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Effect of Variety and Weed Management Practices on Yield and Yield Attributes of Wheat

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Abstract

An experiment was conducted at Agronomy Field Laboratory of Rajshahi University to evaluate the effect of variety and weeding regime on yield and yield components of wheat. Four varieties viz. Prodip -V_1, Gourab -V_2, Shatabdi -V_3, Bijoy -V_4 and five weeding regime viz. a) No weeding -W_0, b) Weed free -W_1, c) One hand weeding at 20 DAS -W_2, d) Two hand weeding (1st at 20 DAS and 2nd at 42 DAS) -W_3 and e) Lintur 70 WG @ 250 g ha^{-1} -W_4 were included as treatments in the experiment. The experiment was laid out in a Split-plot Design with three replications. The results revealed that Prodip produced the highest grain yield (5.33 t ha^{-1}) followed by Gourab (4.85 t ha^{-1}), while the lowest grain yield (3.98 t ha^{-1}) was obtained from Shatabdi. The highest grain yield (5.09 t ha^{-1}) was obtained in Weed free (W_1) followed by W_3 (Two hand weeding) (4.89 t ha^{-1}) and the lowest grain yield (4.13 t ha^{-1}) was obtained in no weeding treatment (W_0). The highest grain yield (5.64 t ha^{-1}) was obtained from the combination of Prodip and weed free treatment (V_1W_1) and the lowest (3.57 t ha^{-1}) was obtained from the combination between Shatabdi and no weeding treatment (V_4W_0).

Keywords: Variety, weeding regime, yield, wheat

Introduction

Wheat (*Triticum aestivum L.*) is a crop of global significance. It is a staple food of millions of people. It supplies about 20 per cent of the food calories for the world's growing population. Carbohydrate and protein are two main constituents of wheat. Wheat is considered as the king of cereal crop because its cultivation is easier, nutrient content is higher and ecologically suitable. In Bangladesh, it is the second staple food crop next to rice having an annual production of 9.58 lakh tones and total area of 4.39 lakh hectares (AIS, 2010). Though wheat is an important cereal crop in Bangladesh, its average yield is low compared to other wheat growing countries of the world. In Holand, UK, France and Norway, the average yield of wheat is 7.50, 6.20, 5.90 and 4.80 t ha^{-1}, respectively, whereas in Bangladesh it is only 2.10 t ha^{-1} (FAO, 1999). In Bangladesh among total food grain production in the 2010-11 was 34.5 million metric tons in which the contribute of wheat was 0.97 million metric tons respectively (BFSR, 2011) and in 2011-12 production of wheat 2.78 mt ha^{-1} (BBS, 2011-12).

The yield of wheat depends on many factors such as varieties and suitable agronomic practices. Varieties play an important role in producing high yield of wheat. Different varieties respond differently for their genotypic characters, input requirement, growth process and the prevailing environment during growing season. The growth process of wheat plants under a given agro-climatic condition differs with variety (Anon., 1990). Bangladesh has a number of modern wheat varieties namely Prodip, Gourob, Shatabdi, Bijoy etc. Number of tillers, number of spikelets, spike length, grain size, grain yield and other yield contributing characters differ from one variety to another.

The introduction of high yielding wheat varieties having high inputs requirements has resulted in tremendous increase in weed population in wheat fields. Weeds consume at least as much nitrogen, phosphorus and potassium nutrients as crop plants (Veleva, 1982). Moreover, in row crops much of the costs of inter-tillage, seedbed preparation and seed cleaning operations are due to weed infestation. Hand weeding and inter cultural operation are generally done after the emergence of weeds. The effect of weed competition is greatest when the crop is young, however, there are situations where late germinating weeds can lower the crop quality and interfere with harvest (Tomar *et al*., 2003) and the extent of losses in wheat caused by weeds is alarming. Besides causing a considerable reduction in yield, weeds deplete soil fertility, particularly nitrogen (Gautum and Singh, 1981) and increase incidence of insect pests (Singh and Singh, 1977). Furthermore, it has been reported that the crop yield may be increased about 37% (Baluch, 1993) or even up to 65% (Mirkamali, 1987) by controlling weeds. So, the present study was undertaken to find out the effect of variety and weeding regime on yield of modern wheat varieties.

Materials and Methods

An experiment was conducted at the Agronomy Field Laboratory; Department of Agronomy and Agricultural Extension, University of Rajshahi, Bangladesh during the period from November, 2009 to March, 2010 to study the effect of variety and weeding regime on yield and yield components of wheat. Four varieties viz. Prodip -V_1, Gourab -V_2, Shatabdi -V_3 and Bijoy -V_4 and five weeding regimes viz. a) No weeding -W_0 b) Weed free -W_1 c) One hand weeding at 20 DAS -W_2 d) Two hand weeding (1^{st} at 20 DAS and 2^{nd} at 42 DAS) -W_3 and e) Lintur 70 WG @ 250 g ha^{-1} -W_4 were included as treatments in the experiment. The experiment was laid out in a Split-plot Design with three replications. Each block was divided into 4-main plots. Each main plot was then sub-divided in 5-subplots. The wheat varieties were randomly assigned in the main plots and weeding regimes in the sub-plots. Thus, the total numbers of subplots were 60. The unit plot size was 2.5m x 2m having a plot to plot 0.5m. Distance between blocks was 1m. The experimental plots were fertilized with Urea, Triple super phosphate, Muriate of potash and Gypsum at 220-180-50-120 kg ha^{-1} respectively. The whole amount of triple super phosphate, muriate of potash, gypsum and 1/3 of urea were applied as basal dose at final land preparation. The rest 2/3 amount of Urea was applied as top dressing in two equal splits. The first split was applied at 20 days after sowing (DAS) and the second at 42 DAS. Seeds were sown on 17 November, 2009 @ 120 Kg ha^{-1}. Seeds were placed continuously in lines. The spacing between lines was 25 cm. After sowing, the seeds were covered with soil and slightly pressed by hands. Weeding was done as per treatment. Normal intercultural operations were done as and when necessary. The data were recorded on yield and yield contributing characters. At maturity, ten hills were randomly selected and uprooted from each unit plot excluding boarder rows for collecting data on yield and yield contributing characters of wheat before harvesting. After sampling, the crop from each unit plot ($1m^2$) was harvested at fully maturity on 21 March, 2010 to record the data on grain and straw yields. The recorded data were analyzed using the analysis of variance technique and mean differences was adjudged by New Duncan Multiple Range Test (DMRT) as per to Gomez and Gomez (1984) with the help of MSTAT-C package.

Results and Discussion

Effect of variety and weeding regime on yield and yield contributing characters of wheat

Plant height was not significantly influenced by variety but numerically the longest plant (99.99 cm) was obtained from the variety Bijoy but the smallest plant (97.75 cm) was obtained from the variety Prodip (Table 1). Alam (2009) reported that Prodip produced the longest and the shortest plant was produced by Sourav. Plant height was significantly affected by weeding regime. The longest plant (101.59 cm) was obtained from the weed free treatment, which was statistically identical with one hand weeding treatment (Table 2). The shortest plant (95.40 cm) was recorded in no weeding treatment. The reduction in plant height of wheat due to weed competition was also reported by Pandey *et al*. (2002).

Number of total tillers $plant^{-1}$ was significantly influenced by different varieties. The highest number of total tillers $plant^{-1}$ (5.49) was produced by the variety Prodip. On the other hand variety Gourab produced the lowest number of total tiller (4.42) $plant^{-1}$ (Table 1). Khatun (2007) observed that total number of tiller $plant^{-1}$ was significant in different varieties. Number of total tillers $plant^{-1}$ was significantly affected by weeding regime. It was found that weed free treatment produced the highest number (5.25) of total tillers $plant^{-1}$ which was significantly different from all other treatments followed by two hand weeding treatment (5.10). The lowest (4.11) total tillers number $plant^{-1}$ was produced in no weeding treatment (Table 2).

Number of fertile tillers $plant^{-1}$ was significantly affected by variety. The highest number of fertile tillers $plant^{-1}$ (4.75) was produced by variety Prodip followed by variety Bijoy (4.23). On the other hand, the lowest number of fertile tillers $plant^{-1}$ (3.66) was produced by the variety Gourab (Table 1). Alam (2009) reported that Prodip produced the highest number of fertile tillers $plant^{-1}$ and lowest in Protiva. The highest number of fertile tillers $plant^{-1}$ (4.95) was observed in weed free treatment followed by two hand weeding treatment (4.49), which was statistically identical with one hand weeding treatment. On the other hand, the lowest number of fertile tillers $plant^{-1}$ (3.27) was produced by no weeding treatment (Table 2). Weed competition resulted in significant decrease in productive tillers $plant^{-1}$ of wheat reported by Blackshaw (1993). Similar findings were also reported by Pandey *et al*. (2002).

The variety Prodip significantly produced the longest panicle (18.51cm) but the shortest (16.12 cm) panicle

was produced by Gourab (Table 1). Khan (1993) observed that the wheat varieties influenced on spike length. Panicle length significantly varied due to weeding regime treatment. The highest panicle length (18.80 cm) was observed in weed free treatment and the shortest panicle (16.21 cm) was obtained from no weeding treatment, which was statistically similar with other weeding treatment (Table 2).

Significantly the highest number of spikelets spike^{-1} (20.42) was produced by Prodip which was statistically simillar with Gourab and the lowest value (18.19) was produced by Bijoy (Table 1). Chatha *et al.* (1986) also observed that variety differed in the number of total spikelets spike^{-1}. The number of spikelets spike^{-1} was also significantly influenced by weeding regime. The highest number of spiketets spike^{-1} (20.20) was obtained from weed free treatment (Table 2). On the other hand, the lowest number of spikelets spike^{-1} (18.35) was produced by no weeding treatment. Pandey *et al*. (2002) reported that weed competition prior to spike formation stage hindered the development of spikelets, which might be a reason to lessen the number of spikelets spike^{-1}.

Number of fertile spikelets spike^{-1} significantly varied due to varietal differences. The highest number of fertile spikelets spike^{-1} (18.07) was produced by Prodip followed by Bijoy (17.49) but Shatabdi produced the lowest number of fertile spikelets spike^{-1} (14.0) (Table 1). Khan (1993) observed the number of fertile spikelets spike^{-1} were variable for different wheat varieties. Number of fertile spikelets spike^{-1} significantly varied due to weeding regime at 1% level of significance. The highest number of fertile spikelets spike^{-1} (18.35) was obtained from weed free treatment followed by two hand weeding treatment (16.38). The lowest number of fertile spikelets spike^{-1} (15.09) was produced by no weeding treatment (Table 2).

Number of grains spike^{-1} varied significantly due to variety. The highest number of grains spike^{-1} (43.11) was obtained from Prodip. On the other hand, the lowest number of grains spike^{-1} (29.83) was obtained from variety Shatabdi (Table 1). Shrestha (1988) observed that number of grains spike^{-1} was different for different wheat varieties. Number of grains spike^{-1} was significantly influenced by weeding regime. The highest number of grains spike^{-1} (40.69) was produced in weed free treatment, which was statistically similar with two hands weeding treatment and the lowest number of grains spike^{-1} (33.48) was obtained from no weeding treatment (Table 2). Similar result was also found by Pandey *et al*. (2002).

Variety did not differ significantly in respect of 1000-grain weight. Weight of 1000-grain varied significantly due to weeding regime. The highest 1000- grain weight (52.04g) was measured in weed free treatment where as the lowest (47.30g) was measured in no weeding treatment (Table 2). Two hand weeding treatment was statistically similar to weed free condition in producing 1000-grain weight. Islam (1987) and Mamun and Salim (1989) also observed reduction in 1000-grain weight due to weed competition respectively by 7.22% and 29.44% in wheat.

Grain yield was significantly affected by variety. Prodip produced the highest grain yield (5.33 t ha^{-1}) followed by Gourab (4.85 t ha^{-1}) while Shatabdi produced the lowest (3.98 t ha^{-1}) grain yield (Table 1). BARI (2010) also reported the highest grain yield (4.33 t ha^{-1}) were recorded from variety Prodip followed by BARI GAM-25 (4.26 t ha^{-1}). Grain yield of wheat was also significantly varied by weeding regime. The highest grain yield (5.09 t ha^{-1}) was obtained from weed free treatment followed by two hand weeding treatment (4.89 t ha^{-1}). The lowest grain yield (4.13 t ha^{-1}) was produced by no weeding treatment (Table 2). According to Reddy and Reddi (2002), weeds are estimated to cause 45.5 to 63.9 % reduction in wheat yield and El-Hamid *et al*. (1998) reported 42-56% decrease in wheat yield due to weed competition.

Straw yield was not significantly influenced by variety but Prodip produced the highest (7.30 t ha^{-1}) and Shatapdi produced the lowest (6.99 t ha^{-1}) straw yield (Table 1). Sultana (1996) showed that straw yield varied significantly among the varieties. Straw yield of wheat varied significantly due to different weeding regime. The maximum straw yield (7.67 t ha^{-1}) was produced by weed free treatment. The lowest straw yield (6.45 t ha^{-1}) was produced by no weeding treatment (Table 2). Islam (1987) and Mamun and Salim (1989) also observed reduction in straw yield in wheat due to weed competition.

Interaction effect of variety and weeding regime on yield and yield contributing characters of wheat

The interaction effect of variety and weeding regime had significant effect on yield and yield contributing characters like number of total tillers plant^{-1}, panicle length, number of fertile spikelets spike^{1}, number of grains spike^{-1} and straw yield. The highest plant height (103.29cm), panicle length (22.45cm), number of spikelets spike^{-1} (21.40), number of grains spike^{-1} (46.99), 1000-grain weight (55.27g), grain yield (5.64 t ha^{-1}) and straw yield (8.47 t ha^{-1}) were found by the interaction of Prodip and completely weed free condition besides the highest number of total tillers plant^{-1} (6.03), number of fertile tillers plant^{-1} (5.69), number of fertile spikelets spike^{-1}(24.15) produced by the interaction of V_4W_1, V_2W_1 and V_3W_1 respectively

Table 1. Effect of variety on yield and yield contributing characters of wheat

Variety	Plant height (cm)	Number of total tillers plant^{-1}	Number of fertile tillers plant^{-1}	Panicle length (cm)	Number of spikelets spike^{-1}	Number of fertile spikeles spike^{-1}	Number of grains spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
V_1	97.75	5.49a	4.75a	18.51a	20.42a	18.07a	43.11a	53.01	5.33a	7.30
V_2	97.81	4.42c	3.66c	16.21b	19.87a	15.59bc	34.95b	47.19	4.85b	7.05
V_3	99.99	4.85b	4.23b	17.47ab	18.19b	17.49ab	35.45b	49.01	4.48c	7.02
V_4	98.24	4.55bc	3.72c	16.35b	18.37b	14.0c	29.83c	49.06	3.98d	6.99
LS	NS	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	NS
CV (%)	4.92	5.94	8.99	5.76	5.52	4.93	5.53	4.25	6.32	4.91
LSD value	-	0.30	0.38	1.68	1.35	1.96	3.14	-	0.24	-

In each column ,figures having similar letters or without letters do not differ significantly, where as figures bearing dissimilar letters differ at 1% level of probability (as per DMRT).
V_1= Prodip, V_2=Gourob, V_3=Bijoy, V_4=Shatabdi
CV=Co-efficient of variation; LS=Level of Significance and NS=Not significant

Table 2. Effect of weeding regime on yield and yield contributing characters of wheat

Weeding regime	Plant height (cm)	Number of total tillers plant^{-1}	Number of fertile tillers plant^{-1}	Panicle length (cm)	Number of spikelets spike^{-1}	Number of fertile spikelets spike^{-1}	Number of grains spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
W_0	95.40 b	4.11c	3.27c	16.21b	18.35c	15.09d	33.48c	47.30b	4.13c	6.45c
W_1	101.59a	5.25a	4.95a	18.80a	20.20a	18.35a	40.69a	52.04a	5.09a	7.67a
W_2	98.63ab	4.85b	4.13b	16.86b	19.08abc	16.21bc	37.21b	48.83b	4.64b	7.16b
W_3	99.50ab	5.10ab	4.49b	17.36b	19.77ab	16.38b	39.72a	51.47a	4.89ab	7.53ab
W_4	97.11b	4.81b	3.61c	16.33b	18.66bc	15.39cd	35.58bc	48.20b	4.56b	6.63c
LS	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV (%)	4.92	5.94	8.99	5.76	5.52	4.93	5.53	4.25	6.32	4.91
LSD value	4.03	0.32	0.41	1.10	1.18	0.89	2.31	2.35	0.32	0.39

In each column ,figures having similar letters or without letters do not differ significantly, where as figures bearing dissimilar letters differ at 1% and 5% level of probability (as per DMRT). W_0=No weeding, W_1=Weed free, W_2=One hand weeding at 20 DAS, W_3=Two hand weeding (1^{st} at 20 DAS and 2^{nd} at 42 DAS), W_4=Lintur, CV=Co-efficient of variation, NS=Not significant, LS=Level of Significance

Table 3. Interaction effect of variety and weeding regime on yield and yield contributing characters of wheat

Variety x weeding regime	Plant height (cm)	Number of total tillers plant^{-1}	Number of fertile tillers plant^{-1}	Panicle length (cm)	Number of spikelets spike^{-1}	Number of fertile spikelets spike^{-1}	Number of grains spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
V_1W_0	95.69	4.46b	2.81	17.08b-e	19.39	17.46b-d	37.01d	51.37	4.96	6.35g
V_1W_1	103.29	4.65b	4.66	22.45a	21.40	18.55b	46.99a	55.27	5.64	8.47a
V_1W_2	96.91	4.51b	3.89	17.47bc	20.15	18.25bc	43.94ab	52.05	5.27	7.50b-d
V_1W_3	97.01	4.60b	3.97	18.38b	21.08	18.61b	44.14ab	54.45	5.57	7.56bc
V_1W_4	95.87	4.53b	2.97	17.20b-d	20.06	17.48b-d	43.49ab	51.91	5.21	6.61d-g
V_2W_0	95.39	3.65c	3.97	15.38de	19.67	14.35ef	37.90cd	43.01	4.08	6.61d-g
V_2W_1	99.49	4.69b	5.69	17.23b-d	20.37	16.25de	43.29ab	51.88	5.25	6.94b-g
V_2W_2	97.58	4.59b	4.69	16.21c-e	19.82	16.0de	42.15a-c	45.07	4.92	7.44b-e
V_2W_3	99.27	4.64b	5.04	16.39ce	19.85	16.15de	42.53a-c	51.42	5.11	7.63ab
V_2W_4	97.33	4.53b	4.37	15.40de	19.66	15.19ef	38.89b-d	44.60	4.89	6.65d-g
V_3W_0	94.03	3.74c	3.45	17.15b-d	17.16	15.27ef	31.61e	47.24	3.91	6.44fg
V_3W_1	103.04	5.66a	5.05	18.06bc	19.40	24.15a	40.97b-d	50.29	5.07	7.69ab
V_3W_2	101.38	4.68b	3.95	17.36bc	18.19	16.26de	31.97e	49.37	4.54	6.62d-g
V_3W_3	102.89	5.53a	4.84	17.45bc	18.67	16.41c-e	40.81b-d	49.78	4.55	7.67ab
V_3W_4	98.59	4.64b	3.87	17.34bc	17.55	15.36ef	31.88e	48.38	4.36	6.69c-g
V_4W_0	95.50	4.60b	2.85	15.23e	17.17	13.30f	27.39e	47.58	3.57	6.42fg
V_4W_1	100.56	6.03a	4.41	17.46bc	19.65	14.45ef	31.51e	50.73	4.41	7.59b
V_4W_2	98.67	5.63a	4.01	16.43c-e	18.17	14.35ef	30.78e	48.82	3.82	7.08b-g
V_4W_3	98.82	5.64a	4.10	17.22b-d	19.47	14.37ef	31.41e	50.25	4.35	7.27b-f
V_4W_4	96.96	5.55a	3.23	15.40de	17.37	13.55f	28.05e	47.92	3.77	6.59e-g
LS	NS	0.01	NS	0.05	NS	0.01	0.01	NS	NS	0.01
CV (%)	4.92	5.94	8.99	5.76	5.52	4.93	5.53	4.25	6.32	4.91
LSD value	-	.64	-	1.64	-	1.79	4.62	-	-	0.78

In each column ,figures having similar letters or without letters do not differ significantly, where as figures bearing dissimilar letters differ at 1% and 5 % level of probability (as per DMRT).

V_1= Prodip, V_2=Gourob, V_3=Bijoy, V_4=Shatabdi

W_0=No weeding, W_1=Weed free, W_2=One hand weeding at 20 DAS, W_3=Two hand weeding (1^{st} at 20 DAS and 2^{nd} at 42 DAS), W_4=Lintur, CV=Co-efficient of variation, NS=Not significant, LS= Level of Significance.

On the other hand, the lowest plant height (94.04cm) from V_3W_0, number of total tillers plant^{-1} (3.65) from V_2W_0, number of fertile tillers plant^{-1} (2.81) from V_1W_0, panicle length (15.23cm), number of spikelets spike^{-1} (17.17), number of fertile spikelets spike^{-1}(13.30), number of grains spike^{-1} (27.39), grain yield (3.57 t ha^{-1}) and straw yield (6.42 t ha^{-1}) were found by the interaction of V_4W_1 but 1000-grain weight (43.01g) was obtained from the interaction V_2W_0 (Table 3).

From the above discussion, it can be concluded that wheat yield is increased by the variety Prodip with weed free condition and wheat yield is decreased tremendously if no weed control measure is taken.

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