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INTEGRATED WEED MANAGEMENT AND ITS EFFECT ON THE SEED COTTON YIELD IN COTTON (*Gossypium hirsutum* L.) CROP

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ABSTRACT

Integrated weed control comprising the use of herbicide and cultural operation was carried out against major weed communities belonging to broad leaf, narrow leaf and sedges infested in cotton crop during the year 2004-05 at the Plant Protection Institute, Faisalabad. The treatments viz., Stomp 455 G/L CS @ 1.875 L ha-^{1} at pre-emergence of crop, Grip-up 48% SL @ 3.00 L ha-^{1} as post-em at 45 days, Two Hoeing (25 and 45 days after crop emergence), Stomp 455 G/L CS @ 1.875 L ha-^{1} at pre-em + Grip-up 48% SL @ 3.00 L ha-^{1} as post-em at 45 days, Stomp 455 G/L CS @ 1.875 L ha-^{1} at pre-em + Hoeing at 45 days after crop emergence and Hoeing at 25 days of crop emergence + Grip-up 48% SL @ 3.00 L ha-^{1} as post-em at 45 days were compared with the untreated check (UTC). The best weed control of 96.8 % was recorded in the integration of the pre and post-em herbicide treatment of Stomp 455 G/L CS and Grip-up 48% followed by Grip-up 48% with 90.25% weed control as compared with the UTC. The lowest weed control of 74.14% was recorded from Two Hoeings. As a consequence of the weed control, the highest seed cotton yield of 2671 kg ha-^{1} was obtained from integrated treatment of pre and post-em application of Stomp 455 G/L CS and Grip-up 48% SL followed by the integrated treatment of Hoeing and Grip-up 48% SL with 2629 kg ha-^{1}yield. All other treatments although comparatively gave lower performance towards weed control and seed cotton yield, but were significantly better than UTC which produced the lowest yield of 1932 kg ha-^{1} because of weed suppression. Results showed that all the weed control measures were effective and enhanced the seed cotton yield from 22.98 to 38.25 % over UTC. The study concluded that integrated weed management in cotton crop can significantly reduced the weed infestation and improve the seed cotton yield.

Key words: *Gossypium hirsutum* L., upland cotton, weed management, herbicides.

INTRODUCTION

Weeds are serious menace blocking the way of improvement in the yields of agricultural crops. Jain *et al*. (1981) found that weeds consume 5 to 6 times nitrogen, 5 to 12 times phosphorus and 2 to 5 times potash more than cotton crop at the early growth stages and thus reduced seed cotton yield from 54 to 85%. Anderson (1983) reported that weeds reduce yield and quality of crops, harbor insects/pests, diseases, impair human health, destroy irrigation system and depreciate land values. They compete with crops mainly for light, nutrients, water and carbon dioxide. Shad (1987) stated that cotton, being a crop of irrigated areas, is severely infested by almost all types of kharif weeds. Among 10 most important weeds commonly observed in Pakistan, *Cynodon dactylon* L. is a serious threat to our National Agriculture after *Trianthema monogyna* L. While,*Dactyloctenium aegyptium* L. is the fourth major weed causing yield losses to the crops.

Many weed scientists have evaluated various methods to control infestation of weeds and attempted to reduce yield losses in cotton crop. Nobrega *et al.* (1998) evaluated mixtures of herbicides to control weeds in cotton. The results showed that diuron (1.5 kg ha^{-1}) + alachlor (1.5 kg ha^{-1}), diuron (1.0 kg ha^{-1}) + trifluralin (1.6 kg ha^{-1}) and diuron (1.5 kg ha^{-1}) + pendimethalin (1.5 kg ha^{-1}) were the most efficient pre-emergence mixtures for controlling weeds for a period of 60 days after planting. Fiber quality was not affected by the herbicides. Rout (1998) evaluated different herbicides in rain fed cotton in India

and found that metolachlor (pre-em) at 1.25 kg ha^{-1} gave the best weed control and seed cotton yield, while glyphosate and pendimethalin greatly decreased plant height and cotton yield when more than one application was given. Panwar *et al*. (2001) evaluated trifluralin, pendimethalin, acetachlor, fluazifop-p-butyl and pysithiobac in combination with manual weeding in cotton. Application of pendimethalin and trifluralin at 1000 g ha^{-1} and pyrithiobac at 100 g ha^{-1} reduced the weed population significantly over the weedy control. One hoeing at 45 days after sowing followed by 1500 g acetochlor ha^{-1} was the most effective in controlling the weeds and recorded significantly higher seed cotton yield than the weedy control. Hiremath and Rao (2001) conducted a study to see the effect of weed management in irrigated hybrid cotton found that diuron+ manual weed control, inter-cultivation, standard farmer's practice and diuron followed by glufosinate @ 0.525 kg ha^{-1} applied after 20 or 40 days of sowing produced similar seed cotton yields to that of weedy-free control. Askew *et al*. (2002) conducted field trial and reported that weeds were controlled and yield was increased by the application of herbicides at different levels. The pre-sowing and pre-emergence herbicides are not effective against all weeds, whereas, post-emergence herbicides can control weeds but it needs proper time and skill. The combination of pre and post emergence herbicides are required to be integrated for effective weed control and increased in seed cotton yield. Ali*et al*. (2005) reported that maximum increase of 199.4% in seed cotton yield was obtained with Stomp 330E in combination with inter-culturing plus hand weeding while Round-up 490G/L @ 4.7 L ha^{-1} with 188.9% should increase over untreated check. Stomp 330E in combination with inter-culturing + hand weeding gave 90% broad leaf weeds (BLW) and 89% narrow leaf or grassy weeds (NLW) control, respectively, while Round-up 490G/L (directed spray) in combination with inter-culturing + hand weeding provided 93% control of BLW and 80% of NLW over untreated check.

Keeping in view the small scenario of weed control in cotton crop, recent study was conducted to evaluate the integrated weed management approach for enhancing the seed cotton yield per hectare.

MATERIALS AND METHODS

The study was conducted to evaluate the effect of integrated weed management on seed cotton yield for two consecutive years; 2004 and 2005 at the Plant Protection Institute, Faisalabad, Pakistan. Cotton cultivar FS-999 was sown in 75 cm spaced rows in plots measuring 8.25x10.00 m^2 following the randomized complete block design replicated thrice. Fertilizer @ 57.5:23:25 NPK kg ha^{-1} was applied at the time of sowing except N. Nitrogen was applied in three equal splits at sowing, after 35 days of crop emergence and nitrogen (N) at flowering stage of the crop. The planning of treatments was based on the use of herbicides, cultural operation (Hoeing) and integration of herbicide + cultural operation. Stomp 455 G/L CS was diluted in 300 liter of ordinary water and Grip-up 48% SL in 200 liter of tap water and applied through knapsack hand sprayer using T-Jet nozzle. Weed population m^{-2} in each case was recorded 30 days after applying the treatments. Crop was kept under regular observation for recording any incident concerning to phytotoxicity or physiological disorder due to herbicide action. Two pickings of seed cotton were done from each treatment for recording yield data. Data on weed density and seed cotton yield were compiled and statistically analyzed using Fihser's analysis of variance technique and the Least Significant Difference (LSD) test at $P \leq 0.05$ for comparing the treatment means to determine their efficacy for different parameters (Steel and Torrie, 1980).

RESUTLS AND DISCUSSION

WEED DIVERSITY

Weed species given in Table-1 showed that experimental area was infested with three different types of weeds belonging to BLW, NLW and Sedges communities. The BLW comprising seven species was dominating group with 62% mean population frequency followed by NLW species occupying 26% share recorded during 2004 and 2005. The lowest infestation of 12% belonging to Sedges was due to the single species of *Cyperus rotundus* L. Among all the weed species, *Trianthema partulacastrum* L. with 26% frequency was the most thickly populated weed of the trial area. The varying types of weeds found in the trial area was in conformity with the earlier findings of Shad (1987), who reported the presence of these weed communities in the cotton fields of Pakistan.

WEED DENSITY

The data on weed density m^{-2} (Table-2) showed that all the treatments included in the study controlled the weeds efficiently as compared with the untreated check (UTC). The weed density was significantly reduced in the herbicides, hoeing and in the integration of herbicides and hoeing treatments. Grip-up 48% SL, Stomp 455 G/L CS + Grip-up 48% SL and Hoeing + Grip-up 48% SL remained at par with 98.1% control of BLW. The lowest weed count of 0.33 m^{-2} resulted in 90.5% weed control was recorded from the Two hoeings. However, the BLW control was equally good in all other treatments and showed statistically at par weed control and significantly higher over the UTC. In case of NWL, the lowest weed count of 0.67 m^{-2} with the highest weed control of 96.2% was observed where Stomp 455 G/L CS + Grip-up 48% SL was applied followed by Grip-up 48% SL alone with 1 weed m^{-2} with 88% weed reduction and Hoeing + Grip-up 48% SL with 1.67 weed m^{-2} resulting in 79.95% weed control as against the UTC. Similarly, Sedges the third community of weeds was significantly controlled through Grip-up 48% SL resulting in 84.66% weed mortality with minimum weed count of 0.33 m^{-2}. All other treatments performed lower than Grip-up 48% SL but at par among them towards weed control except Stomp 455 G/L CS where significantly higher weed density of 4 m^{-2} was recorded. The results are in conformity with the earlier studies carried out by Nobrega *et al.*(1998), Rout (1998), Hiremath and Rao (2001), Panwar *et al*. (2001), Askew *et al*. (2002) and Ali *et al*. (2005) showing significant weed control through the integrated use of herbicides and cultural operation.

SEED COTTON YIELD

Data given in Table-3 showed that all the treatments comprising single or integrated method of weed control produced the significant higher seed cotton yields ranging from 2376 to 2671 kg ha^{-1} which was 22.98 to 38.25% higher than the yield obtained form UTC 1932 kg ha^{-1}. The highest seed cotton yield of 2671 kg ha^{-1} was obtained from Stomp 455 G/L CS + Hoeing followed by Hoeing + Grip-up 48% SL. These finding as similar to those reported by Anderson (1983), Rout (1998), Hiremath and Rao (2001), Panwar *et al*. (2001), Askew *et al*. (2002) and Ali *et al*. (2005). In case of single method, approach of weed control with Grip-up 48% SL proved the best and provided 98.1% control of BLW, 88% of NLW and 84.66% of Sedges but resulted in the lowest seed cotton yield of 2376 kg ha^{-1} among the other test treatments. The finding showed that control of weeds, at post emergence stage after at 45 days of crop emergence could not contribute efficiently as compared with the other treatments. Stomp 455 G/L CS although gave statistically higher seed cotton yield of 2490 kg ha^{-1} than Grip-up 48% SL but proved weak herbicide against the germinating NLW and Sedges but later suppressed their growth. The hoeing operation twice although produced the significantly higher seed cotton yield of 2535 kg ha^{-1} than both the pre and post-em herbicides but could not surpass the highest yield standard in this study. The integration of pre and post-em herbicides remained at 4^{th} position in case of seed cotton yield performance. It might be due to the suppressive effect of Grip-up 48% SL on the cotton plant which could not recover to normal health and vigour due to the adverse effect of both the herbicides. The integration of pre and post-em herbicides with that of hoeing operation remained the best towards seed cotton yield performance. Similar results had been reported by Nobrega *et al.* (1998), Rout (1998), Hiremath and Rao (2001), Panwar *et al*. (2001), Askew *et al*. (2002) and Ali *et al*. (2005) suggesting the integrated use of various methods of weed control.

CONCLUSIONS

It was deduced from the study that integrated method of weed management in cotton crop was the most effective for the control of all the three types of weeds comprising BLW, NLW and Sedges communities and resulted in the significantly higher seed cotton yield as compared with the single method approach and the untreated check. The study also indicated that use of the Stomp 455 G/L CS at pre-em stage of the crop and weeds proved a weak herbicide on NLW and Sedges while, Grip-up 48%SL at post-em stage of the weeds as well as that of the crop was poor to enhance the seed cotton yield. The findings necessitated to test and evaluate some other options like biological method to control various types of weeds for increasing the seed cotton yield on per unit area.

Table-1. Weed density as affected by integrated weed management IWM in cotton during 2004 and 2005.

I. BROAD LEAF WEEDS

S.No.	ENGLISH NAME	LOCAL NAME	TECHNICAL NAME	FREQUENCY %
1.	Horse purslane	Itsit	*Trianthema partulacastrum*	26
2.	False amaranth	Tandla	*Digera arvensis*	11
3.	Pigweed	Jungli cholai	*Amaranthus viridis*	4
4.	Wild cucurbit	Chibber	*Mukia maderaspatana*	9
5.	Common purslane	Qulfa	*Portulaca oleracea*	4
6.	Red spurge	Lal dodhak	*Euphorbia pilulifera*	3
7.	Puncture vine	Bakhra	*Tribulus terrestris*	5
TOTAL				**62**
II. NARROW LEAF WEEDS				
8.	Bermuda grass	Khabbal	*Cynodon dactylon*	8
9.	Crowfoot grass	Madhana	*Dactyloctenum aegyptium*	9
10.	Johnson grass	Baru	*Sorghum halepense*	6
11.	Jungle rice	Swanki	*Echinochloa colona*	3
TOTAL				**26**
III. SEDGES				
12.	Purple nutsedge	Deela	*Cyperus rotundus*	**12**

Table- 2. Weed density as affected by integrated weed management IWM in cotton during 2004 & 2005.

S.NO	TREATMENTS	WEEDS m^{-2}			% WEED CONTROL		
		BLW	NLW	SEDGES	BLW	NLW	SEDGES
1.	Stomp 455 G/L CS @ 1.875 L ha^{-1} pre-em.	0.67b	3.67b	4.00b	96.2	55.94	53.9
2.	Grip-up 48% SL @ 3.00 L ha^{-1} post-em at 45 days.	0.33b	1.00b	1.33c	98.1	88.00	84.66
3.	Two hoeing, 25 and 45 days after crop emergence.	1.67b	2.00b	3.67bc	90.5	76.00	55.94
4.	Stomp 455 G/L CS @ 1.875 L ha^{-1} at pre-em + Grip-up 48% SL @ 3.00 L ha^{-1} post-em at 45 days.	0.33b	0.67b	0.33c	98.1	96.2	96.2
5.	Stomp 455 G/L CS @ 1.875 L ha^{-1} at pre-em + hoeing at 45 days after crop emergence.	0.67b	2.00b	3.67bc	96.2	76.00	57.67
6.	Hoeing at 25 day of crop emergence + Grip-up 48% SL @ 3.00 L ha^{-1}post-em at 45 days.	0.33b	1.67b	2.33c	98.1	79.95	61.59

7.	Untreated Check	17.67a	8.33a	8.67a	N.A.	N.A.	N.A.
$LSD_{0.5}$		2.20	3.25	3.10	-	-	-

Table-3. Seed cotton yield as affected by integrated weed management IWM in cotton during 2004 & 2005.

S.NO.	TREATMENTS	YIELD kg ha^{-1}	YIELD INCREASE %
1.	Stomp 455 G/L CS @ 1.875 L ha^{-1} pre-em.	2490 c	28.88
2.	Grip-up 48% SL @ 3.00 L ha^{-1} post-em at 45 days.	2376 d	22.98
3.	Two hoeing, 25 and 45 days after crop emergence.	2535 bc	31.21
4.	Stomp 455G/L CS @1.875 L ha^{-1} at pre-em + Grip-up 48% SL @ 3.00 L ha^{-1} post-em at 45 days.	2528 bc	30.84
5.	Stomp 455G/L CS @1.875 L ha^{-1} at pre-em + hoeing at 45 days after crop emergence.	2671 a	38.25
6.	Hoeing at 25 day of crop emergence + Grip-up 48% SL @ 3.00 L ha^{-1} post-em at 45 days.	2629 ab	36.07
7.	Untreated Check	1932 e	N.A.
$LSD_{0.5}$		112.3	-

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