

EVALUATION OF CHEMICAL, MECHANICAL AND MANUAL WEED CONTROL METHODS IN COTTON

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ABSTRACT

An experiment was conducted to evaluate various weed control methods i.e. chemical, mechanical and manual at the Agronomic Research Station, Bahawalpur during Kharif, 2004. Treatments were Dual Gold 960 EC @ 2 lit ha⁻¹ pre-plant incorporated, Pendimethalin (Stomp 330 E) @ 3.75 lit ha⁻¹, Dual Gold 960 EC @ 2 lit ha⁻¹ + one earthing up, 8 weeks after sowing, Pendimethalin (Stomp 330 E) @ 3.75 lit ha⁻¹ + earthing up after 8 weeks of sowing. For mechanical weed control, two inter row cultivations, one at 4 weeks after sowing (before first irrigation) and other 8 weeks after sowing (after first irrigation) with tractor cultivation (by adjusting the tines) were given. Manual weed control was done by hand hoeing i.e. with hand hoe (1st 4 weeks and 2nd 8 weeks after sowing) and in an other manual weed control treatment one hand hoeing after 4 weeks of sowing and earthing up 8 weeks after sowing. Weed biomass was significantly reduced from 75 to 95 % in all the weed control treatments and seed cotton yield was increased by 46 to 61 % over weedy check. Dual Gold was found most effective against nutsedges and broad leaf weeds, while Stomp 330 E. was most effective against broad leaf weeds only. The maximum seed cotton yield was recorded in Dual Gold + earthing up after 8 weeks of sowing treated plots, followed by Stomp 330 E. + earthing up after 8 weeks of sowing treated plots. Although, cultivation with tractor was economically a better practice, yet combination of chemical and mechanical methods of weed control was the best solution for weed control and maximum economic returns.

Key words: *Gossypium hirsutum* L. integrated weed management seed cotton

INTRODUCTION

Weeds are a serious menace in crop production. Weeds reduce yield and quality of crops, harbor insects and disease organisms, impair human health, destroy irrigation system, and depreciate land values. 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.

Jalis and Shah (1982) while conducting research on weed problems in cotton and their control at Faisalabad reported that weed control increased yields by 14.53 to

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70.34%. They further reported that pre-emergence application of 2.0 lit acre⁻¹ of Stomp-330 E (pendimethalin) was effective in increasing cotton yield. Information about weeds, and their effects on cotton yield and weed management technology for cotton is lacking. Different methods are being used for controlling weeds. Some use mechanical method by modifying the commonly used cultivator while others rely on Stomp, as pre-emergence herbicide and still many other use none of the method. Cheema *et al.* (1988) revealed that pre-emergence and pre-plant incorporation of Pendimethalin (1.32 kg a.i. ha⁻¹) was most effective in controlling both broad leaf and grassy weeds but was less effective against *Cyperus rotundus* L.

Chemical weed control is of recent origin and is being emphasized in modern agriculture. However, it has not been adopted so far on a commercial scale due to lack of comprehensive information. In view of the aforesaid facts an investigation to evaluate the efficacy of different chemical, mechanical and manual weed control methods in cotton was carried out to develop a better weed management technology for cotton under Bahawalpur conditions.

MATERIALS AND METHODS

A field study was conducted to ascertain the effects of various weed control methods i.e. chemical, mechanical and manual, at Agronomic Research Station Bahawalpur during Kharif, 2004. The experiment was laid out in Randomized Complete Block Design with four replications and a plot size of 9.0 x 3.0 m². The experiment comprised eight treatments given in Table-1. Cotton cultivar BH-160 was planted in 75 cm apart rows with single row hand drill on May 16, 2004. A recommended dose (120-60-60 NPK kg ha⁻¹) of fertilizer was applied. All P and K + 1/3 Nitrogen was applied at sowing while remaining 2/3 Nitrogen was applied in two split doses with 1st and 3rd Irrigations. First irrigation was applied 30 days after emergence and subsequent irrigations were given at an interval of about two weeks depending upon the weather conditions. Pesticides were also applied as and when required to protect the cotton crop. Pre-emergence herbicides were sprayed with knapsack hand sprayer having flat fan nozzle. For inter-row cultivation, tractor mounted common cultivator was used by adjusting the tines according to the row distance. Hand hoeing was done with "Kasola" (hand held tool) at an interval of 4 and 8 weeks after sowing. Data on weed biomass m⁻² were recorded 60 days after sowing. Boll plant⁻¹, boll weight and seed cotton yield were also recorded and subjected to standard analysis of various technique and LSD test was employed to compare treatment means at 5% level of significance (Steel & Torrie, 1980). Economic and marginal analysis of the treatments was employed to determine the cheapest weed control method (CIMMYT, 1988).

Table-1. Weed control treatments in cotton

T ₁	Dual Gold 960 EC @ 2 lit ha ⁻¹ pre-plant incorporation.
T ₂	Pendimethalin (Stomp 330 E) @ 3.75 lit ha ⁻¹ pre-plant incorporation.
T ₃	Dual Gold 960 EC @ 2 lit ha ⁻¹ (PPI) + one earthing up 8 WAS*.
T ₄	Pendimethalin (Stomp 330 E) @ 3.75 lit ha ⁻¹ (PPI) + earthing up after 8 WAS.
T ₅	Mechanical weed control two cultivations with tractor (4 & 8 WAS).
T ₆	Manual weed control with Kasola (1 st 4 weeks and 2 nd 8 WAS)
T ₇	Manual weed control (one hand hoeing after 4 weeks + earthing up 8 WAS).
T ₈	Weedy Check.

WAS* = weeks after sowing

RESULTS AND DISCUSSION

Total weed dry biomass was significantly reduced 75-95% in all the weed control methods as compared to weedy check. Dual Gold 960 EC pre-plant incorporated

appeared to be the most effective in suppressing weed biomass. Stomp 330 E as pre-emergence was relatively less effective in reducing the total weed dry biomass as compared to Dual Gold herbicide. *Cyperus rotundus* was not suppressed by pre-emergence application of Stomp (Table-2). Dual Gold + earthing up and Stomp 330 E + earthing up treatments were very effective in reducing total dry biomass of all the weeds.

Table-2. Effect of different weed control methods on weed biomass after 60 days of sowing.

Treatments	Dry weed biomass (g m ⁻²)	Weed mortality (%)
T ₁ Dual Gold 960 EC	44 d	82
T ₂ Stomp 330 E	52 c	78
T ₃ Dual Gold 960 EC + earthing up 8 WAS*	12 e	95
T ₄ Stomp 330 E + earthing up 8 WAS	16 e	93
T ₅ Intercultivation 4 and 8 WAS	60 b	75
T ₆ Manual weeding with Kasola 4 and 8 WAS	60 b	75
T ₇ One hand hoeing 4 WAS + earthing up 8 WAS	52 c	78
T ₈ Weedy check	240 a	-

Any two means not sharing a letter in common differ significantly by LSD at 0.05 probability level.

Seed cotton yield significantly increased from 46 to 61 % in most of the treated plots vs weedy control plot (Table-3). Maximum seed cotton yield was obtained in Dual Gold + earthing up, followed by Stomp 330 E + earthing up treatment. While Dual Gold and Stomp 330 E applied as pre-emergence were statistically at par with one hand hoeing done 4 weeks after sowing + earthing up 8 weeks after sowing. However, T₅ & T₆ treatments were statistically non-significant. Data regarding 100-boll weight and number of boll plant⁻¹ (Table-3) indicated similar trend as in the case of seed cotton yield among different weed control methods (Table-3).

Table-3. Effect of different weed control methods on yield and yield components of cotton.

Treatments	No. of bolls/plant	100 Boll weight (g)	Seed cotton yield (kg ha ⁻¹)	Increase over control (%)
T ₁ Dual Gold 960 EC	36.33 c	372.7 bc	2897 c	53
T ₂ Stomp 330 E	35.33 cd	370.0 bc	2860 c	51
T ₃ Dual Gold 960 EC + earthing up 8 WAS*	40.00 a	390.3 a	3050 a	61
T ₄ Stomp 330 E + earthing up 8 WAS	36.67 b	375.3 b	2977 b	58
T ₅ Intercultivation 4 and 8 WAS	31.67 e	360.0 de	2767 d	46
T ₆ Manual weeding with Kasola 4 and 8 WAS	31.67 e	358.0 e	2760 d	46
T ₇ One hand hoeing 4 WAS + earthing up 8 WAS	34.33 d	366.7 cd	2863 c	51
T ₈ Weedy check	28.33 f	298.7 f	1890 e	-

WAS* = Weeks after sowing.

Any two means not sharing the same letter in a column differ significantly by LSD at 0.05 probability level.

Economic and marginal analysis of various treatments (Tables 4&5) showed that inter-row cultivation with tractor was the most economical weed control method with maximum marginal rate of return (Rs. 1626 ha⁻¹). However, all other treatments were better than control in terms of net benefits ranging from Rs. 15129/- to Rs. 20578/- ha⁻¹. From the above discussion it could be concluded that inter row cultivation with tractor is the best and economical weed control practice under normal conditions for cotton grown in Bahawalpur region. Although cultivation with tractor was economically a better practice yet combination of chemical and mechanical methods of weed control was the best solution for weed control to get maximum seed cotton yield with marginal rate of return from 748.97 to 910.53% (Table-5).

Table-4. Economic Analysis of various weed control methods in cotton

Parameters	Treatments								Remarks
	T1	T2	T3	T4	T5	T6	T7	T8	
Seed cotton yield	2897	2860	3050	2977	2767	2760	2863	1890	kg ha ⁻¹
Adjusted yield	2607	2574	2745	2679	2490	2484	2577	1701	10% less than actual yield.
Value of yield	57028	56306	60047	58603	54469	54338	56372	37218	@ Rs.2187.5/ 100 kg
Cost of 2-hoeing	-	-	-	-	-	-	1000	-	10 men/day/ ha
Cost of 2-cultivation	-	-	-	-	1000	2000	-	-	@ Rs.100/ man/day
Cost of earthing up	-	-	1000	1000	-	-	1000	-	@Rs.500 ha ⁻¹ / cultivation
Cost of herbicide	960	1220	960	1220	-	-	-	-	@Rs.500/ha ⁻¹ / earthing up
Sprayer rent + Application charges	300	300	300	300	-	-	-	-	*
Cost that vary	1260	1520	2260	2520	1000	2000	2000	-	
Net benefits Rs. ha ⁻¹	56768	54786	57787	57787	53469	52338	54372	37209	

* Stomp Rs.325/lit, Dual Gold 960 EC Rs.480/lit.

Table-5. Dominance and Marginal Analysis of weed control methods in cotton.

Treatments	Cost that vary Rs. ha ⁻¹	Net benefits Rs. ha ⁻¹	Benefit over control Rs. ha ⁻¹	Marginal rate of return (%)
T ₁ Dual Gold 960 EC	-	37209	-	-
T ₂ Stomp 330 E	1000	53469	16260	1626
T ₃ Dual Gold 960 EC + earthing up 8 WAS*	1260	56768	18559	1472.94 D
T ₄ Stomp 330 E + earthing up 8 WAS	1520	54786	17577	1156.38 D
T ₅ Intercultivation 4 and 8 WAS	2000	54372	17163	858.15 D
T ₆ Manual weeding with Kasola 4 and 8 WAS	2000	52338	15129	756.45 D
T ₇ One hand hoeing 4 WAS + earthing up 8 WAS	2260	57787	20578	910.53 D
T ₈ Weedy check	2520	56083	18874	748.97 D

REFERENCES CITED

- Anderson, W.P. 1983. Weed Science Principles. 2nd edition. West Pub. Co., St. Paul, Minn, USA. 33-42.
- Cheema, Z.A., S. Ahmed and A.J. Wahla. 1988. Chemical weed control in cotton. Pak. J. Agric. Sci. 25 (4) : 339-347.
- CIMMYT. 1988. From agronomic data to farmer recommendations. An Economics Training Manual Completely revised edition Mexico. D.F.
- Jalis, A. and M.L. Shah. 1982. Weed control in cotton resume. The Pak. Cottons 26 (3):141-148.
- Schwerzel, P.J. and P.E.L. Thomas. 1971. Weed competition in cotton. PANS., 17 (1) : 30-34.
- Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics. McGraw Hill Book Co, inc., New York.