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GROWTH, YIELD AND QUALITY OF WHEAT VARITIES AS AFFECTED BY DIFFERENT LEVELS OF NITROGEN

H. Mondal[1], S. Mazumder[2], S. K. Roy[3], T. A. Mujahidi[4] and S. K. Paul[5]

[1]Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[2]Sher-e-Bangla Nagar Adorsha Mohila College, Dhaka-1207, Bangladesh,
[3]Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[4]Plant Breeding Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701, Bangladesh
[5]Agronomy Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701, Bangladesh.
E-mail: kbdhimangshu88@gmail.com

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Abstract

A field experiment was conducted at the experimental field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during November 2012 to March 2013 to evaluate the response of three (3) wheat varieties viz., BARI Gom23, BARI Gom24 and BARI Gom25 under four levels of nitrogen fertilizer i.e, 75, 100, 125 and 150 kg N ha^{-1}. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Results showed that plant height, number of leaves $plant^{-1}$, leaf length and dry matter content were significantly affected due to varieties and/or nitrogen levels. Grains ear^{-1}, number of fertile grains $plant^{-1}$, 1000-grain weight, grain yield and harvest index were also significantly influenced by varieties and/or nitrogen levels. The value of all parameters studied in this experiment increased with increasing nitrogen levels up to 125 kg N ha^{-1} and thereafter decreased with fertilizer increasing level. Combination results showed that BARI Gom-24 with application of 125 kg N ha^{-1} gave the maximum grain yield (4.71 t ha^{-1}), harvest index (49.37 %) and protein content (10.88%).

Introduction

Wheat (*Triticum aestivum* L.) is the first important cereal crop throughout the world and second in Bangladesh. It is the leading cereal crop which ranks first both in area (21,360 thousand hectares) and production (5,76,317 thousand metric ton) of the world (FAO, 2014). It is a staple food for about one billion in as many as 43 countries and provides about 205 of total food calories. It contains carbohydrate (78.1%), protein (14.7%), minerals (2.1%), fat (2.1%) and considerable proportion of vitamins (Jahan. 2014). Wheat is cool-loving crop and adopted for cultivation in regions with cooler climatic conditions whereas Bangladesh lies in the warmer part of the world, however wheat is grown in the winter or cold season in Bangladesh from November to March. Although wheat is cultivated in a large area (0.453 million ha) in Bangladesh but the average yield (3.03 t ha [1]) of wheat is very low. The low yield of wheat may be due to various factors such as lack of varieties, good quality seed, untimely seedling, low fertilization, seed rate, sowing techniques etc. Balanced fertilization and better cultural practices are needed for obtaining higher yield of wheat. Nitrogen is one of the basic elements required for obtaining higher wheat yield. It is largely used in the synthesis of protein, chlorophyll and other vital compounds which are attributed to all physiological and biochemical processes of plants. The response to N fertilization varies according to location, climate, crops and their varieties, type and characteristics of the soil, rate, time of fertilizer application and its placement (Mengel and Kirkby, 1978). Unlike the other major plant nutrient elements, nitrogen is the

most limiting one in most of the soils of Bangladesh for sustenance of optimum plant growth. Therefore, this nutrient is mostly added extraneously in order to supplement their deficiencies in soil for successful crop production. But the addition of nitrogen beyond optimum level affects plant performance adversely. On the other hand, nitrogen either as nitrate or ammonium form is very unstable in soil in its natural cycle. It is reported that split application of nitrogen is better than singles application for increasing yield of wheat (Gravelle *et al.*, 1989). Top dressing and split application of nitrogen fertilizers at critical crop growth stages of wheat are now emphasized (Singh, 1988) as it is more beneficial than applying as single dose at sowing (Randhawa *et al.*, 1976). However, the yield response varies with number of split and time of nitrogen application. Hence, it would be a good effort to develop an effective schedule for nitrogen management for wheat crop by the way of quantity split and time of application. Besides this, the quality of wheat is directly related to protein content. High grain protein level in wheat is an important consideration for human nutrition but the varieties grown in the country are of low to medium protein content (Warsthorn, 1988). High grain quality required a steady nutrient supply. Many authors have found that most of the nitrogen uptakement by wheat plants occur before anthesis (Dhugga and Waines, 1989; Frank *et al.*, 1989). Hence, the application of nitrogenous fertilizer is important for increasing grain protein content of wheat. In Bangladesh, very little research work has been done on the effect of nitrogen application on wheat grain protein content and to acknowledge no work seems to have been reported on its relation with grain yield, as regards of in view of the limited information on the aforesaid problems a study was therefore, undertaken to determine the response of wheat variety as influenced by different levels of nitrogen.

Materials and Methods

The experiment was conducted at the agronomy field of Sher-e-Bangla Agricultural University, Dhaka-1207, during the period from November 2012 to March 2013. The experimental area is located at 23.41' N and 90.22' E latitude and at an altitude of 8.6 m from the sea level. The soil of the experimental field belongs to the Tejgaon series under the Agroecological Zone, Madhupur Tract (AEZ- 28) and the General Soil Type is Deep Red Brown Terrace Soils. The experiment was laid out in Randomized Complete Block Design (RCBD) with factorial arrangement and three replications. There are two sets of treatments in the experiment. Factor A: Variety (3), V_1 = BARI Gom-23 (Bijoy), V_2 = BARI Gom-24 (Prodip), V_3 = BARI Gom-25 and Factor B: Nitrogen levels (4) N_1 = 75 kg N ha^{-1}, N_2 = 100 kg N ha^{-1}, N_3 = 125 kg N ha^{-1}, N_4 = 150 kg N ha^{-1}. There were 12 treatment combinations. Seeds were sown continuously in line on 19 November, 2012. The line to line distance was maintained at 20 cm. The form of N fertilizer was granular urea. The experimental plots were fertilized with P, K, S and B at the rate of 26-50-20-1 kg ha^{-1}, respectively in the form of triple superphosphate (TSP), muriate of potash (MOP), gypsum and boric acid, accordingly during final land preparation as basal dose. The fertilizer does was according to soil test basis. Here K application was high than P to improve the grain quality. One third of nitrogenous fertilizer was incorporated in the soil at the time of final land preparation according to treatments. The remaining amount of nitrogenous fertilizer was applied as top dressing in two split doses at crown root initiation stage (20 DAS) and prior to spike initiation stage (55 DAS). Two times weeding were done manually at 25 and 45 DAS. Two irrigations were applied at the time of crown root initiation stage (20 DAS) and booting stage (55 DAS). Excess water was drained out from the field. All other intercultural operations were done as per requirement. The crop was harvested on March 18, 2013. The necessary data were collected from ten selected plants from each plot in the field at 30 days interval and at harvest, and dry matter weight of plant was collected at 30 days interval from

the sub-samples of 5 plants plot^{-1} uprooting from 2nd line and were oven dried until a constant level. Final yield data were collected from undisturbed middle three rows in the center. The data obtained for different characters were statistically analyzed following the analysis of variance techniques by using MSTAT-C computer package programme. The significant differences among the treatment means were compared by least significant difference (LSD) at 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

Plant height

Significant variation was recorded for plant height of wheat due to varieties at 90 DAS (Table 1). The tallest plants were observed from V_2, while the shortest plants were found in V_1.On the other hand, due to nitrogen plant height of wheat varied significantly at 90 DAS. At 90 DAS, the tallest plants were observed from N_3 and the shortest plants were found in N_1. Significant differences were also recorded for the interaction effect of varieties and nitrogen on plant height of wheat at 90 DAS. At 90 DAS, the tallest plants were observed from V_2N_3 and the shortest) plants were found in V_1N_1. Similar results were found by (Randhawa *et al.*, 1976).

Table 1. Effect of variety, nitrogen rate and their combination on plant height of wheat

Treatment	Plant height (cm) at		
	30 DAS	60 DAS	90 DAS
Variety			
V_1	30.58 c	61.33 c	90.79 c
V_2	37.17 a	69.14 a	95.85 a
V_3	33.72 b	65.39 b	93.05 b
$LSD_{(0.05)}$	3.063	3.050	2.604
Nitrogen level			
N_1	35.33	63.37 d	89.17 d
N_2	34.89	66.61 c	92.15 c
N_3	38.33	72.78 a	98.77 a
N_4	36.33	69.70 b	95.20 b
$LSD_{(0.05)}$	NS	3.063	2.945
Variety x Nitrogen level			
V_1N_1	22.67 h	57.78 i	82.18 g
V_1N_2	32.67 f	60.89 h	92.14 ef
V_1N_3	32.67 f	65.45 e	93.18 de
V_1N_4	33.33 e	63.00 g	91.76 f
V_2N_1	34.67 d	68.33 c	93.17 de
V_2N_2	40.67 b	67.55 d	96.04 b
V_2N_3	42.00 a	72.45 a	99.85 a
V_2N_4	34.33 d	70.22 b	94.12 d
V_3N_1	38.67 c	67.67 d	92.14 ef
V_3N_2	31.67 g	67.22 de	95.41 c
V_3N_3	32.67 f	63.00 g	93.74 d
V_3N_4	32.67 f	63.89 f	93.43 d
$LSD_{(0.05)}$	0.126	0.341	1.208
CV (%)	7.59	4.32	5.94

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25, N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N ha^{-1}and N_4 - 150 kg N ha^{-1}.

Number of leaves per plant

Statistically significant differences were recorded for number of leaves plant^{-1} of wheat due to different varieties. At 90 DAS, the maximum number of leaves plant^{-1} was found from V_2 and the minimum number of leaves plant^{-1} was observed from V_1 (Table 2). Different nitrogen levels were significantly affect on number of leaves plant^{-1} of wheat at 90 DAS and the highest (number of leaves plant^{-1} was recorded from N_3 whereas, the lowest number of leaves plant^{-1} was found from N_1 (Table 2). Significant variation was also recorded due to combined effect of varieties and different nitrogen levels in terms of number of leaves plant^{-1} of wheat at 90 DAS and the maximum number of leaves plant^{-1} was observed from V_2N_3 whereas, the lowest number of leaves plant^{-1} was found from V_1N_1.

Table 2. Effect of variety, nitrogen rate and their combination on number of leaves plant^{-1} of wheat

Treatment	Number of leaves plant^{-1} at		
	30 DAS	60 DAS	90 DAS
Variety			
V_1	3.03 c	3.08 c	3.11 c
V_2	5.03 a	5.14 a	5.17 a
V_3	4.08 b	4.09 b	4.22 b
$LSD_{(0.05)}$	0.4421	0.2172	0.1709
Nitrogen level			
N_1	3.11 c	3.56 d	4.00 d
N_2	4.01 b	4.40 b	4.62 b
N_3	5.00 a	5.11 a	5.15 a
N_4	4.03 b	4.07 c	4.15 c
$LSD_{(0.05)}$	0.8270	0.1930	0.2895
Variety x Nitrogen level			
V_1N_1	2.67 j	3.00 f	3.02 i
V_1N_2	3.00 i	3.l1 *e*	3.21 g
V_1N_3	3.34 g	3.11 *e*	3.20 g
V_1N_4	3.11 h	3.11 *e*	3.11 h
V_2N_1	4.64 d	5.04 b	5.11 c
V_2N_2	5.20 b	5.05 b	5.22 b
V_2N_3	5.31 a	5.35 a	5.45 a
V_2N_4	4.97 c	5.05 b	5.11 c
V_3N_1	4.05 f	4.11 c	4.11 *e*
V_3N_2	4.05 f	4.11 c	4.00 f
V_3N_3	4.16 *e*	4.00 d	4.11 *e*
V_3N_4	4.15 *e*	4.11 c	4.33 d
$LSD_{(0.05)}$	0.043	0.045	0.041
CV (%)	2.49	5.93	3.20

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25, N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N ha^{-1}and N_4 - 150 kg N ha^{-1}.

Leaf length (cm)

Statistically significant differences were recorded for leaf length due to different wheat varieties and different level of nitrogenous fertilizer and also for the combination of variety and different nitrogen rate at 90 DAS (Table 3). The highest leaf length was found from V_2 and the lowest leaf length was observed from V_1 while due to the application of different dose of nitrogen the highest leaf length were observed from N_3 whereas, the shortest leaf length was found from N_1 and due to the combined effect of varieties and nitrogen the maximum leaf length were observed from V_2N_3 whereas, the lowest were found from V_1N_1.

Table 3. Effect of variety, nitrogen rate and their combination on leaf length of wheat

Treatment	Leaf length (cm) at		
	30 DAS	60 DAS	90 DAS
Variety			
V_1	19.96 c	26.24 c	28.43 c
V_2	23.72a	30.25 a	31.22 a
V_3	21.53 b	28.33 b	30.03 b
$LSD_{(0.05)}$	1.209	1.844	1.111
Nitrogen level			
N_1	21.82 c	26.92 c	27.13 c
N_2	23.20 b	28.52 b	29.44 b
N_3	24.30 a	29.92 a	31.44 a
N_4	23.04 b	28.55 b	29.22 b
$LSD_{(0.05)}$	1.076	1.273	1.630
Variety x Nitrogen level			
V_1N_1	17.06 j	25.67 i	26.71 h
V_1N_2	20.11 h	27.33 f	28.52 f
V_1N_3	21.45 f	28.22 e	29.84 d
V_1N_4	21.11g	26.22 g	27.29 g
V_2N_1	22.78 c	31.11 b	31.90 b
V_2N_2	24.22 b	28.78 d	29.26 d
V_2N_3	24.78 a	32.33 a	32.51 a
V_2N_4	21.89 e	31.00 b	31.11 c
V_3N_1	22.56 c	28.22 e	28.45 f
V_3N_2	22.22 d	27.00 f	29.23 e
V_3N_3	17.89 i	29.55 c	31.73 b
V_3N_4	21.00 g	29.11 c	30.71 c
$LSD_{(0.05)}$	0.418	0.688	0.223
CV (%)	7.49	7.03	3.40

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25, N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N $ha^{-1}$and N_4 - 150 kg N ha^{-1}.

Dry matter content (g $plant^{-1}$)

Significant differences were recorded for dry matter content in plant of wheat due to different varieties and nitrogen levels, and also due to their combination effect at 90 DAS (Table 4). The maximum total dry matter in wheat plant were recorded from V_2, whereas the lowest were in

V_1 On the other hand at 90 DAS, the highest dry matter in plant were recorded from N_3, whereas the lowest were found in N_1. In case of combination effect the highest dry matter were observed from V_2N_3, whereas the lowest were found in V_1N_1.

Table 4. Effect of variety, nitrogen rate and their combination on weight of dry matter (g plant^{-1}) of wheat

Treatment	Dry matter (g plant^{-1}) at		
	30 DAS	60 DAS	90 DAS
Variety			
V_1	2.04 c	9.33 c	12.79 c
V_2	3.98 a	12.14 a	17.85 a
V_3	2.79 b	10.39 b	14.05 b
$LSD_{(0.05)}$	0.103	1.050	1.627
Nitrogen level			
N_1	2.33 d	7.37 d	13.17 d
N_2	2.89 c	9.31 c	14.15 c
N_3	4.33 a	11.78 a	17.77 a
N_4	3.33 b	10.60 b	15.20 b
$LSD_{(0.05)}$	0.037	1.089	1.945
Variety x Nitrogen level			
V_1N_1	1.75 i	8.56 i	10.38 j
V_1N_2	2.01h	9.19 g	11.39 i
V_1N_3	2.04 h	10.38 *e*	15.20 *e*
V_1N_4	2.34 gh	9.20 g	13.79 g
V_2N_1	2.77*ef*	10.27 *e*	15.70 *e*
V_2N_2	3.59 c	11.39 *e*	17.49 c
V_2N_3	4.98 a	14.04 a	19.49 a
V_2N_4	3.74 b	13.09 b	18.67 b
V_3N_1	2.37 g	8.97 h	11.99 h
V_3N_2	2.79 *ef*	9.59 f	14.30 f
V_3N_3	3.04 d	12.03 c	16.59 d
V_3N_4	2.85 *e*	10.99 d	13.29 g
$LSD_{(0.05)}$	0.028	0.292	0.638
CV (%)	1.94	1.20	1.38

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25, N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N ha^{-1}and N_4 - 150 kg N ha^{-}

Grains ear^{-1}

Number of grains ear^{-1} was significantly influenced by varieties, different nitrogen rate and also their combination (Table 5). The maximum grains ear^{-1} (17.47) in wheat plant was recorded from V_2, whereas the minimum (16.17) were found in V_1. Due to different nitrogen fertilizer application the maximum (17.60) grains ear^{-1} in wheat plant was recorded from N_3, whereas the minimum (16.29) were found in N_1. In case of combination effect the highest (18.24) grains ear^{-1} was observed from V_2N_3, whereas the lowest (15.57) were found in V_1N_1

Number of fertile grains plant^{-1}

Variation in fertile grains plant^{-1} among the studied varieties was statistically significant (Table 5). The highest (54.69) number of fertile grains plant^{-1} was observed in V_2 whereas, the lowest (45.55) was V_1. Results also showed that number of fertile grains plant^{-1} increased with increasing nitrogen levels and thereafter decreased by gradually increased the nitrogen levels. The highest (52.85) number of fertile grains plant^{-1} was recorded at N_3 whereas, the lowest (48.63) was N_1. The interaction effect of variety and nitrogen levels in relation to number of fertile grains plant^{-1} gave the highest (59.67) number of fertile grains plant^{-1} was observed in V_2N_3 and the lowest (40.33) was recorded in V_1N_1.

Number of unfertile grains plant^{-1}

Variation in number of unfertile grains plant^{-1} among the studied varieties was statistically significant (Table 5). The highest (7.36) number of unfertile grains plant $^{-1}$ was observed in V_1 whereas, the lowest (3.00) was recorded in V_2. From Table 5 it is also observed that unfertile grains plant^{-1} decreased with increasing nitrogen and thereafter increased by gradually increased the nitrogen levels. The highest (6.45) unfertile grains plant^{-1} was observed N_1 and the lowest (5.63) number of unfertile grains plant $^{-1}$ was recorded in N_3. The interaction effect of different variety and nitrogen levels in relation to number of unfertile grains plant $^{-1}$ was also statistically significant. The highest (7.89) number of unfertile grains plant $^{-1}$ was observed in V_1N_1 and the lowest (2.05) was recorded in V_2N_3.

1000-grain weight

A significant difference in 1000-grain weight was also observed in studied varieties of wheat. The highest (54.95 g) 1000-grain weight was recorded in V_2. In contrast, the lowest (50.91 g) 1000-grain weight was recorded in V_1. Genotypic variation in 1000-grain weight was also observed by many researchers in wheat (Ghosh *et al.*, 1991; Bisht *et al.*, 1999; Hassan, 2006; Chowdhury, 2008) that also conformity with the present experimental result. The highest (53.92 g) 1000-grain weight was recorded in N_3 whereas, the lowest (49.82 g) 1000-grain weight was recorded in N_1. In case of combination, the highest 1000-grain weight was recorded in V_2N_3 (57.60 g) whereas, the lowest (48.97 g) 1000-grain weight was recorded in V_1N_1.

Grain yield (t ha^{-1})

Variety had significant effect on grain yield of wheat (Table 5). The highest (4.61 t ha^{-1}) grain yield was recorded in V_2 whereas; the lowest (3.45 t ha^{-1}) was recorded from V_1. Nitrogen had also significant effect on grain of wheat. Results showed that grain yield increased with increasing nitrogen rate and thereafter decreased by gradually increased the nitrogen. The highest (4.77 t ha^{-1}) grain yield was recorded in N_3 whereas, the lowest (3.20 t ha^{-1}) were recorded from N_1. The interaction effect of variety and nitrogen on grain yield was significantly differ. In case of unit area, V_2N_3 produced the highest (4.71 t ha^{-1}) grain yield. In the interaction effect, V_1N_1 was produced the lowest (3.23 t ha^{-1}) grain yield.

Straw yields (t ha^{-1})

The straw yield showed significant differences among the studied varieties (Table 5). BARI gom-23 produced the highest (5.92 t ha^{-1}) straw yield. On the other hand, BARI gom-24 produced the lowest straw yield (5.02 t ha^{-1}). On the other hand the highest (6.03 t ha^{-1}) straw yield was

recorded in N_1 whereas, the lowest (4.83 t ha^{-1}) was recorded in N_3. The interaction effect of variety and nitrogen in relation to straw yield was also significant. The highest (6.11 t ha^{-1}) straw yield was observed in V_1N_1 and the lowest (4.83 t ha^{-1}) was recorded in V_2N_3.

Harvest index (%)

Variation in harvest index among the studied varieties was statistically significant (Table 5). The highest (47.87 %) HI was recorded in BARI Gom-24 whereas, the lowest (36.82 %) harvest index was observed in BARI Gom-23. On the other hand in case of nitrogen rate the highest (49.68 %) HI recorded in N_3 whereas, the lowest (34.67 %) harvest index was observed in N_1. The interaction effect of variety and nitrogen in relation to HI was also statistically significant. Results showed that the highest (49.37%) HI was found in V_2N_3 and the lowest in V_1N_1 (34.58 %) due to the combination of variety and nitrogen dose.

Table 5. Effect of variety, nitrogen rate and their combination on yields and yield components of wheat

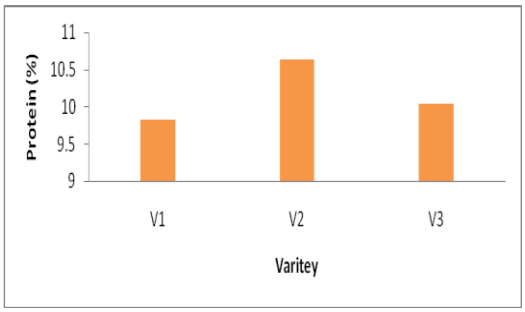
Treatment	Grains ear^{-1}	No. of fertile grains $plant^{-1}$	No. of unfertile grains $plant^{-1}$	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index (%)
Variety							
V_1	16.17 c	45.55 c	7.36 a	50.91 c	3.45 c	5.92 a	36.82 c
V_2	17.47 a	54.69 a	3.00 c	54.95 a	4.61 a	5.02 c	47.87 a
V_3	16.88 b	49.83 b	5.89 b	52.47 b	4.00 b	5.32 b	42.92 b
$LSD_{(0.05)}$	0.4941	3.994	1.488	1.529	0.5271	0.2798	3.945
Nitrogen level							
N_1	16.29 d	48.63 c	6.45 a	49.82 d	3.20 d	6.03 a	34.67 d
N_2	16.81 c	51.89 b	6.37 b	51.59 c	4.10 c	5.67 b	41.97 c
N_3	17.60 a	52.85 a	5.63 d	53.92 a	4.77 a	4.83 d	49.68 a
N_4	17.20 b	52.07 b	5.89 c	52.90 b	4.40 b	5.24 c	45.64 b
$LSD_{(0.05)}$	0.2390	0.627	0.079	0.943	0.2703	0.3378	2.849
Variety x Nitrogen level							
V_1N_1	15.57 i	40.33 j	7.89 a	48.97 j	3.23 j	6.11 a	34.58 j
V_1N_2	17.22 d	51.78 e	7.11 b	52.55 e	3.53 i	5.39 f	39.57 f
V_1N_3	16.15 f	43.33 i	7.11 b	49.90 i	3.32 g	5.84 c	36.25 h
V_1N_4	15.81 f-h	45.44 h	7.11 b	50.00 h	3.76 h	5.91 b	38.88 g
V_2N_1	16.74 e	53.55 cd	2.89 g	56.84 b	4.66 b	5.61 e	45.38 c
V_2N_2	17.13 d	54.00 b	4.33 e	53.20 d	4.46 d	4.95 h	47.39 b
V_2N_3	17.75 bc	59.67 a	2.05 h	57.60 a	4.71 a	4.83 j	49.37 a
V_2N_4	18.24 a	52.55 d	3.00 f	52.59 e	4.01 f	4.90 i	45.00 c
V_3N_1	17.58 c	49.44 f	6.22 c	50.93 g	4.39 e	5.80 c	43.08 d
V_3N_2	16.07 f	49.89 f	5.11 d	51.57 f	4.58 c	5.78 d	43.08 d
V_3N_3	17.95 b	53.78 c	6.00 c	53.82 c	3.30 g	5.73 d	35.48 i
V_3N_4	15.90 fg	46.55 g	5.78 c	53.37 d	3.81 g	5.19 h	42.33 e
$LSD_{(0.05)}$	0.288	0.988	0.575	0.557	0.054	0.060	1.03
CV (%)	3.74	2.09	5.40	4.03	9.47	7.29	5.40

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25, N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N $ha^{-1}$and N_4 - 150 kg N ha^{-}

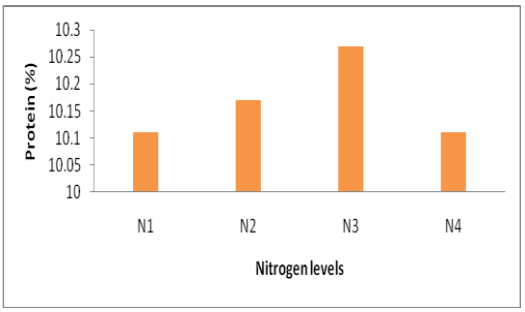
Protein content (%)

Variation in Protein (%) among the studied varieties was statistically significant (Figure 1). The highest protein content was recorded in BARI Gom-24 (10.64 %) whereas, the lowest protein content was observed in BARI Gom-23 (9.82 %)



V_1= BARI Gom-23, V_2=BARI Gom-24 and V_3=BARI Gom-25.

Fig. 1. Effect of varieties on protein (%) of wheat ($LSD_{0.05}$ = 0.0045)



N_1=75 kg N ha^{-1}, N_2 = 100 kg N ha^{-1}, N_3 -= 125 kg N $ha^{-1}$and N_4 = 150 kg N ha^{-1}.

Fig.2. Effect of nitrogen on protein (%) of wheat ($LSD_{0.05}$ = 0.0072)

The effect of nitrogen on Protein (%) was statistically significant (Figure 2). Result revealed that the highest (10.27 %) protein content recorded in N_3 whereas, the lowest (10.11 %) protein was observed in N_1.

The combination effect of variety and nitrogen in relation to protein (%) was also statistically significant (Table 6). Results showed that the highest (10.88 %) protein was recorded in V_2N_3 and the lowest (9.53 %) was in V_1N_1 .

Table 6. Combination effect of varieties and nitrogen on protein (%) of wheat

Treatments	Protein (%)
V_1N_1	9.53 *e*
V_1N_2	10.05 c
V_1N_3	10.54 b
V_1N_4	9.85 de
V_2N_1	10.05 c
V_2N_2	10.62 b
V_2N_3	10.88 a
V_2N_4	10.04 c
V_3N_1	9.89 c-*e*
V_3N_2	9.81 *e*
V_3N_3	10.02 cd
V_3N_4	10.52 b
$LSD_{(0.05)}$	0.1713
CV (%)	4.38

In a column means having similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
V_1–BARI Gom-23, V_2–BARI Gom-24 and V_3–BARI Gom-25
N_1–75 kg N ha^{-1}, N_2 - 100 kg N ha^{-1}, N_3 - 125 kg N $ha^{-1}$and N_4 - 150 kg N ha^{-1}.

Conclusion

Based on the results of the study it can be concluded that cultivating BARI Gom-24 coupled with application of 125 kg N ha^{-1} will be a promising practice for good yield also for higher protein content of wheat. However, to reach a specific conclusion and recommendation, more research work on different varieties and rate of nitrogen should be done over different Agroecological zones.

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