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HERBICIDAL EFFECT ON THE GROWTH AND YIELD OF WHEAT

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ABSTRACT

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A field trial was conducted at Regional Wheat Research Center, Shyampur, Rajshahi during winter season of 2004-2005 to make certain a suitable herbicide for weed control as well as increase the yield of wheat. Effect of twelve treatment combinations i.e. Lintur 70 WG at two, four and six leaves stage of three doses, 2-4,D Amine at four leaves stage, one hand weeding and control on wheat variety Shatabdi were studied. The major weeds observed were *Chenopodium album, Cyprus rotundus, Cynodon dactylon and Echinochloa crusgalli*. The population and dry weight of weeds were minimum in Lintur 70 WG @ 375 g/ha at two leave stage and maximum in control plot i.e. no weeding. Weed control efficiency (%) was maximum in Lintur 70 WG @375 g/ha at two leave stage which was at par with hand weeding. Yield and yield components significantly responded to different treatments. Lintur 70 WG @ 375 g/ha at two leave stage sprayed significant effects on weeds. The maximum grain yield (3.4 t/ha) was obtained by Lintur 70 WG @ 375 g/ha at two leave stage which was at par with hand weeding due to lower weed-crop competition resulted higher absorption of nutrients and sufficient interception of sunlight as well as air. The lowest grain yield (2.4 t/ha) was found in control plot (No weeding) due to weed-crop competition from first to last resulted sharing of nutrient, air and sunlight. Significantly more wheat yield was recorded in weed free treatment. Wheat yield was gradually decreasing with the increasing of weed populations.

Keywords: Herbicide, Weeds control, Wheat Yield

INTRODUCTION

Wheat is the second leading cereal crops in Bangladesh. Wheat is grown more or less all over Bangladesh as sole or intercrop. But the average yield of wheat is relatively low in contrast to the potential yields obtained on the research field. Wheat yield gets severely reduced due to broad spectrum weed flora in different areas. Wheat is grown in winter and since the low temperature favors germination and growth of important weeds like *Chenopodium sp.* (Hirano et.al.1991).Some other scientists observed that the broadleaf weeds were predominant in wheat field (Mamun and Salim.1989). Weeds are another serious problem in wheat cultivation and unchecked weed growth reduces crop yield up to 57% (Singh *et al.*, 1997). Besides other crops weed is a major problem for maximizing higher yields of wheat. Due to weed infestations the per capita production of wheat in farmers' level is minimum. Field experiment of wheat with herbicides in Bangladesh showed that weed populations are usually greater with minimum tillage and unwedded conditions (Quddus, 1989). Herbicidal weed control is well established in others wheat growing countries but in Bangladesh farmers mainly depended on manual weeding. Under the changing socio-economic condition in our country workers are not available to undertake tedious agricultural operations. Grain yield of wheat can be achieved through proper weed management. Application of herbicides may be effective for proper weed management and boost up the yield of wheat. Alternate methods of establishing crops, especially weed control through herbicide without sacrificing yield are needed. Therefore, keeping these facts in view, the present investigation was made.

Materials and Methods

The investigation was carried out at Regional Wheat Research Center Farm, Shyampur, Rajshahi, during winter season of 2004-2005 using wheat var. Shatabdi. There were twelve treatment combinations, rate and application timing given (Annexture-1, Table A)

A recommended dose of nitrogen (100 kg/ha) from urea, phosphorus (60 kg/ha) from triple super phosphate, potassium (40 kg/ha) from muriate of potash and sulphur (20 kg/ha) from gypsum were used. The entire amount of phosphorus, potassium and sulphur and 2/3rd of nitrogen were applied at the time of final land preparation. The remaining nitrogen was applied at CRI stage after 1st irrigation as top dress. Hand weeding was done after 1st irrigation. The experiment was laid out in RCB design with three replications. The unit plot size was 5m X 3m. Seeds were sown on 2 December, 2004. Three irrigations were applied at CRI, maximum tillering stage and grain filling stage. The various species of weed were counted in a 1m^2 demarcation place at post emergence seedling. In the same area total numbers of various weeds were collected after 45 DAS and at harvest of seeding and oven dry weight of weeds were recorded. Data on yield and yield contributing characters were collected from randomly selected 1m^2 demarcation places and statistically analysis.

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Weed control efficiency was calculated as:

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

Where, A and B are the dry matter weight (g/m^2) of weeds of control and treatments respectively.

METHOD OF DRY MATTER DETERMINATION

The number of weeds per m^2 was calculated from 3 samples of same plot. The weed species were separated on three categories and packed and labeled separately. Then put the samples in oven for 24 hours at 105^{0}C temperature. Dry weight weed species were measured by electric balance at normal room temperature. Grain yield was recorded from five representative sample of 1 m^2 area per plot. Yield component data were recorded from 10plants/plot. All the data were analyzed following standard statistical procedure and means were separated by DMRT.

RESULT AND DISCUSSION

Effect on weeds of different treatments

The four major weed species infesting in the wheat field were *Chenopodium album*, *Cynodon dectylon*, *Cyperus rotundus* and *Echinochloa crusgalli* (Table 1). Balyan (1999) who has also reported the same weed species in wheat fields. *Chenopodium album sp.* and *Cyperus rotundus sp.* were found dominant in all the treatments. Weed population and biomass production of weeds were greatly influenced by different weedicides and times of application. All weedicide treatments significantly reduced weed population resulting lower dry biomass as compared to the control treatment in all weed species. Significantly the lowest number of weeds/m^2 and dry biomass yield were recorded in Lintur 70 WG- 375 g/ha at two leaves stage (10 - 15 DAS) application which was followed by one hand weeding at 25 DAS. 2, 4 D Amine and Lintur 70 WG- 300 g/ha at two leaves stage (10 - 15 DAS) also reduced the weed population and dry matter production over control but it was not as good as Lintur 70 WG- 375 g/ha at two leaves stage (10 - 15 DAS) and hand weeding. Lintur 70 WG- 375 g/ha at two leaves stage application controlled all types of species but more effective on broad leaves.

Table 1. Number and dry weight of different weed species/m^2 as affected by weed control methods

Treatments	Rate of application	*Chenopodium album*		*Cynodon dactylon*		*Cyperus rotundus*		*Echinochloa crusgalli*		Grain yield (t/ha)
		No.	Dry weight (g)	No.	Dry weight (g)	No.	Dry weight (g)	No.	Dry weight (g)	
Lintur 70 WG	250 g/ha	13	0.66	21	4.55	28	2.96	18	1.62	2.70de
Lintur 70 WG	300 g/ha	22	1.12	22	4.67	24	2.62	32	2.88	2.80cd
Lintur 70 WG	375 g/ha	4	0.20	12	2.55	20	2.01	19	1.90	3.40a
Lintur 70 WG	250 g/ha	18	0.92	18	3.82	32	3.49	20	1.92	3.13ab
Lintur 70 WG	300 g/ha	18	0.92	19	3.88	29	3.36	22	1.98	3.40a
Lintur 70 WG	375 g/ha	20	1.02	27	5.73	23	2.58	22	2.00	2.96bc
Lintur 70WG	250 g/ha	32	1.63	28	5.92	29	3.38	21	2.05	3.14ab
Lintur 70 WG	300 g/ha	23	1.17	20	4.36	16	1.72	33	2.94	2.80cd
Lintur 70 WG	375 g/ha	20	1.02	18	3.91	36	3.92	24	2.18	2.86cd
2,4 D Amine	1.5 L/ha	22	1.12	11	2.48	15	1.63	26	2.35	3.18ab
Hand weeding	One operation	23	1.17	4	0.86	13	1.42	4	0.36	3.30a
Control	No weeding	231	11.78	120	25.44	31	3.41	26	2.41	2.40e

In a column, means followed by common letters do not differ significantly at 1% level of DMRT

Effect on weeds

The herbicide treatments in general were found effective in killing the different weeds and reducing their dry matter production. The dry matter weight of weeds significantly decreased by one hand weeding (45 DAS) and application of Lintur @ 375 g/ha as compared to dry matter wt. of before spray (45 DAS) and control. Herbicide 2, 4 D Amine and Lintur @ 300 g/ha also decreased the dry matter weight than control but not as compared with hand weeding and Lintur 70 WG @ 375 g/ha due to less effectiveness on weeds. Further the weed dry matter production increased significantly with increased period of time due to decrease effectiveness on herbicides in case of all treatments. The weed control efficiency of hand weeding was very high i.e. 83.4% and 81.7% at 45 DAS and at harvest which at par with Lintur @ 375 g/ha as compared to control and other treatments. The maximum weed population and dry weight were per unit area were recorded in control treatments (no weeding) and the lowest in Lintur 70 WG-375 g/ha as two leave stage which was followed by Lintur WG 300 g/ha in four leave stages and hand weeding (Table 2). Similar trend were also found by Singh and Singh 1992. Weeds are less affected in Lintur 70 WG @ 250 g/ha at 6 leave stage. But over- all performance, it indicated that, Lintur 70 WG @ 375 g/ha at two leave stage would be as good as controlling weeds. Similar trend was also found in dry weight of weeds. Similar results were also observed by Sharma *et.al*., 1999.

Table 2. Weed dry matter production (g/m2) and control efficiency (%) at 25 DAS and different time after spray

Treatments	Rate of application	Before spray (g/m2)	After spray(g/m2)		Weed control efficiency (%)	
			45 DAS	At harvest	45 DAS	At harvest
Lintur 70 WG	250 g/ha	30.45	10.2	13.90	66.5	54.3
Lintur 70 WG	300 g/ha	34.36	11.27	14.30	67.2	58.3
Lintur 70 WG	375 g/ha	38.70	6.61	7.21	82.9	81.3
Lintur 70 WG	250 g/ha	31.32	10.15	12.30	67.5	60.7
Lintur 70 WG	300 g/ha	30.20	10.14	11.35	66.4	62.4
Lintur 70 WG	375 g/ha	34.32	11.33	13.21	66.9	61.5
Lintur 70 WG	250 g/ha	31.20	12.98	14.23	58.3	54.4
Lintur 70 WG	300 g/ha	25.26	10.19	11.65	59.6	53.8
Lintur 70 WG	375 g/ha	26.65	11.03	12.98	58.6	51.2
2 - 4, D Amine	1.5 L/ha	34.20	7.58	8.97	77.8	73.7
Hand weeding	One operation	30.25	3.81	5.51	83.4	81.7
Control	No weeding	31.23	43.04	51.32	-	-

Effect of weeds on yield and yield attributes

Significant differences were also found in yield and yield contributing characters (Table 2). Lintur 70 WG @ 375 g/ha at two leave stage produced the highest spike/m2, grain/spike, TGW and grain yield which was at par with hand weeding due to lower weed-crop competition resulted higher absorption of nutrients and sufficient interception of sunlight as well as air which statistically at par with hand weeding and lowest grain yield and yield components were also found in control plot i.e. no weeding due to weed-crop competition from first to last resulted sharing of nutrient, air and sunlight. The treatment hand weeding and Lintur 70WG @ 375 g/ha at two leave stage produced highest grain yield when the weeds were controlled by the application of Lintur 70 WG@ 375 g/ha in two leave stage and Lintur 70 WG @ 300 g/ha in two leave stage. Similar results were also reported by Verma and Sirvastava 1998. Significantly lowest yield were obtained from unwedded plot.

Table 3. Yield and yield attributes of wheat variety Kanchan as affected by different treatments

Treatments	Rate of application	Plants /m^2	Spike/m^2	Spikelet/ spike	Grain /spike	TGW (g)
Lintur 70 WG	250 g/ha	240bc	253	18ab	38.6ab	41.1
Lintur 70 WG	300 g/ha	234cde	259	17bc	33.3bc	36.6
Lintur 70 WG	375 g/ha	259a	290	19a	39.5a	42.0
Lintur 70 WG	250 g/ha	234cde	265	16bcd	37.1ab	36.7
Lintur 70 WG	300 g/ha	244b	235	17bc	39.0ab	38.1
Lintur 70 WG	375 g/ha	240bcd	265	17bc	38.7ab	36.7
Lintur 70 WG	250 g/ha	233de	277	18abc	38.5ab	38.2
Lintur 70 WG	300 g/ha	224f	289	16bcd	36.1abc	37.2
Lintur 70 WG	375 g/ha	231e	259	16cd	36.1abc	38.0
2,4 D Amine	1.5 L/ha	216g	283	17bc	36.9ab	38.4
Hand weeding	One operation	264 ab	279	18abc	36.8ab	39.9
Control	No weeding	199h	245	17d	32.6c	34.3
CV (%)		1.69	12.30	4.60	5.45	6.71
LSD(0.05)		6.52	NS	1.36	3.42	NS

Benefits

We made a calculation of return by reducing weeding cost, keeping all other input costs constant. Data from Table 4 reveals that the use of Lintur 70 WG at the rate of 375g/ha sprayed at 25 DAS have given highest benefit Taka 65750 (8.02 %), hand weeding Taka 63050 (7.09%), Lintur 70 WG at the rate of 300g/ha Taka 64100 (7.66%) and 2-4, D Amine Taka 61400 (5.49%), per hectare, respectively over control.

Table 4. Cost related to herbicide uses and returns by some newly developed herbicides

Treatments	Rate of application	Input costs related to weeding				Grain yield (t/ha)	Grain price (Total Tk.)	Return (after deducting weeding cost (Tk.))
		Herbicide Cost (Tk[$]./ha)	Labour cost for application (Tk./ha)	Rent of sprayer (Tk.)	Total (Tk./ ha)			
Lintur 70 WG	250 g/ha	1250	250	150	1650	2.70	54000	52350
Lintur 70 WG	300 g/ha	1500	250	150	1900	2.80	56000	54100
Lintur 70 WG	375 g/ha	1875	250	150	2275	3.40	68000	65750
Lintur 70 WG	250 g/ha	1250	250	150	1650	3.13	62600	60950
Lintur 70 WG	300 g/ha	1500	250	150	1900	3.30	66000	64100
Lintur 70 WG	375 g/ha	1875	250	150	2250	2.96	59200	56950
Lintur70 WG	250 g/ha	1250	250	150	1650	3.14	62800	61150
Lintur 70 WG	300 g/ha	1500	250	150	1900	2.80	56000	54100
Lintur 70 WG	375 g/ha	1875	250	150	2250	2.86	57200	54950
2,4 D Amine	1.5 L/ha	1800	250	150	2200	3.18	63600	61400
Hand weeding	One operation	-	2,950	-	2950	3.30	66000	63050
Control	No weeding	-	-	-	-	2.40	48000	48000

Overall performance of the treatments we observed that Lintur 70 WG @ 375 g/ha at two leave stage (10-15 DAS) was better performance both weeds control as well as higher grain yield. On the other hand Lintur 70 WG at the rate of 375g/ha herbicide was economically suitable for the control of wheat weeds comparatively

[$] Tk. = Bangladeshi Currency called Taka (Tk.), Tk. 1 = USD $0.64_{APPROX.}$ (as on the study period 2004-2005)

with less cost. So, Lintur 70 WG @ 375 g/ha at two leave stage was recommended in weeds control at wheat field in Bangladesh.

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ANNEXTURE-1

Table A. Treatment combinations, rate and timing of application

Treatments	**Rate**	**Time of Application (DAS[2])**
T_1 = Lintur 70 WG	250 g/ha	10 - 15 DAS (two leaves stage)
T_2 = Lintur 70 WG	300 g/ha	10 - 15 DAS (two leaves stage)
T_3 = Lintur 70 WG	375 g/ha	10 - 15 DAS (two leaves stage)
T_4 = Lintur 70 WG	250 g/ha	20 - 25 DAS (four leaves stage)
T_5 = Lintur 70 WG	300 g/ha	20 - 25 DAS (four leaves stage)
T_6 = Lintur 70 WG	375 g/ha	30-35 DAS (four leaves stage)
T_7 = Lintur 70 WG	250 g/ha	30-35 DAS (six leaves stage)
T_8 = Lintur 70 WG	300 g/ha	30-35 DAS (six leaves stage)
T_9 = Lintur 70 WG	375 g/ha	30-35 DAS (six leaves stage)
T_{10} = 2 - 4, D Amine	1.5 L/ha	20- 25 DAS (four leaves stage)
T_{11} = Hand weeding	One operation	30-35 DAS
T_{12} = Control	No operation	-

[2] Days After Sowing