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Original Research Article

Glyphosat and Paraquat herbicides weed control and yield effect after emergence in cotton

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Abstract

Response of various post emergence herbicides at different levels i.e. round up was applied as 4.75 lha^{-1}, 2.75 L ha^{-1} and 1.75 L ha^{-1} (Glyphosat), Gramaxone 20EC (Paraquat) as 2.55 lha^{-1} and untreated (no spray) were field experimented against cotton cultivar CIM-473 under field condition at CCRI cotton research institute, Multan. Significant Control of weeds and increase in yield and yield contributing factors were observed. It was indicated that the highest significant yield, number of bolls, fresh weed biomass, dry weed biomass, plant height and weed control were obtained by using Round up (Glyphosate) @ 4.75 L ha^{-1} as compared to other treatments including untreated (control). Average boll weight was not significant among treatments but significant against control. The highest net profit was obtained by the Round up 490 G/L when treated @ 4.75 L ha^{-1} than all other treatments.

Keywords: Cost benefit analysis, Cotton growth, Glyphosate, Paraquat, Yield components

Introduction

Cotton is a major cash crop cultivated in Pakistan and is an important source of foreign exchange. The cotton has 1% share in GDP and 5.1% in agriculture. It has been cultivated an area of 2917 thousand hectares with 10074 thousand bales and yield as 587 kegs ha^{-1}. At present, the average seed cotton yield of Pakistan is much lower than other advanced countries i.e. UK, China, and India (Anonymous, 2016).

Besides many other factors like cultivar selection, irrigation techniques, fertilizer application rates and methods etc, the low yield per hectare is caused by serious weed infestation in the crop. Weeds compete in several ways with crop plants for space, nutrients, water, sunlight and many other basic requirements. These are the host and provide shelter for many insect/pests diseases. These can reduce average yield 33.50% to 55% or even result in complete crop failure (Ali *et al.*, 2013).

Weeding by cultural practices is laborious, tedious and difficult in contrast herbicide weed control in cotton, the method is easy, time saving and effective. Ali *et al.*, 2013, Alves *et al.*, 2011, Chaudhry *et al.*, 2011, Johnson *et al.*, 2009, Holloway *et al.*, 2008, Oad *et al.*, 2007, Deshpande *et al.*, 2006, Sheikh *et al.*, 2006 and Ali *et al.*, 2005, experimented in field and stated that weeds were controlled and cotton yield was maximized by the application of chemicals at applied on various rates and did not have negative effects on fibre quality characteristics. The herbicides Round up 490 G/L @ 4.75 lha^{-1}, 2.75 lha^{-1} and 1.75 lha^{-1} and Gramaxone 20EC @ 2.55 lha^{-1} were applied against untreated control after emergence of cotton plants, herbicides significant controlled all weeds and increased yield and yield components.

The chemical weed control appeared more beneficial and effective that was the objective of this research.

Materials and Methods

The investigations were carried out at the field area of CCRI Institute, Multan, during 2011 and 2012 on silt loam soil. Experiment was laid out in randomized complete block (R.C.B.D) design with three repeats against five treatments. Round up 490 G/L @ 4.75 lha^{-1}, 2.75 lha^{-1} and 1.75 lha^{-1} and Gramaxone 20EC @ 2.25 lha^{-1} and untreated control for cv CIM-473 by using net plot size 20ft x 50ft with 75cm R x R and 25cm P x P distance. The herbicides were applied after emergence of cotton plants. Each herbicide was mixed thoroughly in a spray volume of 250 L ha^{-1} and sprayed uniformly with knapsack sprayer fitted with fiat fan nozzle.

Uniform and normal field operations were applied for all the treatments. Weed control and yields component characteristics were investigated like number of weeds per m^2, Fresh weed biomass gm per m^2, weeds dry weight gm per m^2, bolls count per plant, Boll weight (g), Final plant height and yield of seed cotton kg ha^{-1}. Particular crop husbandry practices were adopted and insect/pests were controlled through regular insecticidal sprays. Data on weed control collected after 10, 20 and 30 days of spray and on yield and yield components at maturity were statistically analyzed by analysis of variance techniques and statistically significant differences among the means of the treatments were analyzed by Duncan's test of multiple range at 5% probability level as described by (Steel and Torrie, 1986).

Results and Discussion

Tested herbicides at different levels gave statistically significant decrease of weed population over untreated control as indicated in Table-1. Results were highly significant for lowest number of weeds (40.0 and 42) were found in plot treated with Round up 490 G/L @ 4.75 lha^{-1} against untreated control (274.5and 275) after 20 DAS (days after spray) respectively during 2011-12. It is the quality of Round up 490 G/L that it gives good results after 20 DAS. These results are supported by (Ali *et al.*, 2013 and Deshpande *et al.*, 2006). Data also represented that application of Round up 490 G/L @ 4.75 L ha^{-1}produced the lowest fresh weed biomass (228.6 and 229.6 g) against untreated control (4489.0 and 4491 g) after 20 DAS during both the years according to its quality then weed fresh biomass started to increase. These findings are in line with that of (Chaudhry *et al.*, 2011 and Johnson *et al.*, 2009). (Table-1)

Table-2 showed that the lowest dry weed biomass was produced by Round up 490 G/L @ 4.75 L ha^{-1} (177.4 and 179.6 g) against untreated control (645.0 and 646.5 g) after 20 DAS, then it started to increase. Ali *et al.*, 2013, Holloway *et al.*, 2008 and Ali *et al.*, 2005 were reported the same results. The highest significant bolls count per plant (19.17 and 20.01) was produced by Round up, when applied as 4.75 lha^{-1} against untreated control (10.40 and 11.30). These results are supported by (Chaudhry *et al.*, 2011, Sheikh *et al.*, 2006 and Ali *et al.*, 2005. 16).

The data in Table-3 also presented that statistically the highest boll weight was obtained by Round up 490 G/L applied @ 4.75 lha^{-1} (2.77 and 2.78 g) as compared with untreated control (2.16 and 2.18 g) These results are supported by Chaudhry *et al.*, 2011, Sheikh *et al.*, 2006 and Ali *et al.*, 2005. The tallest plant height was found in Round up 490 G/L treated plots when it was applied @ 4.75 L ha^{-1} (91.00 and 93.40 cm) against untreated control (62.03 and 63.70 cm) These results were supported by Ali *et al.*, 2013, Chaudhry *et al.*, 2011, Johnson *et al.*, 2009, Oad *et al.*, 2007 and Sheikh *et al.*, 2006. Data also showed that application of Round up 490 G/L @ 4.75 lha^{-1} produced significantly the highest yield of seed cotton (2076 and 2085 kilo grams ha^{-1}) against untreated control (870 and 891 kg ha^{-1}) and other treatments. It was occurred due to better growth of cotton plants as a result of minimum competition with weeds for moisture, nutrients, space etc. which attributed to yield of cotton. These results are in accordance with Ali *et al.*, 2013, Chaudhry *et al.*, 2011, Johnson *et al.*, 2009, Holloway *et al.*, 2008, Oad *et al.*, 2007 and Sheikh *et al.*, 2006.

Economics of new technology (inputs) was the basic consideration in this study, data indicated that maximum net profit was obtained by Round up 490 G/L when applied @ 4.75 lha^{-1} (Rs.12552.25) with less expenditures against other treatments including untreated control. On the basis of this evaluation, we can conclude that Round up 490 G/L @ 4.75 lha^{-1} may be sprayed for obtaining maximum return.

Table - 1: Effect of herbicides on weeds count and fresh weed biomass m^{-2}

Treatments	No. of Weeds m^{-2} 2011			No. of Weeds m^{-2} 2012			Fresh Weed Weight (gm^{-2}) 2011			Fresh Weed Weight (gm^{-2}) 2012		
	10 DAS	20 DAS	30 DAS	10 DAS	20 DAS	30 DAS	10 DAS	20 DAS	30 DAS	10 DAS	20 DAS	30 DAS
Round up 4.75 L ha^{-1}	48.7d	40.0c	78.0d	49.6d	42c	79.8d	341.2c	228.6c	382.2c	343.4c	229.6c	381c
Round up 2.75 L ha^{-1}	52.8c	86.5d	116.0c	52.4c	88.2d	116.c	619.5c	790.6d	1112.0d	620.5c	793.6d	1114.3d
Round up 1.75 L ha^{-1}	84.10b	113.5b	184.6b	85.4b	117.5b	185.3b	1368b	2171.0b	2860.0b	1371b	2173b	2863.0b
Gramaxone 2.55 L ha^{-1}	37.4c	100.5c	124.6c	38.0c	102.5c	126.5c	593.4d	1051.0c	1579.0c	596.4d	1053c	1582c
Control	240.3a	274.5a	290.1a	241.5a	274.5a	292a	3209a	4489.0a	5472.0a	3209a	4491a	5474a

DAS: Days after spray

Table - 2: Effect of herbicides on dry weed biomass gm^{-2} and bolls $plant^{-1}$

Treatment	Boll Weight 2011	Boll Weight 2012	Plant Height 2011	Plant Height 2012	Seed Cotton Yield 2011	Seed Cotton Yield 2012
Round up 4.75 L ha^{-1}	2.77a	2.78a	91.00a	93.40a	2076a	2085a
Round up 2.75 L ha^{-1}	2.67a	2.69a	85.00ab	87.30b	1579b	1587b
Round up 1.75 L ha^{-1}	2.53a	2.55a	76.67c	78.00c	1349b	1365b
Gramaxone 2.55 L ha^{-1}	2.60a	2.63a	83.00b	84.80b	1512b	1526b
Control	2.16b	2.18b	62.03d	63.70d	870c	891c

Table - 3: Effect of herbicides on boll weight (g), plant height (cm) and seed cotton yield (kg ha^{-1})

Treatments	Dry Weed Weight (gm^{-2}) 2011			Dry Biomass of weed (gm^{-2}) 2012			Bolls $plant^{-1}$ 2011	Bolls $plant^{-1}$ 2012
	10 DAS	20 DAS	30 DAS	10 DAS	20 DAS	30 DAS		
Round up 4.75 L ha^{-1}	138.3d	177.4c	182.6c	140.3d	179.6c	184.3c	19.17a	20.01a
Round up 2.75 L ha^{-1}	175.2c	219.3d	314.9d	176.5c	220.3d	316.7d	15.13b	16.30b
Round up 1.75 L ha^{-1}	230.5b	267.7b	483.8b	233.2b	269.3b	486.0b	13.00bc	13.62bc
Gramaxone 2.55 L ha^{-1}	129.1e	225.8c	341.0c	130.2e	227.7c	343.2c	15.03b	16.50b
Control	461.0a	645.0a	793.0a	463.3a	646.5a	795.3a	10.40c	11.30c

Table - 4: Cost benefit analysis for Post-Emergence Herbicides

Treatment	Total Herbicide Cost	Ave. Yield kg ha^{-1}	Cotton Sticks Value ha^{-1}	Gross Benefit	Total cost of Production	Net Benefit Obtained
Round up 4.75 L ha^{-1}	1927.00	2076	1500	43020	30467.75	12552.25
Round up 2.75 L ha^{-1}	1107.00	1579	1500	33080	29026.5	4053.5
Round up 1.75 L ha^{-1}	615.00	1349	1500	28480	28247	233.0
Gramaxone 2.55 L ha^{-1}	1100.00	1512	1500	31740	28935.75	2804.25
Control	-	870	1500	18900	27033.25	-8133.25

Seed Cotton Value (Rs) =800 / 40 kg; Cotton Sticks Value =600/ acre, Round up 490 G/L =410/L; Gramaxone 20EC =440/L

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