EFFECT OF NEWLY DEVELOPED HERBICIDES ON THE GROWTH AND YIELD OF WHEAT

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Accepted for publication: October 20, 2008

ABSTRACT

Hossain M. I., Barma N.C.D., Rafiqul Islam A.T. M., Uddin M.Z. and Rahman M.M. 2009. *Effect of Newly Developed Herbicides on the Growth and Yield of Wheat.* **Int. J. Sustain. Crop Prod. 4(1):1-4**

A field trial was conducted at Regional Wheat Research Centre, Shyampur, Rajshahi during winter season of 2007-08 to select the suitable herbicide for weed control of wheat var. Prodip. Six treatment combinations i.e. Affinity @1.5 kg/ha, Hammer @ 104 ml/ha, 2-4, D Amine @ 1200 ml/ha, U 46 @1200 ml/ha at 25 day after sowing (DAS), one hand weeding at 24 DAS and control (no weeding) were considered for this study. Four major weeds namely *Chenopodium album, Cyperus rotundus, Cynodon dactylon and Vicia Sativa* were observed in the experimental field. The weed population and dry weight of weeds were low with Affinity @ 1.5 kg/ha at 25 DAS and high with control plots. Among the treatments, Affinity @1.5 kg/ha at 25 DAS showed higher weed control efficiency (77.4%) which is at par with hand weeding (78.2%). Different treatments were significantly influenced grain yield and yield components of wheat. The maximum grain yield (4.28 t/ha) was obtained with Affinity @ 1.5 kg/ha at 25 DAS and hand weeding (4.35t/ha). This higher yield might be due to less weed-crop competition resulting higher absorption of nutrients and sufficient interception of sunlight as well as air circulation. The grain yield (3.93 t/ha) was found with control as anticipated. Wheat yield was found to be gradually decreased with the increase of weed populations.

Key words: Herbicide, weed control efficiency, yield components

INTRODUCTION

Wheat is the second leading cereal crops and growing more or less as sole or intercrop in Bangladesh next to rice. The national average grain yield of wheat is relatively low compared to potential yields obtained in the research field. Weed infestation is one of the major yield constraints of wheat production in Bangladesh. Wheat yield is severely reduced due infestation of broad spectrum weed flora in different areas. The low temperature is favorable for germinating and growing of *Chenopodium sp.* (Hirano, 1991) that highly infests winter crops like wheat. Few other scientists reported the predominance of broadleaf weeds in wheat field (Mamun and Salim, 1989). Uncontrolled weed growth reduces crop grain yield up to 57% (Singh *et. al*., 1997). Due to severe weed infestations, the wheat productivity in farmers' field becomes very low. Field experiments of wheat with herbicides in Bangladesh showed that weed population is usually higher in case of minimum tillage and un-weeded conditions (Quddus, 1989). Herbicidal weed control is well established in many other wheat growing countries but in Bangladesh farmers mainly depend on manual hand weeding. Under the changing of socio-economic conditions availability of the agricultural laborers is reducing day by day that hampered agricultural operations seriously. Grain yields of wheat can be increased through proper weed management. Application of herbicides may be an effective and alternative option for proper weed management to boost up the wheat grain yield. Under this circumstance, the study was conducted to select the suitable herbicide for weed control of wheat var. prodip.

MATERIALS AND METHODS

The investigation was carried out at Regional Wheat Research Centre Farm, Shyampur, Rajshahi, during winter season of 2007-08 using Prodip wheat variety. There were six treatment combinations which are as follows

Treatments	Rate	Time of application
T_1 = Affinity	1.5 kg/ha	25 DAS
T_2 = Hammer	104 ml/ha	25 DAS
T_3 = 2 - 4, D Amine	1200 ml/ha	25 DAS
T_4 = U 46	1200 ml/ha	25 DAS
T_5 = Hand weeding	One operation	24 DAS
T_6 =Control (No weeding).		

A recommended dose of nitrogen (100 kg/ha) from urea, phosphorus (60 kg/ha) from triple super phosphate (TSP), potassium (40 kg/ha) from muriate of potash (MP) and sulphur (20 kg/ha) from gypsum and boron (1 kg/ha) from boric acid were applied. The entire amount of phosphorus, potassium sulphur and boric acid and two-third of

nitrogen were applied at the time of final land preparation. The remaining nitrogen was applied at crown root initiation (CRI) stage after 1st irrigation as top dress. Hand weeding was done after seven days of 1st irrigation. The experiment was laid out in randomized complete block (RCB) design with three replications. Each plot size was 5 m X 3m. Seeds were sown on 27 November 2007. Three irrigations were applied at CRI, maximum tillering stage and grain filling stages. The various species of weed were counted from the samples of pre-demarcation area at post emergence seedling from each plot. Total number of various weeds species was collected at 25 and 35 days after seeding (DAS) and oven dry weight of weeds from each sample was recorded. Data on grain yield and yield contributing characters were recorded from five randomly selected 1 m^2 samples and the mean was used statistically analyze. Weed control efficiency was (WCE) calculated as:

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

Where, A and B are the dry matter weight (g/m^2) of weeds of control and treated plots respectively. Input costs were also recorded to see the economic benefits of the treatments.

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 labelled separately. Then the samples were put in oven for 24 hours at 105^0C 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 10 plants/plot. All the data were analyzed following standard statistical procedure and means were separated by DMRT.

RESULT AND DISCUSSION

Effect different treatments on weed

The four major weed species infesting in the wheat field were *Chenopodium album*, *Cynodon dectylon*, *Cyperus rotundus* and *Vicia sativa* (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 Affinity 1.5 kg/ha at 25 DAS application which was followed by one hand weeding at 24 DAS and 2,4-D Amine 1200 ml/ha at 25 DAS. Hammer @104 ml/ha also reduced the weed population and dry matter production over control but it was not as good as Affinity @1.5 kg/ha and hand weeding. This might be due to less effectiveness of Hammer on weeds. Only broad leaves species were killed by 2-4, D amines but not the other species. Affinity application controlled all types of species but U 46 @1200 ml/ha did not show any significant effect compared to others.

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*		*Vicia sativa*		Grain yield
		25 DAS	35 DAS	25 DAS	35 DAS	25 DAS	35 DAS	25 DAS	35 DAS	t/ha
Affinity	1.5 kg/ha	24	41	3	2	104	42	1	1	4.28
Hammer	104 ml /ha	24	23	6	6	111	35	2	3	4.22
2 - 4, D Amine	1200 ml/ha	27	11	8	8	108	64	1	1	4.24
U 46	1200 ml/ha	28	68	2	2	120	97	1	2	4.15
Hand weeding	One operation	12	33	1	1	111	84	0	2	4.35
Control	No weeding	33	45	2	2	128	82	0	0	3.97
LSD (0.01)										NS
CV(%)										9.35

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

The herbicide treatments were found effective in killing the different weeds and reducing their dry matter production. The dry matter weight of weeds was significantly decreased by one hand weeding at 24 DAS, also applications of Affinity @ 1.5 kg/ha as compared to dry matter weight of weed before spray (25 DAS) and control. Other herbicides i.e.2-4, D Amine, Hammer and U-46 also decreased the dry matter weight of weed than control but not as compared to hand weeding and Affinity due to less effectiveness on weed. The weed dry matter production further decreased significantly when additional dose of herbicides were applied at 35 DAS. The weed control efficiency of hand weeding was very high i.e. 78.2% at 35 DAS which was followed by Affinity @ 1.5 kg/ha (77.4%). The maximum weed population and dry weight per unit area were recorded in control (no weeding) and the lowest with Affinity applied at 25 DAS followed by Hammer, 2-4, D Amine and U 46 applied at 25 DAS and hand weeding (Table 2). Similar trend was also found by Singh and Singh (1992). Weeds were less affected in Hammer @ 104 ml/ha at 25 DAS. Overall performance, it is indicated that, Affinity 1.5 kg/ha at 25 DAS would be as good as controlling weeds. Similar trend was also found in dry weight of weeds. Among the herbicides used Affinity application (1.5 kg/ha) showed the highest weed control efficiency at 25 DAS followed by hand weeding. The lowest weed control efficiency (30.6%) was recorded from Hammer applied at 35 DAS compared to the control.

Table 2. Weed dry matter production (g/m^2) and control efficiency (%) at 25 and 35 DAS as affected by some newly developed herbicides

Treatments	Rate of application	Weed fresh matter(g/m^2)		Weed dry matter(g/m^2)		Weed control efficiency (%) over control	
		25 DAS	35 DAS	25 DAS	35 DAS	25 DAS	35 DAS
Affinity	1.5 kg/ha	114.2 a	18.1 c	13.7 a	2.8 d	11.0	77.4
Hammer	104 ml /ha	83.5 ab	29.3 b	12.2 ab	8.6 b	20.7	30.6
2 - 4, D Amine	1200 ml/ha	115.6 a	27.9 b	14.8 a	7.7 b	3.9	37.9
U 46	1200 ml/ha	60.4 b	24.6 b	8.7 b	4.8 c	16.5	61.2
Hand weeding	One operation	103.9 a	18.2 c	13.1 a	2.7 d	14.9	78.2
Control	No weeding	126.1 a	81.1 a	15.2 a	12.4 a	-	-
LSD(0.05)		39.21	32.33	5.17	5.909		
CV (%)		22.1	26.9	16.2	22.3		

Effect on yield and yield attributes

Differenent weed control treatments did not show any significant effect on grain yield and yield contributing characters of wheat (Table 1 and 3). However, T_1 (Affinity @1.5 kg/ha at 25 DAS) produced numerically the highest grain yield (4.28 t/ha) which was at par with hand weeding (4.35 t/ha). The higher yield was attributed due to lower weed-crop competition, higher absorption of nutrients and sufficient interception of sunlight as well as air circulation. The lowest grain yield (3.97 t/ha) and yield components were also found in control plot i.e. no weeding due to high weed-crop competition, sharing of nutrients, air and sunlight by weeds. Verma and Sirvastava, (1998) reported significant yield advantage through herbicide use.

Table 3. Yield and yield attributes of wheat variety Kanchan as affected by some newly developed herbicides

Treatments	Rate of application	Spike/m^2	Spikle length	Spikelets/spike	Grains/ spike	TGW (g)	Bio-mass (t/ha)
Affinity	1.5 kg/ha	231	11.8	17.8	40.4	55.8	11.2
Hammer	104 ml /ha	234	11.9	17.9	39.4	56.1	11.5
2,4 D Amine	1200 ml/ha	225	12.3	18.3	40.9	55.1	11.2
U 46	1200 ml/ha	237	12.3	18.1	40.0	57.5	11.2
Hand weeding	One operation	232	12.2	17.5	40.9	53.9	11.2
Control	No weeding	231	12.2	18.6	40.0	56.3	11.2
LSD(0.01)		NS	NS	NS	NS	NS	NS
CV (%)		4.11	3.82	4.08	5.91	3.36	1.68

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

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 Affinity @ of 1.5 kg/ha sprayed at 25 DAS have given highest benefit Taka 126920 (6.91 %) followed by hand weeding Taka 127550 (7.09%), Hammer taka 125850 (5.66%), U 46 taka 122850 (3.14%) and 2-4, D Amine Taka 125650 (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 Taka)	Return (after deducting weeding cost (Tk))
		Herbicide Cost (Tk/ha)	Labour cost for application (Tk/ha)	Rent of sprayer (Tk)	Total (Tk/ ha)			
Affinity	1.5 kg/ha	1080	250	150	1480	4.28	128400	126920
Hammer	104 ml/ha	350	250	150	750	4.22	126600	125850
2-4 D Amine	1200 ml/ha	1150	250	150	1550	4.24	127200	125650
U 46	1200 ml/ha	1250	250	150	1650	4.15	124500	122850
Hand weeding	One operation	-	2,950	-	2950	4.35	130500	127550
Control	No weeding	-	-	-	-	3.97	119100	119100

Recommendation

The treatment, Affinity @ 1.5 kg/ha at 25 DAS performed better for both weed control and higher wheat grain yield. On the other hand Affinity herbicide was economically suitable for the control of wheat weeds comparatably with less cost.

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