but *Solanum nigrum* showed resistance to all of the weedicides. When pendimethalin was tested in cotton on light to medium textured soils at the rate of 1.2 kg ai/ha, it appeared more effective than trifluralin (1.5 kg ai/ha). It was found safe for the crop and selective as pre-emergence than flumeturon (1.2 kg/ha). (Parshutin *et al.* 1980). Research investigations with butam in cotton have shown that it can control major annual grasses of USA and also broad-leaved weeds such as *Alopecurus myosuroides* Huds., *Amaranthus retroflexus* L. and *Chenopodium album* L. at rates ranging 2.4 to 4.5 kg ai/ha, according to soil type

without effecting cotton. However, butam cannot be used post emergence herbicide (Schwartzbeck, 1976). Directed spray of dalapon at the rate of 5-10 kg/ha killed 60-70 percent perennial weeds mainly *Sorghum halepense* and *Cynodon dactylon* without affecting the cotton yield (Stonov *et al.* 1962).

The objective of this study was to evaluate the effect of different pre and post-emergence weedicides on weed population in cotton (Cv. NIAB 78) under field conditions.

MATERIALS AND METHODS

A field trial was carried out to investigate the effect of three herbicides, i.e., butam, pendimethalin and dalapon and hand weeding on the growth and yield of cotton and weed population on a loam soil at the Agronomic Research Area, University of Agriculture, Faisalabad, during 1983-84. The experiment was laid out in a randomized complete block design with four replications. Plot size was 6 m x 3.6 m. The treatments included pre-emergence application of butam at 5.18 kg ai/ha, pre-plant incorporation of pendimethalin at 1.32 kg ai/ha, directed post-emergence application of dalapon at 10.6 kg ai/ha, hand weeding (two hoeings) and weedy check (control).

A newly recommended cotton variety, 'NIAB-78' was sown on May 25, 1983, using a seed rate of 20 kg/ha with a single row hand drill in 75 cm apart rows. Thinning was done, when the plants attained 15 cm height, to maintain 45 cm plant-to-plant distance within rows. Basal dose of 62 kg P₂O₅/ha and 50 kg K₂O/ha was applied at sowing, while 100 kg N/ha was applied in two splits, i.e. half at sowing and half at pre-flowering stage.

First irrigation was applied 30 days after sowing and subsequent irrigations were given at the interval of about two weeks, depending upon the weather conditions. One treatment of pendimethalin was sprayed and incorporated in the soil one day before sowing. Butam and second treatment of pendimethalin were applied at pre-emergence immediately after sowing. Dalapon was used as directed post-emergence 36 days after sowing. Herbicidal spray was done with the help of knapsack hand-sprayer CP-3 fitted with 4 flat fan nozzles (8003), on specially made boom.

In hand weeded plots, two hoeings were given with kasola (hand hoe) first at three weeks after sowing and second at five weeks after sowing. Data on germination of cotton and weed population was recorded from 1.5 m² area randomly selected at three different places in each plot. To record data on plant height, number of bolls formed, number of mature bolls and seed cotton weight/plant, 10 cotton plants were randomly selected from each plot. Weed population was counted one month, two months and three months after sowing. The seed cotton yield was recorded on plot basis and calculated on hectare basis. Duncan's New Multiple Range test was used to establish statistical significance among treatment means.

RESULTS AND DISCUSSION

The most common weed in the field was *Cyperus rotundus* L. ('Deela'). *Trianthema monogyna* L. ('Itsit'), *Digitaria timorensis* (Kunth) Bal. (Madhana), *Echinochloa colonum* (Linn.) Link. (Swank), *Euphorbia pilulifera* L. (Hazardani), *Corchorus tridens* L. ('Jungli jute'), were also found but relatively on small scale. Weed

population was significantly affected by different control practices. In case of first count, weed density in all the treated plots was almost half than weedy check. However, weed density among various herbicidal treatments and hand weeding was statistically the same. In case of second count, weed density was significantly low in plots where dalapon was applied as directed post-emergence spray and it was significantly high in control plots. Weed density in other treatments was also significantly lower than control, but was found to be statistically at par. At the time of third count, weed density in case of pendimethalin (1.32 ai/ha) applied both at pre-plant (incorporated) and pre-emergence stage and Dalapon (10.6 kgai/ha) applied as post-emergence directed was significantly less than weedy check. Weed density in butam-treated plots and hand weeded plots was statistically at par with pendimethalin-applied plots but was significantly lower than control. (Table 1).

A perusal of the data pertaining to weed mortality percentage in Table 2 indicate that all the herbicidal treatments were effective in suppressing weed population and mortality percentage was found relatively higher than two hand weeding. Chaudhry (1982) reported similar results and supported the superiority of chemical weed control over cultural control. Pendimethalin and butam seemed to be effective against broad-leaved weeds of cotton particularly *Trianthema monogyna* L. ('Itsit'), *Corchorus tridens* L. (Jangli jute), *Euphorbia pilulifera* L. ('Hazardani') and certain grasses such as *Echinochloa colonum* (Linn) Beauv. (Swank) and *Digitaria timorensis* (Kunth) Bal. ('Madhana'). Both these herbicides were relatively less effective against *Cyperus rotundus* L.

Table 1. Effect of different weed control practices on weeds of cotton.

Treatments	Weed density (1.5 m ²)		
	(30 DAS ^a)	(60 DAS)	(90 DAS)
Butam (5.18 kg ai/ha) Pre-emergence application	55.50b	98.25b	17.50b
Pendimethalin (1.32 kg ai/ha) Pre-plant (incorporated) application	53.75b	87.50b	11.50bc
Pendimethalin (1.32 kg ai/ha) Pre-emergence application	50.00b	99.25b	14.25bc
Dalapon (10.6 kg ai/ha) Directed Post-emergence application	20.50c	8.25c	
Hand Weeding (two hoeings)	38.75b	72.25b	20.00b
Weedy check	95.00a	273.75a	65.75a

Means not sharing a letter in common differ significantly at 5% probability level
^a DAS = days after seeding

Table 2. Effect of weed control practices on mortality (percentage) of weeds in cotton.

Weeds	Weedy check	butam (pre emergence)	Pendimethalin pre-plant incorporation	Pendimethalin pre-emergence	Dalapon directed post-emergence	Hand weeding
<i>Trianthema monogyne</i> ('Itsit')	0	100	100	100	31.3	93.7
<i>Cenchrus tridens</i> ('Jungli jute')	0	100	100	100	100	100
<i>Euphorbia pelutifera</i> ('Hazardani')	0	87.0	100	100	74.2	96.7
<i>Echinochloa colonum</i> ('Swank')	0	94.2	97.1	94.2	77.1	85.7
<i>Digitaria timorensis</i> ('Madana')	0	100.0	100	100	100	60.0
<i>Cyperus rotundus</i> ('Dwela')	0	60.9	72.5	66.4	92.0	56.0
<i>Sorghum halepense</i>	0	100	100	100	100	100
<i>Cynodon dactylon</i>	0	100	100	100	100	100
Mortality percentage of total number of weeds.	0	75.4	82.5	78.3	87.5	69.6

('Deela'). Directed post-emergence application of dalapon (10.6 kg ai/ha) was quite effective in reducing *Cyperus rotundus* L. ('Deela') population and was also effective against *Digitaria timorensis* (Kunth) Bal. and failed to control *Trianthema monogyna* L. ('Itsit'). Many researchers have reported that weeds of cotton can be effectively controlled by weedicides. (Gursoy 1978, Parshutin et al 1980 and Stonov et al 1962).

Data regarding seed cotton yield per hectare (Table 3) showed significant differences among treatments. All the herbicidal treatments and hand weeding were effective in increasing crop yield. Pendimethalin at (1.32 kg ai/ha) pre-plant incorporation gave the highest seed cotton yield (2.18 t/ha), followed by pendimethalin (1.32 kg ai/ha) applied at pre-emergence stage (2.10 t/ha) and butam (5.18 kg ai/ha) also applied at pre-emergence stage. The yield from dalapon applied at the rate of 10.6 kg ai/ha (1.71 t/ha) was also significantly higher than control, but statistically equal with hand weeding (1.74 t/ha). However, these yields were significantly lower than pendimethalin, pre-plant incorporation or pre-emergence applied and butam pre-emergence applied treatments. Although highest weed mortality was noticed in dalapon treatment yet the yield obtained from this treatment remained lower than butam and pendimethalin. Dalapon was sprayed about one month after sowing of the crop and it was established that weed competition during early growth stages of crop was more; so weed competition for one month resulted in comparatively low yield than butam and pendimethalin which were applied at pre-emergence stage. The possibility of phytotoxicity from dalapon to cotton crop also cannot be ruled out.

Data regarding seed cotton wt/plant and number of mature bolls/plant (Table 3) indicated exactly similar trend as in case of seed cotton yield per hectare among treatments.

Data for germination of cotton and cotton plant height (Table 3) showed non-significant differences. It indicates that butam and pendimethalin applied at pre-emergence stage had no negative effect on cotton germination and growth.

Higher seed cotton yield in case of pendimethalin and butam may be attributed to reduced weed crop competition which resulted in increased number of mature bolls, hence more seed cotton wt/plant and finally higher seed cotton yield/ha. Increased seed cotton yields by herbicidal treatments has been demonstrated by Jalil and Shah (1982), Schwerze et al (1971) and Parshutin et al (1980).

From the above discussion, it appears that weeds of cotton can be controlled successfully by using chemical weedicides.

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Table 3 Effect of weed control practices on seed cotton yield and its components.

Treatments	Germination count/unit area (1.5 m ²)	Plant height (cm)	Total of bolls/plant	No. of mature bolls/plant	Seed cotton weight/plant (gram)	Seed cotton yield/ha (Quintal)
Butam 720 EC at 5.18 kg ai/ha	19.75 NS	173 NS	63.15 ab(1)	35.83 ab	65.73 ab	19.52 ab
Pendimethalin 330E at 1.32 kg ai/ha pre-planting (incorporated)	20.75	166	70.23 a	39.50 a	72.83 a	21.82 a
Pendimethalin 330E at 1.32 kg ai/ha pre-emergence	19.50	159	68.98 ab	38.80 a	71.05 a	20.95 a
Dalapon 85 WP at 10.6 kg ai/ha post-emergence		185	55.23 b	31.25 b	57.83 b	17.13 b
Hand-weeding (Two hoeings)		176	56.50 ab	31.95 b	58.75 b	17.40 b
Weedy check	19.63	159	38.80 c	25.40 c	45.85 c	12.75 c

(1) Means not sharing a common letter differ significantly at 5% probability level.

NS - Non significant

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