

WEED CONTROL PRACTICES IN COTTON (*Gossypium Hirsutum* L.) PLANTED ON BED AND FURROW

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ABSTRACT

Different weed control measures (chemical and mechanical) for effective weed control in bed and furrow planted cotton were studied at Central Cotton Research Institute, Multan, Pakistan during 2004. Mechanical weed control methods included inter-culturing and hand weeding whereas chemical weed control methods included pre and post emergence weedicides. These methods were assessed on the basis of percent weed control and seed cotton yield. All chemical and mechanical weed control methods gave significant weed control and increase in seed cotton yield than un-treated (control). Stomp 330E @ 2.5 lit/ha (pre-emergence) in combination with mechanical methods gave 90.1 percent broadleaf and 89 percent grassy weed control while increase in seed cotton yield was 199.4 percent over untreated check. Round Up 490G/L @ 4.7 lit/ha (post-emergence directed application) in combination with mechanical methods gave 93.4 percent broad leaf and 80.3 percent grassy weed control while increase in seed cotton yield was observed at 188.9 percent over the untreated check.

Key words: *Gossypium hirsutum*, chemical control, mechanical control broadleaf and grassy weeds, seed cotton yield.

INTRODUCTION

Seed cotton yield is the product of interaction of several agronomic and environmental factors. Among agronomic factors weed control is very important for profitable seed cotton yield. Weeds reduce the yield both directly and indirectly. Directly they compete with the crop for space, water, light and nutrients. Indirectly they give shelter to insects and disease casual organisms. Nature has given certain peculiar characters for their existence in the fields. Weed seeds stay dormant for very long time, germinate earlier, their seedlings grow faster, flower earlier, form seeds in abundance and scatter seeds before maturity of main crop.

Weed seeds have remarkable capacity to germinate under varied conditions, but very peculiarly they are season bound and the peak period of germination always takes place in certain season in regular succession year after year. Another characteristic of the weed seeds is the phenomenon of "dormancy" which is an intrinsic physiological power of seed to resist germination even under favorable conditions and also the seeds do not lose their viability for years even under adverse conditions.

In weed crop competition study, it was found that cotton attained 95-100% ground cover in 13 weeks but more obnoxious weeds reached the same level in 5-9 weeks (Buchanan and Burns, 1969). Weeds are considered to be one of the primary

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factors in reduction of seed cotton yield. A cotton crop loss report prepared by several prominent university and USDA weed scientists estimated that up to 20% reduction in cotton yield is due to weed competition in some cotton producing states (Buchanan, 1979). In another study of production factors limiting cotton yield at various sites in Multan district concluded that plant density was the biggest contributor to the yield gap followed by the factors of plant protection and weed management respectively. For the yield gap of 1175 kg seed cotton, plant density accounts for about 43% plant protection about 32% and weed management about 21% and the remaining 1% is an unexplained residual (Gill, et al.1983).

The weed control by hand weeding and inter-culturing is not easy. It needs proper implements, and is time consuming and expensive. Chemical weed control method is easy, time saving and effective. Many researches (Chandi *et al.*, 1993; Charles, 1995; Rajiswari *et al.*, 1996; Charles, 1997; McCloskey, 1997; Patil *et al.*, 1997; Miller *et al.*, 1998; McCloskey *et al.*, 2000; Panwar *et al.*, 2000; Sreenivas, 2000; Cortes *et al.*, 2001; Fairbanks *et al.*, 2001; Jordan *et al.*, 2001 and Askew *et al.*, 2002) conducted field trials and reported that weeds were controlled and yield was increased by the application of herbicides at different levels. They also reported that it had no adverse effect on fiber quality. The application of pre-sowing or pre-emergence weedicides is not effective against all weeds. Post emergence herbicides application can control weeds but it needs proper time and skill. These all factors need to be integrated with each other for effective weed control and increase of seed cotton yield. The extent of reduction in yield due to weeds varies with a number of factors i.e. field-to-field and season to season etc. However, the losses determined at Central Cotton Research Institute, Multan from 1976-1988 by Agronomy Section vary from 34 to 88%. The average of 2 years comes 61.4%. The wider range was due to variation in weather and intensity of weeds in different fields and years (Ahmad, 1995).

Table-1. The most common weeds of cotton in Punjab, Pakistan

Botanical Name	Common name	Local Name
<i>Euphorbia prostrata</i>	Petty spurge	Dhodak
<i>Convolvulus arvensis</i>	Field bindweed	Lehli
<i>Cynodon dactylon pers</i>	Bermuda grass	Khabbal ghash
<i>Cyperus rotundus</i>	Purple nutsedge	Deela
<i>Portulaca oleracea</i>	Common purslane	Kulfa
<i>Sorghum halepense</i>	Johnsongrass	Baru
<i>Trianthema monogyna</i>	Horse purslane	It-Sit
<i>Amaranthus viridis</i>	Green amaranth	Chulai
<i>Echinochloa colonum</i>	Jungle rice	Swanki ghash
<i>Setaria viridis</i>	Green foxtail	Loomar ghash
<i>Euphorbia helioscopia</i>	Sun spurge	Dhodak
<i>Corchorus tridens</i>	Wild jute	Jangli Patsun
<i>Digeria muricata</i>	-	Tandla
<i>Tribulus terrestris</i>	Puncturevine	Bhakhra

Realizing the losses caused by weeds, effective control of un-necessary vegetation in the cotton fields must be adopted to increase the profit from the cotton crop. The major control measures are preventive, cultural, mechanical and chemical control measures. The inter-row cultivation, despite its weed management failure within rows, is an effective weed management strategy, but farmers cannot apply that until the crop height is sufficient to escape from burying. The most efficient cultivation is that which

destroys weeds at their seedling stage by uprooting, cutting their roots and covering others with soil between and within cotton rows. Inter row cultivation is time-honored way of controlling weeds in cotton. Benefits apart from weed control-better aeration, better infiltration of water and reduced evaporation from the soil-are often attributed to inter-row cultivation. Inter-row cultivation controls weeds effectively under ideal conditions but relies heavily on operator's skill, weather and on the crop being taller than the weeds.

Only small seedlings of weeds can be killed easily, therefore, proper timing of the inter-cultivation is essential for effective control. In fact tillage is still the basis upon which a sound weed management programme could be built. With the proper choice, adjustment, and the use of cultivation tools can reduce the weed problems. The integration with the pre-plant application of pendimethalin and trifluralin and pre-emergence application of metolachlor and acetochlor as selective weedicides in cotton has been recommended. The post emergence application of paraquat and glyphosate as directed sprays has also been recommended (Ahmad, 1995)

MATERIALS AND METHODS

Integration of different chemical and mechanical studies was carried out at the Agronomic Research Area of Central Cotton Research Institute, Multan on clay loam soil. Experiment was laid out in split plot design with four replications on well-prepared soil. Bed and furrows were made 75 cm apart by tractor driven implement "bed making machine" and properly shaped by bed shaper. After making proper lay-out, the cotton cult-var CIM-473 was planted, manually by dibbling of seeds at a distance of 30cm in rows at marked lines on the beds on 1st week of June, 2004. The planting irrigation was applied after sowing on the same day. The pre emergence weedicide Stomp 330E @ 2.5 L ha⁻¹ was sprayed after planting irrigation on moist bed and furrows on the same day in their respective plots. The post emergence weedicide Round-Up 490G L⁻¹ @ 4.7 L ha⁻¹ was applied as directed spray 40 days after sowing in respective treatments. Inter-culturing was done on 23rd, 37th and 52nd days after sowing (DAS) in specific plots. Hand weeding was done on 35th DAS in their respective plots. Data were recorded on dry biomass of weeds m⁻² of weeds and seed cotton yield (kg ha⁻¹). The data were subjected to the analysis of variance technique and the means were separated by LSD test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The analysis of data exhibited significant effect of interculturing and herbicides and their interaction for weed biomass of both broad and narrow leaf weeds. However, for the seed cotton yield the interaction of interculturing with herbicides was non-significant statistically. Data indicated that all the mechanical and chemical weed control methods gave statistically significant weed control over untreated check.

All the mechanical and chemical weed control methods gave significant increase in seed cotton yield. On over all average basis in cultural weed control methods, inter-culturing and inter-culturing plus hand weeding gave 48.7 and 71.5 percent increase in yield over no inter-culturing, respectively (Table-1). The chemical weed control methods, Stomp 330E and Round Up 490G/L gave 51.7 and 36.5 percent increase in yield over no chemical, respectively (Table-1). The weed control at 60 DAS indicated that Stomp 330E in combination with inter-culturing plus hand weeding gave 90 percent broad leaf weeds and 89 percent narrow leaf weed control while Round Up 490G/L in combination with

inter-culturing plus hand weeding provided 93% broad leaf weeds and 80% narrow leaf weeds control over untreated check. The maximum increase in seed cotton yield 199.4 percent was observed with Stomp 330E in combination with inter-culturing plus hand weeding while Round Up 490G/L in combination with inter-culturing plus hand weeding gave 188.9 percent increase in seed cotton yield over untreated check (Table-2).

These inferences are in a great conformity with the work of Miller *et al.* (1998), McCloskey *et al.* (2000), Panwar *et al.* (2000), Cortes *et al.* (2001), Fairbanks *et al.* (2001), Jordan *et al.* (2001) and Askew *et al.* (2002).

Table-1. Main effects of the main and sub-plots on weed biomass and seed cotton yield.

Mechanical weed control	Dry weight of weeds 60 DAS* (g m ⁻²)		Seed Cotton Yield (kg ha ⁻¹)	Herbicides	Dry weight of weeds 60 DAS* (g m ⁻²)		Seed Cotton Yield (kg ha ⁻¹)
	Broad leaf	Narrow leaf			Broad Leaf	Narrow leaf	
No inter-culturing	154.6	109.03	1248.0	No Chemical	154.88	146.93	1351.0
inter-culturing	62.25	85.17	1856.0	Stomp 330E	52.83	30.20	2049.0
Inter-culturing+ Hand weeding	43.28	59.73	2140.0	Round Up 490G/L	52.42	76.83	1844.0
CD _{0.05} for main-plots	3.27	10.09		CD _{0.05} for sub-plots	5.14	3.92	191.08

DAS* = Days After Sowing

Table-2. Interaction of different mechanical & chemical weed control methods on weed biomass and seed cotton yield.

Mechanical weed control	Herbicides (L ha ⁻¹)	Weed control 60 DAS				Seed Cotton Yield (kg ha ⁻¹)	% age Increase in Yield
		Dry weight of weeds (g m ⁻²)		%age weed control			
		Broad leaf	Narrow leaf	Broad leaf	Narrow leaf		
No Inter-culturing	No chemical	282.00	179.70	-	-	790	-
	Stomp 330E @ 2.5 L ha ⁻¹	86.30	43.40	69.39	75.85	1583	100.38
	Round Up 490G/L @ 4.7 L ha ⁻¹	95.50	104.00	56.21	41.60	1371	73.54
Inter-culturing	No chemical	99.20	137.10	68.82	23.73	1493	88.98
	Stomp 330E @ 2.5 L ha ⁻¹	44.30	27.40	84.29	84.80	2198	178.23
	Round Up 490G/L @ 4.7 L ha ⁻¹	43.25	91.00	84.65	49.40	1878	137.72
Inter-culturing + Hand weeding	No chemical	83.45	124.00	69.96	30.99	1771	124.18
	Stomp 330E @ 2.5 L ha ⁻¹	27.90	19.80	90.11	89.00	2365	199.4
	Round Up 490G/L @ 4.7 L ha ⁻¹	18.50	35.40	93.44	80.30	2283	188.9
	CD _{0.05} for Interaction	8.91	6.74	-	-	N.S	

CONCLUSION

The integration of chemical (pre and post emergence weedicides) and mechanical (Inter-culturing, hand weeding) weeding methods in bed-furrow planting of cotton gave significant weed control and increase in seed cotton.

REFERENCES CITED

- Ahmad, Z. 1995. Twenty-five years research activities at Central Cotton Research Institute, Multan from 1970-75. pp.6-7.
- Askew, S.D., J.W. Wilcut and J.R.Cranmer. 2002. Cotton (*Gossypium hirsutum* L.) and weed response to flumioxazin applied preplant and post-emergence directed. *Weed Tech.* 16(1):184-190.
- Buchanan, G.A and E.R.Burns. 1969. influence of various periods of weed competition on cotton. *Weed Sci. Soc. of Amer. Abst. No.* 151.
- Buchanan, G.A. 1979. Cotton weed loss Committee Report, 1978. *Proc. Beltwide Cotton Res. Conf.* P.134-136.
- Chandi, J.S., K. Sandhu and T. Singh. 1993. Weed management in American Cotton (*Gossypium hirsutum* L.). Integrated weed management for sustainable agriculture. *Proc. Ind. Society of Weed Science, Int. symposium, Hisar, Ind., 18-20 Nov.* III:176 -178.
- Charles, G.W. 1995. Nutgrass (*Cyperus rotundus* L.) Control in Cotton (*Gossypium hirsutum* L.). *Aus.J. Exp. Agric.* 35(5):633-639.
- Charles, G.W. 1997. Herbicides strategies for reducing nutgrass (*Cyperus rotundus* L.) density in Cotton (*Gossypium hirsutum* L.). *Aus. J. Exp. Agric.* 37(2):231 –241.
- Cortes, J.A., M. Castejon and M.A. Mendiola. 2001. Efficacy in the control of *Abutilon theophrasti* in conventional and transgenic Round-up Ready VTRR Cotton, with Split and Combined herbicide treatments. *Weed Tech.* 15 (1):141-147.
- Gill, M.I., Z. Ahmad and M.M. Ashraf. 1983. Some impression of production factors limiting cotton yields in Multan District. *The Pak. Cottons* 27(1):33-43.
- Mani, V.S. 1980. Weed Control Chapt. 9:263-295. *In. Hand Book of Agriculture* Pub. Jain Book Agency, New Delhi, 1980.
- McCloskey, W. B. 1997. Nutsedge (*Cyperus spp.*) management in Arizona using Round-up Ultra in Round-up Ready Cotton. *Proc. Beltwide Cotton Conferences, 2000, San Antonio, U.S.A.* 4-8 Jan.2:1492-1495.
- McCloskey, W. B., P.A.Clay and S.H.Husman. 2000. Weed control in ultra narrow row cotton in Arizona. *Proc. Beltwide Cotton Conferences, New Orleans, I.A. USA.* Jan.6- 10(1):786-787.
- Miller, D.K., J.L.Griffin, P.R.Vidrine, D.I. Jordan and D.B. Reynolds. 1998. Weed management using Round-up Ready technology. *J.Louisiana Agric.* 41(1):11-13.
- Panwar, R.S., R.S.Balyan and R.S.Malik. 2000. Evaluation of gluforinate for control of weeds in cotton. *Ind. J. Weed Sci.* 32(1/2):94-95.
- Patil, B.M., R.N.Statao and G.S.Lahassiya. 1997. Integrated Weed Management in Cotton. *PKV. Res. J.* 21(2):220-221.

Rajeswari, V.R. and N.R. Charyulu. 1996. Integrated weed control in cotton. *Annals Agric. Res.* 17(4):438-440.

Sreenivas, G. 2000. Effect of application of glyphosate with or without other pre-emergence herbicides in rainfed American cotton (*Gossypium hirsutum L.*). *Ind. J. Weed Sci.* 32(1-2): 98-100.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics: a biological yield approach, 2nd ed. McGraw Hill Book Co, Inc. New York, USA.