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Evaluation and Screening of Glyphosat and Paraquat Herbicides after Emergence in Cotton

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Abstract: Response of various post emergence herbicides at different levels i.e. Round up 490 G/L at the rate of 4.75 L ha^{-1}, 2.75 L ha^{-1} and 1.75 L ha^{-1} (Glyphosat), Gramaxone 20EC (Paraquat) at the rate of 2.55 L ha^{-1} and untreated (control) under field experiment in cotton cultivar CIM-473 at Agronomic Research Area of Central Cotton Research Institute Multan. Significant control of weeds and increase in yield and yield contributing factors were observed. It was observed 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 the 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.

Key words: Cost benefit analysis · Cotton · Growth · Glyphosate · Paraquat · Yield and yield components

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important cash crop of Pakistan and is an important source of foreign exchange. The cotton has 1% share in gross domestic products (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 in Pakistan is much lower as compared to other advanced countries i.e. UK, China, and India [1].

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 [2].

Weeding by cultural practices is laborious, tedious, time consuming and expensive in contrast chemical weed control method is easy, time saving and effective. Many researchers, Ali *et al.* [2], Alves *et al.* [3], Chaudhry *et al.* [4], Johnson *et al.* [5], Holloway *et al.* [6], Oad *et al.* [7], Deshpande *et al.* [8], Sheikh *et al* [9] and Ali *et al.* [10] conducted field trials and reported that weed were controlled and yield was increased by applying herbicides at different levels. It had no adverse effect on fibre quality. The herbicides Round up 490 G/L @ 4.75 L ha^{-1}, 2.75 L ha^{-1} and 1.75 L ha^{-1} and Gramaxone 20EC @ 2.55 L ha^{-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 study.

MATERIALS AND METHODS

The present study was carried out at the Agronomic Research Area, Central Cotton Research Institute, Multan, during 2011 and 2012 on silty clay loam soil. Experiment was laid out in randomized complete block (R.C.B.D) design with three replicates included five treatments. Round up 490 G/L @ 4.75 L ha^{-1}, 2.75 L ha^{-1} and 1.75 L ha^{-1} and Gramaxone 20EC @ 2.25 L ha^{-1} and untreated control for cv CIM-473 by using net plot size 20ft x 50ft with 75cm row to row and 25cm plant to plant distance. All the herbicides were applied after emergence of cotton

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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.

All other agronomic practices were uniform and normal for all the treatments. The weed control, yield and yield component parameters such as number of weeds (m^{-2}), fresh weed biomass (g m^{-2}), dry weed biomass (g m^{-2}), number of bolls $plant^{-1}$, boll weight (g), final plant height (cm) and seed cotton yield (kg ha^{-1}) were determined. 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 the significant differences among the treatment means were separated by Duncan's new multiple range test at 5% probability level as described by Steel and Torrie [11].

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 L ha^{-1} compered to untreated control (274.5 and 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.* [2] and Deshpande *et al.* [8].

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) compared to 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 results are in line with those those obtained by Chaudhry *et al.* [4] and Johnson *et al.* [5].

The lowest dry weed biomass was produced by Round up 490 G/L @ 4.75 L ha^{-1} (177.4 and 179.6 g) in comparison with untreated control (645.0 and 646.5 g) after 20 DAS, then it started to increase. Ali *et al.* [2], Holloway *et al.* [6] and Ali *et al.* [10] were reported the same results.

The maximum number of bolls $plant^{-1}$ (i.e. 19.17 and 20.01) were obtained by Round up 490 G/L, when applied at the rate of 4.75 L ha^{-1} compared to untreated control (10.40 and 11.30). These results are supported by Chaudhry *et al.* [4], Sheikh *et al.* [9] and Ali *et al.* [10].

The data also presented that statistically the highest boll weight was obtained by Round up 490 G/L applied @ 4.75 L ha^{-1} (2.77 and 2.78 g) as compared with untreated control (2.16 and 2.18 g) These results are in line with those of Chaudhry *et al.* [4], Sheikh *et al.* [9] and Ali *et al.* [10].

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) in comparison to untreated control (62.03 and 63.70 cm). These results were supported by Ali *et al.* [2], Chaudhry *et al.* [4], Johnson *et al.* [5], Oad *et al.* [7] and Sheikh *et al.* [9].

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

	No. of weeds m^{-2} 2011			No. of weeds m^{-2} 2012			Fresh weed Biomass (gm^{-2}) 2011			Fresh Weed Biomass (gm^{-2}) 2012		
Treatments	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 g^{-2} and bolls $plant^{-1}$

	Dry weed Biomass (gm^{-2}) 2011			Dry weed Biomass (gm^{-2}) 2012				
Treatments	10 DAS	20 DAS	30 DAS	10 DAS	20 DAS	30 DAS	Bolls $plant^{-1}$ 2011	Bolls $plant^{-1}$ 2012
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 3: Effect of herbicides on boll weight (g), plant height (cm) and seed cotton yield (kg ha^{-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 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 1.

Data also showed that application of Round up 490 G/L @ 4.75 L ha^{-1} produced significantly the maximum seed cotton yield (2076 and 2085 kg ha^{-1}) compared to 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 line with those of Ali *et al.* [2], Chaudhry *et al.* [4], Johnson *et al.* [5], Holloway *et al.* [6], Oad *et al.* [7] and Sheikh *et al.* [9].

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 L ha^{-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 L ha^{-1} may be sprayed for obtaining maximum return.

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