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Effect of level of irrigation and nitrogen rate on yield performance of late sown wheat

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Abstract

The experiment was at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh–2202 during late Rabi season (December-March) of 2015. It was two factorial experiment (1) irrigation level and (2) nitrogen rate. Irrigation significantly influenced on yield and yield contributing characters except harvest index. The highest plant height (79.69cm), maximum number of total tillers plant^{-1} (4.725), number of grains spike^{-1} (40.61), spike length (11.80cm), 1000 grain weight (28.67g), grain yield (3.227 t ha^{-1}), harvest index (41.26%) were obtained by mulching treatment. Nitrogen rate significantly influenced the yield and yield contributing characters. The highest plant height (80.37cm), maximum number of total tillers plant^{-1} (5.124), number of grains spike^{-1} (40.85), spike length (10.37cm), 1000 grain weight (31.86g), grain yield (3.792 t ha^{-1}), harvest index (41.69%) were obtained by the application of 180 kg N ha^{-1}. The combined effect of Irrigation and nitrogen significantly interacted on yield and yield contributing characters. The highest plant height (83.44cm), number of total tillers plant^{-1} (5.66), number of grains spike^{-1} (41.60), 1000 grain weight (36.66g), grain yield (4.32 t ha^{-1}) and harvest index (47.36%) were obtained by application of 180 kg N ha^{-1} with mulching. The present study revealed that high dose of nitrogen 180 kg ha^{-1} and mulching practice can compensate low production of wheat even at late sowing.

Key words: Irrigation, nitrogen, yield, late sown, wheat

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Introduction

Wheat (*Triticum aestivum*) is one of the major cereal crops of the world ranking first in both areage and production among food crops (FAO, 2000). It provides more nourishment for the nations of the world than any other food crops. Wheat grain has high food value containing 12% protein, 1.72% fat, 69.60% carbohydrate and 27.20% minerals (BARI, 1997).

Optimum time for sowing of wheat in Bangladesh is between mid November and first week of December (Hossain and Alam, 1986), due to its own definite requirements for temperature and light for emergence, growth and flowering (Dabre *et al.,* 1993). The detrimental effect of delayed sowing on grain yield was maximum with reduction in 1000-grain weight (Singh and Pal, 2003; Subhan *et al*., 2004). Delayed sowing also significantly reduced test weight (Kumar and Sharma, 2003). High temperature and desicating winds during the month of April might causes forced maturity of late sown wheat, thus resulting in reduction of test weight (Singh and Dhaliwal, 2000). High temperature

in the post anthesis period of late sown wheat shortened the grain filling period resulting in a smaller endosperm, lower grain weight and increased protein content (Ahmed *et al.,* 1994).

Irrigation at optimum level is one of the most important tools for boosting up the yield of wheat (Razzaque *et al.,* 1992). Water plays a vital role in growth and development of wheat. It influences dry matter production, plant height, leaf area, duration of grain filling and grain protein content of wheat (Thomson *et al.,* 1992).

The effect of nitrogen is more prominent and distinct over other fertilizers. Nitrogen is the integral part of protoplasm, protein and chlorophyll and results in increasing cell size, which in turn increases plant height and crop yield. Nitrogen application increases seed yield (Samad *et al.*, 1984). When the nitrogen supply is limited leaf enlargement, tillering, internode elongation, flowering, grain formation and other such development are adversely affected. Higher nitrogen produces more plants per unit area resulting in more intra-crop competition hereby affecting the yield and production cost. On the other hand, lower nitrogen may reduce the yield drastically. This piece of work was undertaken to investigate the effect of irrigation and nitrogen on late sown wheat BARI GOM-26 and the interaction of irrigation and nitrogen on the yield and yield components of wheat BARI GOM-26.

Materials and Methods

The experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from 25 December to 30 March, 2015 in order to study the yield of wheat as affected of different levels of irrigation and nitrogen rates. Seeds of wheat BARI GOM-26 was collected from the Agronomy Field Laboratory, BAU, Mymensingh. The experiment was laid out in a split plot design with three replications. The level of irrigation was assigned in the main plot and the rate of nitrogen in the sub plot. The total number of experimental plot was 60 (5 × 4 × 3). The size of each sub plot was 5 m^2 (2.5 m x 2.0 m). There were two factors (A) Level of irrigation { I_1 = One irrigation (at 20 days after sowing), I_2 = Two irrigations (at 20 and 35 days after sowing), I_3 = Three irrigations (at 20, 35 and 50 days after sowing), I_4 = Four irrigations (at 20, 35, 50 and 75 days after sowing), I_5 = Mulching (straw at 6 t ha^{-1}) and factor (B) Rate of Nitrogen (N_0 = No nitrogen, N_1 = 120 kg N ha^{-1}, N_2 = 150 kg N ha^{-1}, N_3 = 180 kg N ha^{-1}). The experimental field was opened with a power tiller 10 days before sowing. It was further ploughed four times with power tiller followed by breaking clods and leveling the land. All weeds, stubble and crop residues were removed from the experimental field. During final land preparation the land was fertilized with cowdung at 10 t ha^{-1}, TSP at 160 kg ha^{-1}, MoP at 50 kg ha^{-1}, gypsum at 110 kg ha^{-1} and one third of nitrogen of each treatments were incorporated into the soil in each plots before sowing. Irrigation was applied in different plots maintaining irrigation levels as per the experimental treatment. Two times weedings, one at 20 and the other at 45 days after sowing were done by the help of a niri. Maturity of crop was determined as the time when 90% of the grains became golden yellow in colour. The crop was harvested at maturity on 30 March 2015. Harvesting was done plot-wise and tagged for proper identification for further processing. The grains were threshed, cleaned and sun dried and the grain Yield $plot^{-1}$ recorded at 14% moisture content. Afterwards, the yield was converted to t ha^{-1}. Straw was sun dried to record the straw yield $plot^{-1}$ and then converted to t ha^{-1}. Data were recorded on Plant height, total number of tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$, spike length, number of total spikelets $spike^{-1}$, grains $spike^{-1}$, thousand grain weight, grain yield, straw yield, biological yield (t ha^{-1}), harvest Index.

Results and Discussion

***Plant height*:** Plant height was significantly influenced by different times of irrigation. At maturity the tallest

plant (79.69 cm) was found in straw mulching plot which was statistically identical with I_2 (77.25 cm) and I_3 (77.18 cm) and the shortest one (71.31 cm) was found in one irrigation (Table 1). Plant height also influenced by different rate of nitrogen (Table 2). The tallest plant (80.37 cm) was obtained from the highest level (180 kg/ha) of nitrogen. The lowest height value (69.02 cm) was obtained from the control treatment having no nitrogen. Similar results were also reported by Chandra *et al*. (1992) and Ayoub *et al*. (1994). Increased plant height with increasing level of nitrogen might be due to the fact that the supply of nitrogen increased the meristematic activities in plants and formation of protoplasm (Black. 1965). Plant height was significantly influenced by the interaction of different irrigation and different rate of nitrogen. The tallest plant (83.44 cm) was found with mulching under 180kg N ha^{-1} and two irrigation (I_2) with 150 180 kg N ha^{-1} and the shortest one (62.11 cm) was observed in one irrigation (I_1) at 20 DAS with no nitrogen (Table 3).

Table 1. Effect of different levels of irrigation on yield and yield contributing characters of BARI GOM-26.

Irrigation levels	Plant height (cm)	Total tillers $hill^{-1}$	Effective tillers $hill^{-1}$	Non effective tillers $hill^{-1}$	No. of spikelets $spike^{-1}$	No. of grains $spike^{-1}$	Spike length (cm)	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
I_1	71.31b	4.32d	3.890c	0.4350a	14.13d	38.81b	8.932c	25.90b	2.65d	3.970c	6.625c	39.22
I_2	77.25a	4.578b	4.145b	0.4300a	15.57bc	39.68b	8.955c	26.69b	2.847c	4.322b	7.172b	39.81
I_3	77.18a	4.38cd	3.995c	0.3950a	15.30c	39.49b	9.128c	25.80b	2.76cd	4.235b	6.999b	39.33
I_4	72.11b	4.48bc	4.238b	0.249b	16.08b	39.64b	9.905b	26.72b	2.975b	4.278b	7.253b	40.76
I_5	79.69a	4.725a	4.430a	0.290b	18.41a	40.61a	11.80a	28.67a	3.227a	4.970a	8.196a	41.26
Sx	0.830	0.039	0.044	0.018	0.218	0.281	0.132	0.517	0.038	0.073	0.097	0.589
Level of sig.	**	**	**	**	**	*	**	*	**	**	**	NS
CV (%)	3.56	3.47	3.46	12.67	4.50	4.05	5.23	7.71	4.80	5.67	4.59	5.25

** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant, I_1 = One irrigation, I_2 = Two irrigation, I_3 = Three irrigation, I_4 = Four irrigation, I_5 = Mulching.

Number of effective tillers hill^{-1}: The effective tillers $hill^{-1}$ was significantly influenced by the highest number of effective tillers $hill^{-1}$ (4.43) was found with mulching (I_5). On the other hand, the lowest number of effective tillers $hill^{-1}$ (3.89) was obtained with one irrigation (I_1) which was statistically identical with (3.995) three irrigation (I_3) (Table 1). Number of effective tillers $hill^{-1}$ increased with the increasing rate of nitrogen up to 180 kg N ha^{-1}. The highest number of effective tillers $hill^{-1}$ (4.646) was recorded from 180 kg N ha^{-1}. The lowest number of effective tillers $hill^{-1}$ (3.786) was observed from the control treatment having no nitrogen (Table 2). An increase in effective tillers $hill^{-1}$ by fertilizer nitrogen application has also been reported by Abd-El-Latif and El-Thuamay (1986) and Kumar *et al*. (1995). The effect of interaction of level of irrigation and rate of nitrogen had significant effect on number of effective tillers $hill^{-1}$. The highest number of effective tillers $hill^{-1}$ (5.22) was obtained with mulching (I_5) under 180 kg N ha^{-1} (Table 3). The lowest number of effective tillers $hill^{-1}$ (3.61) was obtained with one irrigation (I_1) and no nitrogen which was statistically identical with three irrigation (I_3) and no nitrogen (3.62).

***Spike length*:** Spike length was significantly influenced by irrigation. The longest spike (11.80 cm) was found

with mulching (I_5). On the other hand, the shortest spike (8.932cm) was found with one irrigation (I_1) (Table 1). Spike length increased with the increasing rates of nitrogen up 180kg N ha^{-1}. The maximum spike length (10.37 cm) was produced due to 180 kg N ha^{-1} (Fig 5) and the shortest spike (9.14 cm) was observed in no nitrogen treatment (Table 2). The reason of lowest spike with optimum rate of nitrogen might be due to influence of uptake of high amount of nitrogen. Singh *et al*. (1987) also reported that spike length increased up to 120kg N. From Table 3 it is found was not significantly influenced by the interaction of level irrigation and rate of nitrogen. However, numerically the highest spike length was found (12.88) at mulching (I_5) and 180 kg N ha^{-1} and lowest spike length was (8.20) at one irrigation (I_1) and no nitrogen (Table 3).

Spikelets spike^{-1}: Spikelet is a yield contributing character and in this experiment it was found that spikelets Spike^{-1} was significantly influenced by levels of irrigation. The highest number of spikelets Spike^{-1} (22.61) was found with mulching (I_5). On the other hand, the lowest number of spikelets spike^{-1} (14.13) was found with one irrigation (I_1) (Table 1). Hossain (2009) also stated that spikelets spike^{-1} increased with increasing irrigation. The effect of rate of nitrogen had significant effect on number of spikelets Spike^{-1}. The highest number of spikelets Spike^{-1} (16.94) was obtained with 180kg N ha^{-1}. The lowest number of spikelets spike^{-1} (15.01) was obtained with no nitrogen (Table 2). From Table 3 it was found that the spikelets spike^{-1} was not significantly influenced by the interaction level of irrigation and rate of nitrogen. However, numerically the highest spikelets spike^{-1} was found (18.88) at mulching (I_5) and 180 kg N ha^{-1} and lowest spikelets spike^{-1} was (13.20) at one irrigation (I_1) and no nitrogen (Table 3).

Table 2. Effect of nitrogen on yield and yield contributing characters of BARI GOM-26.

Nitrogen doses	Plant height (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non effective tillers hill^{-1}	No. of spikelets spike^{-1}	No. of grains spike^{-1}	Spike length (cm)	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
N_0	69.02c	4.06d	3.786d	0.274c	15.01c	38.41c	9.14d	23.14d	2.21d	3.14d	5.35d	39.14b
N_1	74.19b	4.288c	3.960c	0.330b	15.59b	39.59b	9.536c	25.19c	2.580c	4.012c	6.592c	39.30b
N_2	78.44a	4.526b	4.166b	0.354b	16.04b	39.74b	9.922b	26.82b	2.984b	4.606b	7.591b	40.17ab
N_3	80.37a	5.124a	4.646a	0.4813a	16.94a	40.85a	10.37a	31.86a	3.792a	5.658a	9.456a	41.69a
Sx	0.693	0.040	0.036	0.012	0.184	0.226	0.131	0.532	0.035	0.063	0.086	0.542
Level of sig.	**	**	**	**	**	**	**	**	**	**	**	**
CV (%)	3.56	3.47	3.46	12.67	4.50	4.05	5.23	7.71	4.80	5.67	4.59	5.25

** = Significant at 1% level of probability, N_0 = No nitrogen, N_1 = 120 kg N ha^{-1}, N_2 = 150 kg N ha^{-1}, N_3 = 180 kg N ha^{-1}.

Grains spike^{-1}: From the result it is found that grains spike^{-1} was significantly influenced by irrigation. The highest number of grains spike^{-1} (40.61) was found in mulching (I_5). On the other hand, the lower number of grains spike^{-1} (38.81) was found in one irrigation (I_1) which was statistically identical with two irrigation (I_2), three irrigation (I_3) and four irrigation (I_4), (39.68), (39.49) and (39.64) respectively (Table 1). The highest number of grains spike^{-1} (40.85) was obtained by the application of 180 kg N ha^{-1} and the lowest number of grains spike^{-1} (38.41) obtained from control treatment having no nitrogen (Table 2). Singh and Singh (1984)

reported that increasing nitrogen rate significantly increased the number of grains spike^{-1}. A linear and positive response for the number of grains spike^{-1} was found when nitrogen was applied to wheat at the rate of 0, 60, 90 and 120 kg N ha^{-1} (Darwinkel, 1983). Similar results were also reported by Hazar and Ceylan (1989), Ayoub *et al.* (1994), and Singh and Singh (1984). From Table 3 it is found that the grains spike^{-1} was not significantly influenced by the interaction level of irrigation and rate of nitrogen. However, numerically the highest grains spike^{-1} was found (41.80) at mulching (I_5) and 180 kg N ha^{-1} and lowest grains spike^{-1} was (36.80) at one irrigation (I_1) and no nitrogen (Table 3).

Table 3. Efficacy of different biorational insecticides on the incidence of okra jassid and curled leaf/plant^{-1} & plot^{-1} at 3rd spray.

Treatment combination	Plant height (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non effective tillers hill^{-1}	No. of spikelets spike^{-1}	No. of grains spike^{-1}	Spike length (cm)	1000 grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
I_1N_0	62.11f	3.90i	3.61g	0.290hi	13.20	36.80	8.200	20.98f	2.06k	2.29m	4.35k	36.10e
I_1N_1	70.36e	4.20gh	3.80efg	0.400cdef	13.44	39.40	8.800	26.78cd	2.34hij	3.71ijk	6.05hi	38.72cde
I_1N_2	81.55a	4.30fg	3.95def	0.350fgh	13.77	39.50	9.330	26.99cd	2.76fg	4.88def	7.64fg	39.95bcde
I_1N_3	71.22de	4.90bcd	4.20cd	0.700a	16.11	39.55	9.400	28.86c	3.45c	5.00de	8.45de	40.86bcd
I_2N_0	69.55e	4.10ghi	3.70fg	0.400cdef	14.55	39.33	8.700	22.66ef	2.34hij	3.31k	5.65i	41.40bcd
I_2N_1	75.66cd	4.30fg	3.95def	0.350fgh	15.33	39.40	8.900	24.96cdef	2.56gh	4.02hi	6.58h	38.94cde
I_2N_2	80.33abc	4.80cd	4.33c	0.460bcd	15.88	39.50	9.000	26.67cde	2.90ef	4.49fg	7.39g	39.23cde
I_2N_3	83.44a	5.11b	4.60b	0.510b	16.50	40.50	9.220	32.47b	3.59c	5.47c	9.06c	39.65cde
I_3N_0	69.44e	4.00hi	3.62g	0.380defg	14.33	37.56	8.330	22.76ef	2.15jk	3.55jk	5.70i	37.73de
I_3N_1	78.60abc	4.22fgh	3.75efg	0.480bc	15.33	39.44	8.880	24.88cdef	2.40hij	3.63ijk	6.03hi	39.82bcde
I_3N_2	79.33abc	4.33fg	4.00de	0.330fgh	15.55	39.50	9.600	26.89cd	2.90ef	4.49fg	7.39g	39.23cde
I_3N_3	81.33ab	5.00bc	4.61b	0.390def	16.00	41.44	9.700	28.66cd	3.59c	5.27cd	8.87cd	40.53bcd
I_4N_0	67.66e	4.15ghi	4.00de	0.150k	14.99	38.57	9.500	24.66def	2.23jk	2.86l	5.09j	43.81b
I_4N_1	68.00e	4.33fg	4.15cd	0.180jk	15.88	39.25	9.660	24.67def	2.48hi	3.90hij	6.38h	38.87cde
I_4N_2	70.33e	4.50ef	4.20cd	0.300ghi	16.22	39.60	9.800	24.86cdef	3.18d	4.29gh	7.47fg	42.52bc
I_4N_3	82.44a	4.95bcd	4.60b	0.366efgh	17.22	41.14	10.66	32.67b	4.01b	6.06b	10.07b	39.84bcde
I_5N_0	76.33bc	4.15ghi	4.00de	0.150k	17.99	39.80	10.98	24.66def	2.29ijk	3.71ijk	5.99hi	38.15de
I_5N_1	78.33abc	4.39fg	4.15cd	0.240ij	17.99	40.44	11.44	24.67def	3.12de	4.80ef	7.92efg	39.37cde
I_5N_2	80.66abc	4.70de	4.35c	0.333fgh	18.77	40.59	11.88	28.68cd	3.18d	4.88def	8.06ef	39.42cde
I_5N_3	83.44a	5.66a	5.22a	0.440bcde	18.88	41.60	12.88	36.66a	4.32a	6.49a	10.8a	47.36a
Sx	1.55	0.089	0.081	0.026	0.413	0.506	0.294	1.19	0.079	0.142	0.192	
Level of sig.	**	**	**	**	NS	NS	NS	*	**	**	**	**
CV (%)	3.56	3.47	3.46	12.67	4.50	4.05	5.23	7.71	4.80	5.67	4.59	5.25

** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significan

***Thousand grain weight*:** There was significant effect of irrigation on 1000 grain weight. The highest 1000 grain weight (28.67g) was found with mulching (I_5).The lowest 1000 grain weight (25.90g) was found in one irrigation (I_1) (Table 1). It was found that there was significant effect of rate of nitrogen on 1000 grain weight. The highest 1000 grain weight (31.86g) was found at 180 kg N ha^{-1} and lowest 1000 grain weight (23.14g) was found at no nitrogen (Table 2). Analysis of variance reveals that the 1000 grain weight was significantly influenced 5% level of significance by the interaction of irrigation and nitrogen treatment. The highest 1000 grain weight (36.66g) was obtained with mulching (I_5) and 180kg N ha^{-1}. On the other hand, the lowest 1000 grain weight (20.98g) was obtained in one irrigation (I_1) and no nitrogen (Table 3).

***Grain yield*:** Irrigation had significant effect on grain yield. From the experiment it is evident that the highest grain yield (3.227 t ha^{-1}) was found with mulching (I_5). The lowest grain yield (2.65 t ha^{-1}) was found with one irrigation (I_1) (Table 1). The highest grain yield (3.792 t ha^{-1}) was produced by the application off 180 kg N ha^{-1}.The lowest grain yield (2.21 t ha^{-1}) was obtained from the control treatment having no nitrogen (Table 2). Improvement in yield components i.e. number of effective tillers $plant^{-1}$, spike length, number of grains $spike^{-1}$ and 1000 grain weight contributed to high yield. It has been reported elsewhere that increase in nitrogen rate resulted in the increase in grain yield of wheat (Singh and Singh, 1984, Karim *et al.,* 1989, BARC, 1989 and Rathore and Patel, 1991). From Table 3 it is found that the grain yield was significantly affected by the interaction of irrigation and level of Nitrogen. The highest grain yield (4.32 t ha^{-1}) was found with the combination of mulching (I_5) and 180kg N ha^{-1}. The lowest grain yield (2.06t ha^{-1}) was found in one irrigation (I_1) with no nitrogen (Table 3).

***Straw yield*:** Straw yield was significantly influenced by irrigation at l% level of probability. The highest straw yield (4.970 t ha^{-1}) was found with mulching (I_5) and the lowest straw yield (3.970 t ha^{-1}) was found in one irrigation (I_1) (Table 1). Straw yield was found to increase progressively with the increase in nitrogen levels up to 180 kg N ha^{-1}. The highest straw yield (5.658 t ha^{-1}) was obtained at 180 kg N ha^{-1}.The lowest straw yield (3.14 t ha^{-1}) was observed from the control treatment having no nitrogen (Table 2). The improvement of vegetative growth in terms of plant height and number of tillers $plant^{-1}$ due to nitrogen fertilization resulted in the improvement of straw yield. The result is in agreement with that of Behera (1995) and Singh *et al.* (1992), who reported that straw yield increased with the increase in nitrogen rates (Table 2). Straw yield was significantly affected by the interaction of irrigation and level of nitrogen. Table 3 shows that the highest straw yield (6.49 t ha^{-1}) was found with 180kg N ha-1 under mulching (I_5). The lowest of that was obtained with one irrigation (I_1) with no nitrogen (2.29 t ha^{-1}).

***Biological yield*:** Irrigation had significant effect on biological yield. From the experiment it is evident that the highest biological yield (8.136 t ha^{-1}) was found with mulching (I_5). The lowest biological yield (6.625 t ha^{-1}) was found in one irrigation (I_1) (Table 1). It was found that there was significant effect of rate of nitrogen on biological yield. The highest biological yield (9.456 t ha^{-1}) was found at 180 kg N ha^{-1} and lowest biological yield (5.35 t ha^{-1}) was found at no nitrogen (Table 2). Biological yield was significantly affected by the interaction of irrigation and rate of nitrogen. Table 3 shows that the highest biological yield (10.80 t ha^{-1}) was found with 180kg N ha^{-1} under mulching (I_5). The lowest of was obtained with one irrigation (I_5) in no nitrogen (4.35 t ha^{-1}).

***Harvest index*:** Irrigation had no significant effect on harvest index at 1% and 5% level of probability. However, numerically the highest harvest index (41.26%) was found in mulching (I_5). The lowest harvest index (39.22%) was observed in one irrigation (I_1) (Table 1). The highest harvest index (41.69%) was

produced 180kg N ha^{-1} and the lowest (39.14%) was found at no nitrogen (Table 2). Harvest index was significantly affected by the interaction of irrigation and level of nitrogen. Table 3 shows that the highest harvest index (47.36%) was found in mulching (I_5) with 180kg N ha^{-1} and the lowest one (36.10%) from the combination of one irrigation (I_1) with no nitrogen (Table 3).

Conclusion

From the different point of view, mulching (I_5) and 180 kg N ha^{-1} showed better result on plant height, total tillers $plant^{-1}$, number of effective tillers $hill^{-1}$, number of grains $spike^{-1}$, spike length, 1000 grain weight, grain yield, straw yield, harvest index. Irrigation level and nitrogen rate interacted significantly for the highest plant height (83.44cm), number of total tillers $plant^{-1}$ (5.66), number of grains $spike^{-1}$ (41.60), 1000 grain weight (36.66g), grain yield (4.32 t ha^{-1}) and straw yield (6.49 t ha^{-1}), harvest index (47.36%) were obtained by application of 180 kg N ha^{-1} with mulching and the lowest values of these characters were obtained by one irrigation at 20 DAS and control treatment having no nitrogen. The highest grain yield was obtained due to the interaction of 180 kg N ha^{-1} and mulching. Within the scope and limitation of the present study, it may be concluded that better grain yield of late planted wheat BARI GOM-26 could be obtained by using nitrogen fertilizer at the rate of 180 kg N ha^{-1} and mulching. Mulching may be practiced in wheat field to economize water for increasing wheat yield.

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