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RESPONSE OF SEMIDWARF WHEAT CULTIVARS TO TIMINGS OF NITROGEN APPLICATION AT DIFFERENT GROWTH STAGES

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A field experiment was carried out to investigate the impact of timing of nitrogen (N) application on yield, yield attributes (earbearing tillers, spikelets/spike, grains/spike, 1000-grain weight, plant height and grain yield/plant) and protein content of semidwarf wheat cultivars. There were four wheat cultivars *viz.* Aghrani, Akbar, Barkat and Kanchan and five patterns of nitrogen application (all of N at sowing; 1/2 of N each at sowing and early tillering; 1/3 of N each at sowing, early tillering and late tillering; 1/4 of N each at sowing, early tillering, late tillering and panicle initiation; 1/5 of N each at sowing, early tillering, late tillering, panicle initiation and flowering). Nitrogen was applied as urea @ 120 kg N/ha. Both the wheat cultivars and timing of N application produced significant effect on grain yield without effects on straw yield and protein content. Grains/spike, 1000- grain weight, plant height and grain yield/plant were influenced by cultivars but earbearing tillers and spikelets/spike were not significant. Earbearing tillers and plant height were influenced by timing of N application but other yield attributes were not affected. The interaction effect of cultivars and timing of N application on grain yield was significant but on other yield attributes and protein content effect was not found significant. The nitrogen application in three splits produced the best performances on grain yield of semidwarf wheat cultivars.

Key words: Protein, Timing of N application, Wheat cultivars, Yield and yield attributes.

Introduction

The soils of Bangladesh are deficient in nitrogen [1]. Many researchers [2-7] suggested that split application of N is the best practice to enhance the efficiency of use utilization. It is estimated that only about 35% of the added N is recovered by the crop and the rest is lost due to leaching, surface run-off, denitrification and immobilization [8]. Hence the efficiency of nitrogenous fertilizers can be increased by applying the total amount split at various growth stages of plants. The present study was, therefore, undertaken to evaluate the effect of timing of N application on yield, yield attributes and protein content of semidwarf wheat cultivars.

Materials and Methods

The experiment was carried out at Bangladesh Agricultural University Farm from Dec., 1989 to March, 1990 using wheat as the test crop. The soil falls under the general soil type, Non calcareous dark grey floodplain soil and Old Brahmaputra Agroecological regions (order Inceptisol; suborder Aquept; and subgroup Aeric Haplaquept). The soil had pH (1:2) 6.7; organic carbon 1.2%; Total N 0.06%; Available P (Olsen method) 14 ppm; Exchangeable K (Ammonium acetate) 0.21 me/100g; Available S (0.15% $CaCl_2$) 10 ppm; and silt loam. The general characteristics of the experimental soils were determined following some standard methods [9].

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There were four semidwarf wheat (*Triticum aestivum* L.) cultivars namely Aghrani, Akbar, Barkat and Kanchan and five timing of N application at different growth stages (all of N at sowing; 1/2 of N each at sowing and early tillering; 1/3 of N each at sowing, early tillering and late tillering; 1/4 of N each at sowing , early tillering, late tillering and panicle initiation; 1/5 of N each at sowing, early tillering, late tillering, panicle initiation and flowering).

The experiment was laid out in a randomized block design with four replications. Each plot was 4 x 2.5 m and spacing between blocks and plots were 1m and 75 cm, respectively. The urea-N was applied at 120 kg N/ha rate as Ali *et al.* [10] found highly significant effect with this rate on wheat in Bangladesh. The phosphorus (P) at 40 kg P/ha and potassium (K) at 20 kg K/ha were applied as basal doses as triple super phosphate and muriate of potash respectively. Wheat was sown at seeding rate of 100 kg/ha on Dec. 2, 1989 with 20 cm row to row spacing. Intercultural operations such as irrigation, weeding, insecticides application were done whenever necessary. The crop was harvested at maturity on March 23, 1990. Yield contributing characters (plant height, earbearing tillers/plant, spikelets/spike, grains/spike, 1000- grain weight etc.) were recorded from ten randomly selected plants from each plot. Grain and straw yield were recorded at 4% moisture basis after harvest. Total N content in grain was determined following the method of AOAC [11] and the protein content was calculated by multiplying total N with 6.25. The data were

analysed statistically and the mean difference were adjudged by Least Significance Difference Test [12].

Results and Discussion

Grain yield. Application of N in three splits (1/3 each at sowing, early tillering and late tillering) gave the highest grain yield (2105 kg/ha) indicating that tillering stage is more critical in dwarf wheat for maximum utilization of applied N (Table 1). The application of N in five splits produced lowest yield (1692 kg/ha). Application of all N at sowing, however, resulted significantly lower yield (1792 kg/ha) in comparison to other timing of N application. The grain yield of wheat also was significantly affected by cultivars. The highest grain yield (1923 kg/ha) was produced by cultivar Akbar and the Aghrani produced the lowest yield (1788 kg/ha). The interaction effect of wheat cultivars and timing of N application on grain yield was significant (Table 2). All the cultivars showed better grain yield response to two and three splits of N application than other timing of N application. Boese [13] observed that grain yields were highest with 2 and 3 applications of nitrogen. Samad *et al.* [14] reported that grain yield was significantly affected by the timing of N application at different growth stages and also revealed that N application at early tillering stage tended to give higher grain yield. Bremner [15] also reported greater yield with early application of nitrogen.

Straw yield. The timing of N application influenced the straw yield of wheat but the effect of cultivars was not statistically significant (Table 1). With N application in three splits (1/3 of N each at sowing, early tillering and late tillering), the crop produced apparently higher straw yield than other timing of N application. The lowest straw yield was with five splits of nitrogen. The straw yield was highest with the cultivar Barkat

Table 1. Yield, Yield Attributes and Protein Content of Wheat as Influenced by Cultivar and Time of N Application.

Factor	Earbearing tillers	Spikelets/ spike	Grains/ spike	1000-grain weight (g)	Plant height (cm)	Grain yield/ plant(g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Protein content (%)
Cultivar									
Aghrani	3.6	13.2	31.5	44.1	89.7	4.89	1788	3226	12.2
Akbar	3.6	12.8	30.5	47.4	90.2	5.09	1923	3467	12.8
Barkat	3.5	13.5	28.4	37.0	90.6	3.69	1836	3680	13.5
Kanchan	3.5	13.0	25.8	44.7	95.7	3.99	1878	3415	12.4
LSD at 5%	NS	NS	3.14	5.32	2.66	0.87	83.0	NS	NS
Time of N *application*									
All at sowing	3.4	13.5	29.6	45.2	93.8	4.47	1792	3261	11.8
1/2 each at sowing and early tillering	3.7	12.9	28.0	42.5	93.1	4.43	1856	3596	12.2
1/3 each at sowing, early tillering and late tillering	3.6	13.1	28.0	43.8	91.4	4.37	2105	3730	12.5
1/4 each at sowing, early tillering, late tillering and panicle initiation	3.6	13.0	30.3	42.1	90.9	4.60	1838	3463	12.3
1/5 each at sowing, early tillering, late tillering, panicle initiation and flowering	3.4	13.4	29.4	42.9	88.6	4.23	1692	3186	11.9
LSD at 5 %	0.32	NS	NS	NS	2.98	NS	93.0	NS	NS

TABLE 2. TIMING OF N x CULTIVAR INTERACTION EFFECT ON GRAIN YIELD OF SEMIDWARF WHEAT.

Timing of N application	Grain yield (kg/ha)			
	Aghrani	Akbar	Barkat	Kanchan
All at sowing	1742	1950	1750	1725
1/2 each at sowing and early tillering	1933	1867	1692	1933
1/3 each at sowing, early tillering and late tillering	1917	2183	2170	2150
1/4 each at sowing, early tillering, late tillering and panicle initiation	1883	1850	1883	1733
1/5 each at sowing, early tillering, late tillering, panicle initiation & flowering	1467	1767	1683	1850
LSD at 5 %	= 186.0			

and the Aghrani gave the lowest yield. The interaction effect of wheat cultivars and timing of N application on straw yield was not significant.

Yield attributes. The effect of timing of N application on earbearing tillers/plant, plant height and grain yield/plant were significant but the effect was not significant on spikelets/spike, grains/spike and 1000 grain weight (Table 1). The tillering was greatest with three splits of N application and was lowest when all N was applied at sowing or in five splits. The maximum plant height was observed with all N application at sowing which was statistically identical to two splits and greater than all other timing of N application. Bhattacharya [16] reported that the time of nitrogen application had significant effect on plant height and 1000 grain weight but number of fertile tillers, spikelets/spike and grains/spike were not much influenced by the time of N application.

The effect of wheat cultivars on grains/spike, 1000 grain weight, plant height and grain yield/plant was significant but on earbearing tillers/plant and spikelets/spike were not influenced (Table 1). The highest grains per spike was produced with the cultivar Aghrani while the cultivar Kanchan gave the lowest grains/spike. The highest 1000 grain weight was obtained by the cultivar Akbar and the cultivar Barkat gave the lowest 1000-grain weight. The cultivar Kanchan had the tallest plants. The interaction effects of cultivars and timing of N application on yield attributes were not significant.

Protein content. The protein content varied with timing of N application and cultivars but the effects were not significant. The protein content was highest with three splits of N application and was lowest when all N was applied at sowing. It has been reported that split application of N did not generally affect N accumulation and grain crude protein content of wheat [17]. Valev [18] observed that N application at ear formation gave some increase in protein content. The interaction effect of timing of N application and cultivars on protein content of wheat was not significant.

In conclusion the results indicated that the application of N in three splits was superior to all other timing of N application with respect to yield and protein content of wheat with a view to minimizing the loss of nitrogen in the soil and maximizing N utilization efficiency. Application of N in five splits produced the lowest yield and protein content. Cultivar Barkat gave the highest and the Aghrani gave the lowest yield and protein content of wheat.

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