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CHEMICAL WEED CONTROL IN COTTON (*GOSSYPIUM HIRSUTUM L.*)

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A field trial to see the effect of some pre and post-emergence herbicides viz. pendimethalin 330E (N-1-ethylpropyl)-3, 4 dimethyl-2, 6-dinitro benzenamine), trifluralin 23EC (α, α, α-trifluoro 2, 6-dinitro-N-N-dipropyl-p-toluidine), paraquat 20 EC(1,1'-dimethyl-4,-4'-bipyridinium ion), and dalapon 85 WP (2,2-dichloropropionic acid) on the growth and yield of cotton and weed population was carried out during 1986-87 on a sandy clay loam soil. The results revealed that the herbicidal treatments such as pendimethalin at 1.15 kg ai $(ha)^{-1}$ pre-emergence or pre-emergence incorporated and trifluralin at 0.175 kg ai $(ha)^{-1}$ pre-emergence incorporated were not effective against Cyperus rotundus (Purple Nutsedge), however, their effect against Cynodon dactylon (Bermuda grass) was relatively better. Although the total population of Paspalum paspalodes (Naru) and Trianthema monogyna (Itsit) was low but these three herbicides were effective against these weeds. Directed post-emergence application of dalapon at 6.76 kg ai $(ha)^{-1}$ and paraquat at 400 g ai $(ha)^{-1}$ controlled all the four weed species, except dalapon which did not effect Pasapalum pasapalodes (Naru). Directed post-emergence application of dalapon at the rate of 6.76 kg ai $(ha)^{-1}$ and paraquat at the rate of 400 g ai $(ha)^{-1}$ gave maximum seed cotton yield. This study indicated that directed post emergence application of herbicides is better practice than pre-emergence application.

INTRODUCTION

Cotton (Gossypium hirsutum L.) is an important fibre crop of Pakistan. It is one of the major sources of foreign exchange. It provides raw material for textile and vegetable ghee industry. Low per hectare yield, besides many other factors, may be attributed to serious weed infestation in the crop. Weeds can decrease the seed cotton yield ranging from 20-55% (Zimdahl, 1980). The conventional method for keeping the fields free from weeds was through cultural practices. This method has become expensive. Chemical weed control being effective and economical is becoming more popular with the cotton growers. Increasing interest in chemical weed control has stimulated researchers to investigate the effectiveness and economics of herbicides. Use of herbicides in Pakistan may prove beneficial in boosting the yield of seed cotton, especially during adverse weather conditions when other mechanical means of weeding are not possible. Jalis and Shah (1984) found that increase in the yield of seed cotton with hand weeding, Comodor 72 EC at 5 l ha^{-1}, Stomp 330E at 3.75 l ha^{-1} Dowpon-M + Bueno-6 at 5 kg + 3 l ha^{-1} and Dowpon-M at 10 kg ha^{-1} over control was 30%, 24%, 30%, 40% and 41% respectively. Brar and Gill (1985) reported that 0.8 kg trifluralin, 1.2 kg fluchloralin and 0.8 kg diuron ha^{-1} pre-emergence effectively controlled weeds. Seed cotton yield with trifluralin and fluchloralin was 1.07 and 1.04 t ha^{-1} respectively, compared with 1.06 t with 2 hand weedings and 0.63 t without weed control.

In view of the afore-said facts, the present study was conducted to evaluate the efficacy of some pre and post-emergence herbicides.

MATERIALS AND METHODS

The investigation was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad during 1986-87. The experiment was laid out in Randomized Complete Block Design with three replications and the plot size measured 12 x 3.6 m. A newly evolved cotton variety NIAB 82 was sown on sandy clay loam soil. Crop was seeded by using 20 kg ha^{-1} of cotton seed in 90 cm apart rows with the help of single row

hand drill and 45 cm distance between the plants was maintained by thinning. Experiment consisted of following herbicidal treatments. Pendimethalin (incorporated) at 1.15 kg ai $(ha)^{-1}$, pendimethalin (Pre-emergence) at 1.15 kg ai $(ha)^{-1}$, trifluralin (incorporated) at 0.175 kg ai $(ha)^{-1}$, paraquat (directed post-emergence) at 400 g ai $(ha)^{-1}$, dalapon (directed post-emergence) at 6.76 kg ai $(ha)^{-1}$, and weedy check.

Pendimethalin and trifluralin were sprayed and incorporated in the soil with hand hoe (Kasula) at the time of sowing. Second treatment of pendimethalin was sprayed as pre-emergence just after sowing cotton. Paraquat and dalapon were applied as directed post-emergence 37 days after sowing (7 days after first irrigation). Herbicidal spray was done with the help of a knapsack hand sprayer (CP-3) fitted with especially made boom and flat fan nozzle No. 8003. The spray volume was 270 litres per hectare. Other agronomic practices were kept uniform for all the treatments.

To record data on germination count, weed population and weed mortality, a unit area measuring 2 m^{-2} was randomly selected at two different places in each plot. Weed population was counted at the interval of one week upto 8 weeks after sowing. Weed biomass was taken from 1 m^{-2} randomly selected from each plot. Weed mortality percentage was calculated 8th week after sowing the crop. For obtaining data on plant height, number of monopodial and sympodial branches and number of bolls, 10 plants were randomly selected from each plot. The seed cotton yield was recorded on plot basis and then calculated on hectare basis. For ginning out turn percentage, sun dried samples were ginned separately with hand gin. Lint obtained from each sample was weighed and lint percentage was worked out by using following formula:

$$G.O.T. = \frac{\text{Weight of lint}}{\text{Weight of seed cotton}} \times 100$$

Duncan's New Multiple Range Test at 5% probability level was applied to compare the differences among the treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Cyperus rotundus (Purple Nutsedge), Cynodon dactylon (Bermuda grass), Paspalum paspalodes (Naru) and Trianthema monogyna (Itsit) were the common weeds of cotton field. The density of later three weed species was very low. Therefore, Cyperus rotundus (Purple Nutsedge) was the only predominant weed in the area. Herbicides such as pendimethalin @ 1.15 kg ai $(ha)^{-1}$ pre-emergence or pre-emergence incorporated, and trifluralin @ 0.175 kg ai $(ha)^{-1}$ pre-emergence incorporated were not effective against Cyperus rotundus (Purple Nutsedge), however the effect against Cyndon dactylon (Bermuda grass) was relatively better. Although the total population of Paspalum paspalodes (Naru) and Trianthema monogyna (Itsit) was low but the herbicides used, showed significant effect against these weeds (Table 1). Selective control of weeds with pre-emergence herbicides has been reported by Kasasian (1969) and Blumenfeld et al., (1982).

Directed post-emergence application of dalapon @ 6.76 kg ai $(ha)^{-1}$ and paraquat @ 400 g ai $(ha)^{-1}$ significantly killed all the four weed species (Table 2), but dalapon had no effect on Paspalum paspalodes (Naru). This suggests that directed post-emergence application of herbicides is better practice in controlling total weed density. It appears that the pre-emergence herbicides may be useful if broad leaf weeds germinate and emerge, just after sowing of the crop. If weeds do not germinate for four to six weeks, then the use of pre-emergence herbicides may be wasteful practice. Gupta and Janardhanam (1982) reported that amongst herbicidal treatments applied to cotton, the net profit was highest with dalapon treatment @ 7.14 kg ha^{-1}. Fresh and dry weight of weed biomass was significantly affected by various herbicidal treatments (Table 3). Directed post-emergence application of dalapon @ 6.76 kg ai $(ha)^{-1}$ appeared most effective in suppressing weed growth. It produced significantly least fresh and dry weight of weeds followed by paraquat @ 400 g ai $(ha)^{-1}$ directed post-emergence. Maximum biomass was found in weedy check plots.

The seed cotton yield was significantly affected by various herbicidal treatments (Table 3). Directed post-emergence application of dalapon @ 6.76 kg g ai $(ha)^{-1}$ gave highest seed cotton yield (19.51 qha^{-1}) followed by directed post-emergence applica-

Table 1. *Effect of some pre and post-emergence herbicides on total weed density in cotton*

Treatment	Ist week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
Pendimethalin incorporated @1.15 kg ai $(ha)^{-1}$	95.71a*	275.3a	265.3b	220.0b	415.7ab	599.0b	730.0b	855.7b
Pendimethalin pre-emergence @1.15 kg ai $(ha)^{-1}$	80.0b	238.7b	257.7b	209.0bc	418.0a	610.3b	705.7b	861.3b
Trifluralin incorporated @0.175 kg ai $(ha)^{-1}$	63.0c	226.7bc	250.7b	188.3c	364.0b	526.7c	698.0b	834.3b
Paraquat directed post-emergence @ 400 g ai $(ha)^{-1}$	Not	recorded				400.0d	521.0c	589.0c
Dalapon directed post-emergence @ 6.76 kg ai $(ha)^{-1}$	Not	recorded				493.7c	562.3c	586.0c
Weedy check	62.3c	220.0c	291.0a	274.3a	436.0a	682.7a	797.3a	947.3a

* Means not sharing a letter in common differ significantly at 5% probability level (DMR)

Table 2. *Weed mortality percentage (8th week after sowing)*

Weed	Pendimethalin incorporated @1.15 kg ai $(ha)^{-1}$	Pendimethalin pre-emergence @ 1.15 kg ai $(ha)^{-1}$	Trifluralin incorporated @ 0.175 kg ai $(ha)^{-1}$	Paraquat directed posteemergence @ 400 g ai $(ha)^{-1}$	dalapon directed Post-emergence @ 6.76 kg ai $(ha)^{-1}$	Weedy check
Cyperus rotundus (Purple Nutsedge)	08.3	08.01	11.05	36.69	37.99	Zero
Cynodon doctylon (Bermuda grass)	26.1	30.41	60.83	65.27	34.72	Zero
Paspalum paspalodes (Naru)	50.0	12.40	24.81	100.0	00.00	Zero
Trianthema monogyna (Itsit)	83.33	77.83	39.00	89.00	66.66	Zero

Table 3. *Effect of some pre and post-emergence herbicides on fresh and dry weight (g m^{-2}) of total weeds*

Treatment	Fresh weight	Dry weight
Pendimethalin @1.15 kg ai $(ha)^{-1}$ incorporated	808.8 cd*	267.0 b
Pendimethalin @1.15 kg ai $(ha)^{-1}$ pre-emergence	743.8 c	269.8 c
Trifluralin @0.175 kg ai $(ha)^{-1}$ incorporated	905.3 b	336.9 a
Paraquat @ 400 g ai $(ha)^{-1}$ directed post-emergence	670.4 d	224.8 c
Dalapon @ 6.76 kg ai $(ha)^{-1}$ directed post emergence	608.0 e	188.0 d
Weedy check	1113.8 a	364.0 a

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

Table 4. *Effect of weed control practices on seed cotton yield and its components*

Treatments	Germination count		Mono-podial branches /plant	Sympo-dial branches /plant	No. of bolls/ plant	Plant height (cm)	Seed cotton yield/ha (quintals)	G.O.T (%)
	7 days after sowing	15 days after sowing						
Pendimethalin @1.15 kg ai(ha)$^{-1}$ pre-emergence incorporated	29.66c*	29.66b	2.43c	19.96b	30.8bc	104.9c	15.12c	38.45**
Pendimethalin @1.15 kg ai (ha)$^{-1}$ pre-emergence	33.66b	35.66a	2.66c	18.33c	31.6bc	115.1b	16.59b	38.53
Trifluralin @0.175 kg ai (ha)$^{-1}$ pre-emergence incorporated	23.33d	26.0b	2.43c	16.33d	29.7c	108.3c	16.81b	38.66
Paraquat @400 g ai (ha)$^{-1}$ directed post-emergence	Not	recorded	3.36b	24.46a	40.0a	128.6a	18.59a	37.83
Dalapon @6.76 kg ai (ha)$^{-1}$ directed post-emergence	Not	recorded	4.43a	23.16a	40.33a	131.2a	19.51a	38.0
Weedy check	39.33a	38.0a	1.9a	15.56d	23.46d	105.0c	13.58	37.53

* Means not sharing a letter in common differ significantly at 5% probability level (DMR).
** Non-significant.

tion of paraquat @ 400 g ai $(ha)^{-1}$ (18.59 qha^{-1}) which was statistically equal to dalapon. Trifluralin @ 0.175kg ai $(ha)^{-1}$ incorporated and pendimethalin @ 1.16 kg ai $(ha)^{-1}$ treated plots produced significantly higher yield than control but these treatments produced statistically same seed cotton yield. However, pendimethalin @ 1.15 kg ai $(ha)^{-1}$ incorporated had less yield than the above four treatments but was higher than control. The increased seed cotton yield in dalapon and paraquat treated plots is mainly due to better weed control and less weed competition than other herbicidal treatments. Jalis and Shah (1984) found that by the application of dalapon @ 10 kg ha^{-1}, there was 41% higher seed cotton yield over control.

Data regarding germination of cotton, showed inhibitory effect of pendimethalin @ 1.15 kg ai $(ha)^{-1}$ incorporated and trifluralin @ 0.175 kg ai $(ha)^{-1}$ incorporated which may possibly be due to relatively higher dose under the sandy clay loam soil condition. The data pertaining to number of sympodial and monopodial branches per plant, number of bolls per plant and final plant height also indicated superiority of directed post-emergence application of herbicides over pre-emergence (Table 4). None of the herbicidal treatments under study affected ginning out turn percentage. Increased seed cotton yield by directed post-emergence herbicides has been demonstrated by Kasasian (1969), Baker (1981), and Jalis and Shah (1984).

From the above discussion it appears that directed post-emergence application of herbicides is a superior practice than pre-emergence, in suppressing weed population in cotton.

REFERENCES

Baker, R.S. 1981. Dalapon as a directed post-emergence spray in cotton. In proceedings 34th Annual Meeting Southern Weed Science Society, 28(En). (Cotton and Tropical Fibre Absts., 7(11):1287; 1982).

Blumenfeld, T., Y. Kleifeld and A. Bargutti. 1982. Johnsongrass control in cotton fields. Phytoparasitica, 10(4):288.

Brar, H.S. and H.S. Gill. 1985. Studies on pre and post-emergence

herbicides for weed control in cotton. J. Res., Pb. Agri. Univ., India, 22(3): 437-442.

Gupta, K.M. and K.V. Janardhanam. 1982. Studies on chemical weed control in cotton. Indian Weed Sci. Soc. Abst. (Weed Abst., 33(11): 3437; 1984).

Jalis, A. and M.L. Shah. 1984. Weedicide trial on cotton. Ann. Rep. Plant Phys. Sec., Ayub Agri. Res. Inst., Faisalabad.

Kasasian, L. 1969. Weed control in cotton. Cotton Growing Review, 46(3): 165-173.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. McGraw Hill Book Co., Inc., New York.

Zimdahl, R.L. 1980. The competitive effect of four weed species on cotton grown on two soil types. Weed-Crop competition. A Review. Inter. Plant Prot. Centre, Oregon State Univ., USA: 61-64.