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Effect of Irrigation Frequencies on Yield and Yield Attributes of Wheat Cultivar (*Triticum aestivum*) 'Shatabdi'

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Abstracts: The experiment was conducted at the crop Botany Field Laboratory, Bangladesh Agricultural University, Mymensingh, during Rabi season from November 2001 to March 2002 to investigate the effect of irrigation frequençies on theyield and yield attributes of the wheat cultivar 'Shatabdi'. Irrigation treatments were given as T0 = no irrigation (control), T1 = one irrigation at 21 DAS, T2 = two irrigations at 21 and 45 DAS, T3 = three irrigation at 21, 45 and 60 DAS and T4 = four irrigation at 21, 45, 60 and 75 DAS. The experiment was laid out in a randomized complete block design where each treatment was replicated three times. Significant effects were observed on plant height, number of effective tillers per hill, spike length, number of spikelets per spike filled grains per spike due to different levels of irrigation. Two irrigations at 21 and 45 DAS significantly enchanced the growth, yield attributes and yield of wheat over other treatments. As a result grain yield (3.52 t/ha), straw yield (4.22 t/ha) and harvest index (45.25%) were significantly higher at T2 treatment than those of other treatments.

Key words: Irrigation, yield, wheat

Introduction

wheat (*Triticum aestivum* L.) an important cereal crop, is ranked first considering the total area and yield per unit area among the cereal crops of the world (FAO, 1987). Nearly two-thirds of the world's population are dependent on the wheat grain for energy and calories. In Bangladesh, wheat is the second staple food crop after rice (Razzaque *et al.*, 1990). It is equally important as human food, feed for livestock and raw materials for industries. On an average, wheat grains contain 12.1% protein which is only 8.29% in rice (Mattern *et al.*, 1970). Lower cost of production and higher nutritive value of wheat as compared to rice has stimulated wheat popularity to farmers. The yield of wheat in our country is approximately 2.16 t ha^{-1} (BBS, 2001) which is very low compared to other wheat growing countries of the world, such as 8.72 t ha^{-1} in Ireland, 8.55 t ha^{-1} in the Netherlands and 8.01 t ha^{-1} in the U.K (FAO, 2000). In Bangladesh, wheat is grown during Rabi season, from the month of November to March. The dry weather conditions and shortage of soil moisture during this period adversely affect the growth and yield performance of wheat. Only about 42.78% of the total wheat growing land of Bangladesh is under irrigation facilities and the rest is remaining under rain-fed condition (BBS, 1998). Drought occurs almost every year due to scanty rainfall in the dry winter season, which adversely affects the growth and yield of wheat. The yield loss due to drought could be minimized by providing irrigations at least during the critical stages of growth. Idris and Islam (2001) found that two irrigations applied at either at tillering and ear emergence stages or at booting and dough stages were most effective in terms of enhancing the growth and yield of wheat. The required quantity and frequency of water at different growth stages of wheat cultivar Shatabdi is not yet reported at farmers level in our climatic and soil conditions.

Therefore, the present study was undertaken to investigation the effect of irrigation frequencies on yield and yield attributes of wheat cultivar Shatabdi in the climatic conditions Mymensingh.

Materials and Methods

The experiment was conducted at the crop Botany Field Laboratory, Bangladesh Agricultural University, Mymensingh from November 2001 to March 2002. The soil texture of the experimental field was silty clay loam with pH value of 6.6. The experiment site belongs to non-calcareous dark-gray floodplain soil under Old Brahmaputra Floodplain Agro Ecological Zone 9 "AEZ-9" (FAO, 1988).

The experiment treatments were T_0 = No irrigation, T_1 = One irrigation at 21 DAS, T_2 = Two irrigations at 21 and 45 DAS, T_3 = Three irrigations at 21, 45 and 60 DAS T_4 = Four irrigations at 21, 45, 60 and 75 DAS. The experiment was laid out in a randomized complete block design (RCBD), where each treatment was replicated three times. The distance maintained between two plots was 0.5m and that between blocks 1.0m. The treatments were randomly assigned to the plots. Soil samples were collected from each of the experimental plots prior to sowing to determine the moisture percentage. Seeds of the cultivar Shatabdi were collected from the Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur and were sown manually in 20cm apart furrows on 16 November 2000 at the rate of 120 Kg ha^{-1}. The plots were irrigated with 2 cm of water each time. Irrigation water

coming through the channel was uplifted to each plot by using a plate. Excess water of the channel was drained out later on.

Three plant samples from each plot were collected randomly at 45, 60, 75 and 90 DAS to measure their growth parameters such as plant height, number of effective tillers per plant, spike length (cm), number of spikelets per spike, number of filled grains per spike etc. The crop was finally harvested on 10th March, 2002. The grain and straw yields were recorded plot by plot and was expressed as quantity in tonnes per hectare. The recorded data were analyzed following the ANOVA-technique and the mean differences were compared by the Duncan's Multiple Range Test.

Results and Discussion

Irrigation frequencies played a significant role in increasing plant height and the number of effective tillers per plant. At control (T0) the height of the plant was the lowest (88 cm) and the tallest plant (102.3 cm) was observed in two irrigation treatment T2 (Table 1). More than three irrigations shortened plant height significantly. Similar trend was found for effective tillers per hill. The maximum number of effective tillers per plant (5.51) were found under two irrigation treatment, which was significantly higher over other treatment. The second highest number of tillers was found under three irrigations at 21, 45 and 60 DAS and followed by single irrigation. However, the control treatment yielded the lowest number of tillers per plant (Table 1) The treatment T2 (two irrigations applied at 21 and 45 DAS) was found optimal for plant height and effective tillers per plant. Yadav *et al.* (1995) reported that two irrigation scheduled at crown root initiation and milk stages gave the maximum plant height (1.026 m), wherease, Islam (1997) reported that maximum plant height was found by three irrigations applied at 25, 50 and 70 days after sowing. Islam *et al.*, (2000) reported that the highest number of effective tillers per plant (3.6) was obtained at control with no irrigation. The highest spike length (9.39 cm) was found at two irrigation treatment (T2), whereas, the lowest spike length (7.83 cm) was observed at control treatment (Table 1).

Furthermore, the highest number of spikelets per spike (16.69) was observed with two irrigations and the lowest number (11.96) of spikelets per spike was found at control treatment. The maximum number of filled grains per spike (28.43) were recorded under two irrigation treatment, which was statistically similar to that of three irrigations. The lowest number of filled grains (20.17) was found at control treatment (Table 1). Jana *et al.* (1995) observed that application of irrigation water increased the number of filled grains per spike as compared to control treatment.

The 1000-grain weight was not significantly affected by irrigation treatments (Table 1). The maximum 1000-grain weight (46 g) was found under two irrigation treatment and the lowest (44.00) was found at control treatment. Hooker *et al.* (1983) also found that irrigation had no significant effect on individual grain weight.

The irrigation treatments had significant effect on grain yield. The highest grain yield (4.15 t ha^{-1}) was found at two irrigations treatment followed by three irrigations treatment (3.50 t ha^{-1}), whereas, the lowest grain yield (2.35 t ha^{-1}) was observed at control treatment (Table 2). Higher grain yield might be the resultant effects of maximum number of effective tillers per plant, highest spike length and maximum number of filled grains per spike. The highest harvest index (47.65%) was recorded at two irrigation treatment (Table 2), which could be due to maximum translocation of assimilates to grain formation. Idris *et al.* (2000) found the highest grain yield (3.67 t ha^{-1}) by two irrigations applied either at tillering and ear emergence stages or at booting and dough stages. Naser (1996) reported that two irrigations at 30 and 50 DAS significantly increased grain and straw yields over control treatment. Quayum and Kamal (1986) reported that crown-root initiation and tillering stages showed the highest

Table 1: Effect of irrigation frequencies on yield contributing characters of wheat

Treatments		Plant height at harvest (cm)	Number of effective tillers $plant^{-1}$	Spike length (cm)	No. of spikelets $spike^{-1}$	No. of filled grains $spike^{-1}$	1000 grain weight (g)
Number of Irrigations given	Irrigations at DAS						
0	No irrigation	88.00c	4.14d	7.83c	11.96d	20.17d	44.00a
1	21	99.83a	4.62c	8.64b	15.37b	25.77b	45.00a
2	21 and 45	102.3a	5.51a	9.39a	16.69a	28.43a	46.00a
3	21, 45 and 60	100.5a	4.93b	9.19ab	15.61b	28.25a	45.25a
4	21,45, 60 and 75	96.22b	4.40cd	8.53b	14.27c	24.40c	45.00a
$LSD_{0.05}$		2.447	0.281	0.688	0.294	1.027	NS
CV(%)		4.54	5.47	4.19	4.04	4.63	5.50

In a column, the figures having common letter(s) do not differ significantly at 5% level of probability
DAS = Days After Sowing

Table 2: Effect of irrigation frequencies on grain yield, straw yield and harvest index of wheat cultivar Shatabdi

Treatments				
Number of Irrigations given	Irrigations at DAS	Grain Yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest Index %
0	No irrigation	2.35d	3.25d	41.96d
1	21	3.56b	4.50a	44.16c
2	21 and 45	4.15a	4.56a	47.65a
3	21,45 and 60	3.50b	4.02b	46.54b
4	21,45,60 and 75	2.63c	3.60c	42.22d
$LSD_{0.05}$		0.309	0.345	0.312
CV(%) •		6.18	5.74	4.27

In a column, the figures having common letter (s) do not differ significantly at 5% level of probability

response to irrigation in increasing the grain yield from 2.07 t ha^{-1} without irrigation to 4.09 t ha^{-1} with two irrigations.

The maximum straw yield (4.56 t ha^{-1}) was found at two irrigation treatment, whereas, the lowest straw yield (3.25 t ha^{-1}) was recorded at control irrigation treatment (Table 2). The highest straw yield with two irrigation frequencies was attributed probably due to maximum gain in plant height and tillers $plant^{-1}$. Naser (1996) also observed the highest straw yield with two irrigations.

The two irrigations treatment produced maximum grain yield (4.15 t ha^{-1}) straw yield (4.56 t ha^{-1}) and harvest index (47.65%) than other treatments used in the experiment.

Conclusion

Two irrigations were found useful in increasing the yield contributing characters of wheat cultivar Shatabdi at BAU Farm, Mymensingh, during winter season. However, further research studies are necessary on other wheat cultivars to give general recommendation of water requirement at different growth stages.

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