

GROWTH AND DEVELOPMENT OF COTTON (*Gossypium hirsutum* L.) AS AFFECTED BY DIFFERENT METHODS OF Pendimethalin APPLICATION

**Dilbaugh Muhammad¹, Muhammad Naveed Afzal²,
Ilyas Raza² and Muhammad Azam Mian²**

ABSTRACT

Weed management is one of the most important factors in obtaining maximum crop productivity. An experiment was carried out consecutively for two years at the Research Farm of Central Cotton Research Institute, Multan during 2007 and 2008 to investigate the most appropriate and the safest method of pendimethalin application and its effects on % weed control, seed cotton yield and its components. Cotton cultivar CIM-496 was sown during the 3rd week of May in both the seasons on silty loam soil. Five different methods were evaluated which included application of pendimethalin 33% @ 2.5 litres ha⁻¹ (0.825 kg ha⁻¹) on prepared land and incorporated into the soil followed by making bed furrow, application on prepared seed bed before making bed furrow, application on dry bed furrow before dibbling and applying irrigation, immediately after planting in standing water and 24 hours after planting in moist soil. Results indicated that application of pendimethalin 33% on dry bed furrow before applying irrigation produced 82.5 % broad leaf and 84.1 % narrow leaf weed control which ultimately led towards obtaining seed cotton yield of 2689 kg ha⁻¹ which was 115.1% higher than the weedy check. However, spray on dry soil and incorporation, which gave 2547 kg ha⁻¹ was also statistically at par with the top ranking treatment. Thus, both these treatments are recommended for adoption, in order to harvest better seed cotton yields.

Key words: Pendimethalin, *Gossypium hirsutum* L., Weeds, Seed cotton yield.

¹ Senior Scientific Officer/Head Agronomy Section

² Scientific Officer Agronomy Section, Central Cotton Research Institute, Multan, Pakistan

INTRODUCTION

Cotton, also known as 'white gold', is an important fiber crop and plays an important role in many developing countries. The yield of the crop is dependent upon the environment in which it is grown and the management practices of the cropping system. Pakistan is the fifth largest producer of cotton in the world, the fourth largest consumer of cotton and the largest exporter of cotton yarn. Cotton and cotton products contribute about 10 per cent to GDP and 60 per cent to the foreign exchange earnings of the country (Anonymous, 2008).

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 systems and depreciate land values. Weed density can be controlled through the application of different herbicides. Among the herbicides, pendimethalin 33% is a directed dinitroaniline herbicide commonly used in Pakistan to control grasses and small-seeded dicot weed species. Applications can be made as pre emergence (PRE) or pre-plant incorporated (PPI).

Gill *et al.* (1996) noted that when pendimethalin applied on dry land and irrigated immediately, exhibited 81% weed control and increased seed cotton yield as compared to delayed irrigation. Hassan *et al.* (1996) noted that pendimethalin and trifluralin significantly decreased the weed infestation and increased seed cotton yield. Khan *et al.* (2001) observed significant decrease in weed population through pendimethalin and oxadiazon and showed significant increase in bolls per plant and seed cotton yield. Kaleem *et al.* (2006) concluded that the maximum reduction in weed density m^{-2} was obtained with the application of pendimethalin at $3.12 \text{ litres ha}^{-1}$ leading to the increased growth and yield of cotton (1305 kg ha^{-1}) as a result of reduced competition with weed plants.

Pendimethalin offers a reasonable alternative for weed control, but adequate information on the best method of application for the herbicide is not available. The present studies were carried out consecutively during crop seasons of 2007 and 2008 to study the different application methods of pendimethalin on weed density and their effect on seed cotton yield under the prevailing agro-ecological conditions of Multan, Punjab, Pakistan.

MATERIALS AND METHODS

An experiment was conducted at the Agronomic Research Area of Central Cotton Research Institute, Multan, Pakistan during 2007 and subsequently repeated in 2008. The cotton cultivar "CIM-496" was

planted during 3rd week of May on a silt loam soil. The experiments were laid out in randomized complete block design with four replications. The bed furrows as made on well prepared soil with 75 cm apart rows from each other by tractor driven implement. The cotton crop was planted manually by dibbling method at 22.5 cm plant to plant distance within the rows. Thinning was done 20 days after sowing by making single plant per hill. Pendimethalin 33% @ 2.5 litres ha⁻¹ (0.825 kg ha⁻¹) was sprayed with knapsack hand sprayer in their respective treatments at proper time. The pure tubewell water @ 2500 litres ha⁻¹ was used for spray in each treatment. The treatments included were application of pendimethalin 33% on prepared land and incorporated into the soil followed by making bed furrow, application on prepared seed-bed before making bed-furrow, application on dry bed-furrow before dibbling and applying irrigation, application immediately after planting in standing water, application 24 hours after planting in moist soil and untreated check. Data recorded were statistically analyzed by using the Fisher's analysis of variance technique and least significant difference (LSD) test at 5% probability was applied to compare the significance of the treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data regarding weed control 30 days after planting (Table-1) in terms of dry weed biomass indicated that the maximum weed control i.e. 82.5 and 84.1% of broad and narrow leave weeds was observed where pendimethalin 33% was applied on dry bed-furrow before planting irrigation while the minimum weed control of broad and narrow leaved weeds was observed where spray was done immediately after planting and 24 hours after planting in moist soil. The application of pendimethalin 33% on prepared land and incorporated into the soil followed by making bed-furrow showed weed control of 77.1 and 80.6% for broad and narrow leaves weeds over untreated, respectively. Pendimethalin 33% application on prepared seed bed before making bed-furrow gave 72.5% broad and 78.4% narrow leaves weeds control. These findings are supported by Richardson *et al.* (2007) who reported that the weeds are controlled more efficiently by the application of pendimethalin.

The application of pendimethalin 33% 60 Days after planting (Table-2) gave satisfactory weed control in all the treatments over untreated plots but the control was lower as compared to 30 days after planting. Pendimethalin 33% application on dry bed-furrow before planting irrigation produced the maximum weed control for broad leaf

and grassy weeds i.e. 53.7 and 63.3%, respectively. The minimum weed control for broad leaf (38.7%) and grassy weeds (46.0 %) was recorded where spray was done immediately after sowing in standing water. The treatments where spray was done on prepared land and incorporated into the soil followed by making bed-furrow produced weed control i.e. 51.2 and 56.3% for broad leaf and grassy weeds, respectively. However, application of pendimethalin 33% on prepared seed bed before making bed-furrow also gave satisfactory weed control (43.7%) for broad leaves and (51.1%) for grassy weeds. Similarly, the treatment where spray was done 24 hours after sowing in moist soil produced 41.3% weed control for broad leaf and 48.0% weed control for grassy weeds. It is concluded that two methods of application of pendimethalin 33% @ 2.5 litres ha⁻¹ (a.i. 0.825 kg ha⁻¹) are recommended on the basis of field trials; firstly, application on dry bed furrow before cotton seed planting and irrigation and secondly application on prepared land and incorporation into the soil followed by making bed furrow.

Data presented in Table-3 indicated that the application of pendimethalin 33% @ 2.5 lit ha⁻¹ produced significantly higher seed cotton yield and its component over untreated plot. The application of pendimethalin on dry bed-furrow before planting irrigation produced the maximum increase in seed cotton yield (115.1%) over the untreated check as well as other pendimethalin treatments except Spray on dry soil and incorporation, which gave 2547 kg ha⁻¹ (Table-3). The increase in seed cotton yield in top ranking treatments was due to the highest boll production and boll weight. These results are in conformity with the results reported by Hassan *et al.* (1996), Cheema *et al.* (1996), Halimie *et al.* (1994) and Shafi *et al.* (1996) who reported that the plots treated with pendimethalin had shown maximum seed cotton yield. The treatments where spray was done on prepared land and incorporated into the soil followed by making bed-furrow resulted in 103.8% increase in yield over untreated. Pendimethalin 33% application on prepared seed bed before making bed-furrow and immediately after sowing in standing water produced 95.5% and 86.2% increase in yield over untreated, respectively. Furthermore, the treatments where spray was done 24 hours after sowing in moist soil resulted in 82.3% increase in yield over untreated.

Table-1. Dry weed biomass (g m^{-2}) as influenced by different application methods of pendimethalin 30 days after planting.

Treatments	Dry weight (g m^{-2})			
	Dry weight (g m^{-2})		%age weed control	
	Broad leaved	Grassy	Broad leaved	Grassy
Spray on prepared land and incorporated into the soil and making bed-furrow.	20.9	6.1	77.1	80.6
Spray on prepared seed bed before making bed-furrow.	25.1	6.8	72.5	78.4
Spray on dry bed-furrow before planting irrigation	16.0	5.0	82.5	84.1
Spray immediately after sowing in standing water	28.7	9.1	68.6	71.1
Spray 24 hours after sowing in moist soil.	29.1	8.8	68.1	72.1
Untreated check	91.3	31.5	-	-
LSD_{0.05}	2.95	2.39		

Table-2. Dry weed biomass (g m^{-2}) as influenced by different application methods of pendimethalin 60 days after planting.

Treatments	Dry weight (g m^{-2})			
	Dry weight (g m^{-2})		%age weed control	
	Broad leaved	Grassy	Broad leaved	Grassy
Spray on prepared land and incorporated into the soil and making bed-furrow.	101.7	53.3	51.2	56.3
Spray on prepared seed bed before making bed-furrow.	117.3	59.7	43.7	51.1
Spray on dry bed-furrow before planting irrigation	96.5	44.8	53.7	63.3
Spray immediately after sowing in standing water	127.8	65.9	38.7	46.0
Spray 24 hours after sowing in moist soil.	122.3	63.5	41.3	48.0
Untreated check	208.4	122	-	-
LSD_{0.05}	3.50	2.74		

Table-3. Seed cotton yield and its components as influenced by different application methods of pendimethalin.

Treatments	Bolls plant ⁻¹	Boll weight (g)	Seed cotton yield (kg ha ⁻¹)
Spray on prepared land and incorporated into the soil and making bed-furrow.	28	2.37	2547
Spray on prepared seed bed before making bed-furrow.	26	2.38	2444
Spray on dry bed-furrow before planting irrigation	29	2.41	2689
Spray immediately after sowing in standing water	25	2.35	2328
Spray 24 hours after sowing in moist soil.	24	2.36	2279
Untreated check	13	2.33	1250
LSD_{0.05}	2.90	0.03	208.122

REFERENCES CITED

- Anonymous. 2008. Economic Survey of Pakistan. Ministry of Food, Agriculture and Livestock, Government of Pakistan, Finance Division, Economics Advisor Wing pp. 20.
- Cheema, M.S., L. Ali, and E. Ullah. 1996. Chemical, mechanical and manual control of weeds in cotton. Paper read at the 5th Pakistan Weed Science Conference March 1996, NARC, Islamabad.
- Gill, M.I., M. Anwar and D. Mohammad. 1996. Effect of pre-planting irrigation (rouni) and time of pre-emergence application of Stomp 330 E (Pendimethalin) in cotton. Paper read at the 5th Pakistan Weed Science Conference March 1996, NARC, Islamabad.

- Halimie, M.A, M.R. Ahmad, and M.A. Sheikh. 1994. Chemical weed control in cotton. Weed Management for sustainable Agriculture. pp. 169-175. Paper read at the 4th Pakistan Weed Science Conference March 26-27, 1994 University of Agriculture, Faisalabad.
- Hassan, G., N.U. Khan, and Q. Nawaz. 1996. Chemical control of weeds in cotton (*G. hirsutum* L.) under D.I.Khan conditions. Paper read at the 1st Crop Protection Conference (CAP) April 21-23, 1996 NWFP Agricultural University Peshawar, Pakistan, Abstracts pp. 41.
- Kaleem, S., M. Ansar, A. Ali and S. Ahmad. 2006. Efficacy of pendimethalin herbicide against *Trianthema monogyna* (horse purslane) weed in cotton crop sown on ridges. Pak. J. Weed Sci. Res.12(3):177-182.
- Khan, N.U., S.U. Khan, G. Hassan, I.H. Shah, and Q. Nawaz. 2001. Studies on weed control in cotton (*G. hirsutum* L.). Online J. Biol. Sci.1(3):143-145.
- Richardson, R.J., H. P. Wilson and T.E. Hines. 2007. Pre emergence herbicides followed by trifloxysulfuron Postemergence in Cotton. Weed Tech. 21(1):1-6.
- Shafi, M., N. Muhammad, M. Rafiq and M. Siddique. 1996. Effect of different herbicides for weed control in cotton crop. Paper read at the 5th Pakistan Weed Science Conference March 1996, NARC, Islamabad.
- Steel, R.G.D. and J. H. Torrie. 1980. Principles and procedures of statistics. A biometric approach, 2nd edition, Mc.Graw Hill, Inc. New York.