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Studies on Herbicidal Weed Control in Mustard

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Abstract: An experiment on herbicidal weed control in mustard was conducted in two successive rabi seasons (1998-1999 and 1999-2000) to find out the effective herbicide for weed control in mustard. Performance of Ronstar and Setoff were tested against one hand weeding at 25 days after sowing and unweeded control plots using three mustard varieties (Daulat, Dhali and Tori-7). Application of Ronstar effectively reduced weed dry weight and gave 10 and 30% higher grain yield of mustard compared to hand weeding and unweeded control plots, respectively. Setoff also reduced weed dry weight but at the same time it reduced plant stand and yield attributes of mustard that causes 60-75% yield reduction compared to unweeded control plot. This indicates that Setoff is detrimental to weeds as well as mustard. Yield difference of the varieties was significant. Among the varieties, Daulat gave the highest grain yield. Interaction effect of varieties and weed control measures was significant. Across the seasons, Ronstar effectively reduced weed growth and consequently gave higher grain yield of mustard regardless of variety.

Key words: Herbicide, weed, mustard

INTRODUCTION

Mustard is the leading oil seed crop of Bangladesh occupying about 60% of the total oil seed crops area of the country (BBS, 1999). Mustard oil is being used as a medium of cooking from the time immemorial. The country is running with acute shortage of edible oil. The total production of edible oil meets only 25% of the country's requirement (Chowdhury and Uddin, 1990). The remaining two-third is imported with a huge amount of foreign exchange. There are two possible ways to mitigate this problem. One is to increase the production area of mustard and another is to increase the productivity of per unit area. Increase the production area is not possible because most of the farmers are interested in growing of high yielding rice instead of mustard. Therefore, increase the productivity of per unit area is the only way to mitigate this problem partially. In Bangladesh, mustard is low yielding due to lack of high yielding varieties and poor management practices. Weed is one of the important factors responsible for low yield in crop. Weed grows simultaneously with crop and competes for natural growth resources, which causes a reduction in crop yield. Weed infestation caused 30 to 35% yield losses in mustard (Gill *et al.*, 1984; Prusty *et al.*, 1996). Proper weed control measure with other intercultural operation can increase the productivity of mustard. In Bangladesh, farmers usually control weeds mechanically but with the development of industry field labors have migrated to the urban areas and remaining labors are scarce and costly.

Therefore, the present experiment was undertaken to find out the most effective herbicide for control of weed in mustard.

MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station, Pabna in two successive rabi seasons (1998-99 and 1999-2000). The experiment was laid out in a split plot design with three replications. Four weed control measures-Ronstar as pre-emergence, Setoff as pre-emergence, one hand weeding at 25 days after sowing (DAS) and unweeded control treatments were imposed in three mustard varieties (Daulat, Dhali and Tori-7). Mustard varieties were assigned in main plot while weed control measures were assigned in subplot. The unit plot size was 3 x 4 m. Fertilizer used @ 120-80-60-40-4-1 kg ha⁻¹ N-P₂O₅-K₂O-S-Zn-B. All PKSZN-B and one-third N were applied as basal. The rest of N was split at 25 and 40 DAS. The seeds were sown on 4th December 1998 and 15th November 1999 at a spacing of 30 x 10 cm. According to treatment, Ronstar (30 ml/10 L water) and Set-off (1g/10 L water) were sprayed through low compression hand operated Knapsack Sprayer on the following day of sowing. In manual weeded plots, weeds were removed at 25 DAS while un-weeded control plots allowed growing of weeds through out the crop growth period.

Weed samples were collected using 50 x 50 cm quadrat placed at three randomly selected spots in each plot at 25 DAS and at harvest of the crop and dry

weight was recorded. Weed control efficiency (WCE) was calculated following (Varshney, 1990).

$$\text{WCE (\%)} = \frac{A-B}{A} \times 100$$

where, A and B are the dry matter yield of weeds in unweeded control and treatment, respectively.

Tori-7 was earlier than other variety. Tori-7 took 75-80 days to become mature while Daulat and Dhali took 90-95 days. At harvest, data on yield component were recorded from ten randomly selected plants in each plot. Grain yield was recorded from 6m² (2 x 3 m) area of each plot. Data on yield and yield contributing characters were analyzed statistically and mean separation was done by LSD test.

RESULTS AND DISCUSSION

Effect on weed

Weed flora: The crop was infested with *Chenopodium album*, *Cyperus rotundus*, *Cynodon dactylon* and some negligible percent of other weeds. However, *Chenopodium album* and *Cyperus rotundus* were dominant weed species.

Weed dry weight and weed control efficiency: Application of herbicides and hand weeding reduced weed dry weight compared to unweeded control plots both at 25 DAS and at harvest, regardless of mustard varieties (Table 1). At 25 DAS, comparatively lower weed dry weight was found in Ronstar used plots while at harvest that was lower at hand weeding plots. Consequently higher weed control efficiency (WCE) was found in Ronstar used plots at 25 DAS but at harvest that was higher in hand weeding plots. Setoff showed poor WCE both at 25 DAS and harvest.

Pre-emergence application of Ronstar suppressed weed growth up to 25 DAS and showed higher WCE than other treatments. At later growth stage, some weeds regenerated in Ronstar used plot that lowered WCE. In hand weeding plots weeds allow growing up to 25 DAS. After 25 DAS, hand weeding caused effective control of weeds and did not allow the weeds so much to regenerate and therefore, higher WCE was found in hand weeding plots at harvest. Higher WCE is desirable from 25 to 40 DAS for better yield of mustard (Singh *et al.*, 2001).

Effect on crop

Yield and yield attributes

Effect of variety: Varietal performance on the yield and yield contributing characters was significant except plants/m² (Table 2). Plants/m² did not vary due to variety.

Among the varieties, Daulat was superior in respect of yield contributing characters and yield. Significantly highest grain yield was obtained from Daulat in 1998-99 while the grain yield of Daulat and Dhali was statistically similar in 1999-2000. The grain yield of Tori-7 and Dhali was identical in 1998-99 but in 1999-2000 grain of Dahli was significantly higher than Tori-7. The almost similar trend was found in straw yield.

Effect of weed management: Herbicide significantly influenced the yield and yield contributing characters (Table 2). Hand weeding and Ronstar used plots showed positive impact on plant population while Setoff used plots showed negative impact in both the years. The lowest plant/m² was recorded in Setoff used plots. Setoff might have phytotoxic effect on mustard. The tallest plant was recorded in Ronstar used plots while the shortest in Setoff used plots. The highest number of branches per plant was found in Ronstar used plots, which was followed by hand weeding and unweeded control plots. The lowest number of branches per plant was observed in Setoff used plots. Siliqua per plant of Ronstar and hand weeding plots was identical but that was significantly higher than Setoff used plots. Significantly lowest number of siliqua per plant was observed in Steoff used plot in 1998-99 while that was identical to hand weeding and unweeded control plots in 1999-2000. Seeds per siliqua were highest in Ronstar used plots in both the years. Weight of 1000-grain of Ronstar and hand weeding plots was statistically similar and that was significantly higher than Setoff used plots. The highest grain yield was recorded in Ronstar used plots, which was followed by hand weeding, unweeded control and Setoff used plots. Straw yield also follows the similar trend. All the weed control methods except Setoff increased the grain yield of mustard. The increase in grain yield with weed control methods is believed to be an indirect expression of reduction in weed-crop competition, which helped in increasing yield component and grain yield of the crop. Setoff used plots gave the lowest yield due to the lowest plant population as well as poor yield contributing characters.

Interaction effect of variety and weed control methods:

Interaction effects of variety and herbicide on the yield and yield contributing characters were significant except number of siliqua per plant in 1998-99, which was not significant (Table 3). Regardless of variety, Ronstar used plots showed higher yield contributing characters, which contributed to the highest grain yield of mustard followed by hand weeding treatment. The similar trend was found in straw yield. Irrespective of variety, Set-off used

Table 1: Treatment effects on weed dry weight (g/m²) and weed control efficiency at 25 DAS and at harvest

Treatments		Weed dry weight (g/m ²)				Weed control efficiency (%)			
		25 DAS		At harvest		25 DAS		At harvest	
Variety	Herbicide	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
Daulat	Ronstar	17.60	13.07	20.92	24.13	23.28	53.10	31.81	18.12
	Setoff	19.60	26.80	30.30	26.00	14.56	15.32	2.21	11.77
	Hand weeding	17.46	23.60	22.40	13.20	23.89	3.83	26.98	55.20
	Unweeded control	22.94	27.87	30.68	29.47	-	-	-	-
Dhali	Ronstar	13.34	12.97	20.80	18.40	50.96	43.43	28.37	41.00
	Setoff	28.00	26.27	29.60	26.53	7.47	14.57	1.89	14.97
	Hand weeding	27.20	22.26	15.72	12.40	10.11	2.92	45.86	60.25
	Unweeded control	30.26	22.93	29.04	31.20	-	-	-	-
Tori-7	Ronstar	14.50	11.87	17.20	24.40	30.29	47.64	12.11	4.20
	Setoff	17.60	21.60	18.28	24.80	15.38	4.71	17.30	2.63
	Hand weeding	19.20	20.80	13.04	12.93	7.70	8.24	37.30	49.23
	Unweeded control	20.80	22.67	20.80	25.47	-	-	-	-

Table 2: Effect of variety and herbicide on the yield and yield contributing characters of mustard

Treatments		Plants/m ²		Plant height (cm)		Branches/plant		Siliqua/plant	
		1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
Variety									
Daulat		32.44	49.00	91.53	104.40	7.37	7.00	149.72	120.00
Dhali		31.11	50.00	73.98	88.80	4.66	4.00	129.63	98.00
Tori-7		32.22	52.00	75.47	68.70	7.12	6.00	162.16	104.00
LSD(0.05)		NS	NS	8.18	12.00	2.10	1.90	22.41	18.50
CV (%)		7.20	10.30	8.99	10.50	8.90	7.50	11.40	8.00
Herbicide									
Ronstar		34.81	68.92	96.32	111.00	11.14	7.51	156.80	107.40
Hand weeding		37.78	54.41	84.78	102.30	9.48	6.16	150.50	99.53
Setoff		16.29	23.70	61.84	39.16	6.16	4.07	133.56	58.40
Unweeded control		34.81	54.89	78.36	96.70	8.28	5.29	147.83	96.96
LSD(0.05)		4.45	7.05	6.97	5.57	0.88	0.67	6.94	16.10
CV (%)		10.50	11.10	8.80	6.45	10.20	11.70	4.80	7.90

Table 2: (cont'd)

Treatments		Seeds/siliqua		1000-grain weight (g)		Grain yield (kg ha ⁻¹)		Straw yield (kg ha ⁻¹)	
		1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
Variety									
Daulat		20.54	21.74	2.00	2.48	695	791	2125	2600
Dhali		10.60	10.82	1.70	2.12	533	756	1642	2480
Tori-7		18.29	11.80	1.97	2.06	581	629	1515	2130
LSD(0.05)		1.73	1.99	NS	NS	105	58	290	260
CV (%)		9.27	10.36	8.60	10.0	11.4	6.11	12.50	8.33
Herbicide									
Ronstar		19.19	15.82	2.35	2.21	825	1086	2446	3590
H weeding		16.57	14.64	2.11	2.45	744	962	2216	3289
Setoff		14.16	13.56	1.46	2.04	245	168	435	380
Unweeded control		15.28	14.76	1.77	2.19	599	685	1946	2350
LSD(0.05)		0.97	1.31	0.25	0.31	49.27	51.85	215.79	220
CV (%)		5.90	9.05	12.90	10.20	9.80	7.22	12.40	9.37

Table 3: Interaction effect of variety and herbicide on the yield and yield contributing characters of mustard

Treatments		Plants/m ²		Plant height (cm)		Branches/plant		Siliqua/plant	
		1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
Variety	Herbicide								
Daulat	Ronstar	33.33	62.22	111.03	125.70	8.73	8.93	160.67	139.10
	Hand weeding	37.77	52.22	98.36	124.20	8.00	7.40	154.50	137.90
	Set-off	15.54	26.67	70.00	50.94	5.30	4.53	139.40	70.87
	Unweeded control	31.11	56.67	86.74	116.7	7.43	6.53	144.33	131.30
Dhali	Ronstar	35.55	69.89	94.25	114.8	6.07	5.40	142.90	56.60
	Hand weeding	40.00	56.55	77.61	106.5	5.20	4.80	135.13	46.87
	Setoff	11.11	21.66	48.01	35.81	3.30	2.87	129.43	34.80
	Unweeded control	37.77	53.45	76.04	98.03	4.25	3.87	129.43	54.73
Tori-7	Ronstar	35.55	75.67	83.68	92.37	8.89	8.20	166.83	126.50
	Hand weeding	35.55	54.44	78.36	76.33	5.23	6.27	161.87	113.80
	Setoff	22.22	22.78	67.52	30.73	4.11	4.80	150.20	69.53
	Unweeded control	35.55	54.55	72.30	75.40	3.27	5.47	169.73	104.90
LSD(0.05)		6.66	12.22	12.07	9.65	1.53	1.16	NS	27.87
CV(%)		11.23	10.31	9.69	12.12	8.87	7.98	6.69	8.45

Table 3: (cont'd)

Treatments		Seeds/silique		1000-grain weight (g)		Grain yield (kg ha ⁻¹)		Straw yield (kg ha ⁻¹)	
Variety	Herbicide	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
Daulat	Ronstar	22.93	24.13	2.50	2.33	967	1128	2926	3840
	Hand weeding	20.77	20.73	2.23	2.50	859	986	2644	3360
	Setoff	18.53	18.73	1.53	2.33	278	317	426	680
	Unweeded weeding	19.80	22.27	1.73	2.56	678	735	2505	2530
Dhali	Ronstar	12.80	11.33	2.13	2.27	772	1146	2444	3570
	Hand weeding	11.77	10.60	1.93	2.40	721	1077	2171	3670
	Setoff	8.67	11.27	1.30	1.90	67	81	225	200
	Unweeded control	9.17	10.07	1.80	1.93	571	720	1727	2450
Tori-7	Ronstar	21.83	12.00	2.43	2.03	736	986	1968	3360
	Hand weeding	18.90	12.60	2.17	2.26	652	824	1833	2840
	Setoff	15.27	10.67	1.53	1.90	389	106	653	270
	Unweeded control	17.17	11.93	1.77	2.07	547	600	1606	2070
LSD(0.05)		2.25	2.28	NS	0.53	85.34	89.80	373.76	380
CV(%)		9.77	10.64	4.55	5.24	11.59	9.25	12.22	10.19

showed lowest plant stand with stunted growth and poor plots yield contributing characters and consequently gave lowest grain yield. The grain yield of mustard in Setoff used plots was even lower than unweeded control plots. Set-off might have phytotoxic effect on mustard which caused reduction in plant stand and crop growth. In general, the grain of mustard in 1999-2000 was higher than that of 1998-99 due to better plant stand in 1999-2000. From this study it is revealed that the pre-emergence application of Ronstar (3ml L⁻¹ water) is very much effective for the control of weed in mustard.

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