Effect of Rates of Nitrogen and Varieties on Yield and Its Contributing Characters in Dwarf Wheat*

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INTRODUCTION

The concept that grain yield is governed by factors affecting carbohydrate production has been revised by putting an additional consideration of factors affecting the capacity of crop to store carbohydrates. Thus, an adequate 'sink' can be provided in many ways, e.g., by many small ears or fewer large ones.

Nitrogen application has been reported to bring considerable increase in yield with an increase in the number of spikes^{5,6)} and number of grains per ear, weight of grains per ear and the test weight of 1000 grain^{2,4)}. However, optimum level of nitrogen for dwarf wheats was reported to fall between 110 and 130 kg/ha^{1,3,7)}. Among the varieties, S 227 was superior to Sonora-64 and Lerma Rojo⁷⁾ and Kalyan Sona proved the best⁸⁾. While Kalyan Sona is reported to run down, the newer triple dwarfs are known to respond more to applied nitrogen.

In view of the above facts, a comparative study of yield-behaviour of the varieties Kalyan Sona, U.P. 301 and H.D. 1941 under the influence of various rates of nitrogen application was done in a field experiment. Variety Kalyan Sona is double gene dwarf and the varieties U.P. 301 and H.D. 1941 are triple gene dwarf.

MATERIALS AND METHODS

A field experiment involving six rates of nitrogen (0, 40, 80, 120, 160 and 200 kg/ha) and three varieties of dwarf wheat (Kalyan Sona, U.P. 301 and H.D. 1941) was conducted under irrigated conditions during Rabi (winter) 1970~71 and 1971~72 at the Research Farm of the Department of Agronomy, Banaras Hindu University.

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The treatments were applied in a split-plot design with the rates of nitrogen in the main plots in latin square and the varieties in the sub-plots across the nitrogen rows. These 18 treatment combinations were replicated six times to occupy 108 ultimate plots. Each treatment in the ultimate plot was assigned to 7 rows each of 12 m length. Recommended doses of phosphorus and potassium @ 35 and 50 kg P and K per hectare, respectively, were applied at sowing. Requirement of nitrogen was met by ammonium sulphate in two splits, i.e., 1/2 at sowing and 1/2 at first irrigation. Single superphosphate and the muriate of potash were used to supply phosphorus and potassium respectively. Sowing was done @ 100 kg seed per hectare in lines 23 cm apart on November 14 in the first year and November 17 in the second year. In addition to a light presowing irrigation, five irrigations were given. Starting from the first irrigation on 21st day (crown root initiation) after sowing, the remaining four successive irrigations were given at an interval of 20 days to coincide (approximately) with the tillering, jointing, flowering and dough stages. The net plot harvested comprised of 3 middle rows (3rd, 4th and 5th) of 10 m (excluding 1 m each way) to give an area of 6.9 sq.m. The harvest was sun-dried for four days, weighed and threshed by a mechanical thresher. The grain was weighed and the straw was determined by subtraction. The yield per plot was multiplied by the factor 1449 to give the yield in kg/ha. Observations on number of spikes per 2 meter row length, length of spike (cm), number of fertile spikelets per spike, number of grains per spike, weight of 1000 grain (gm) and the yield of grain and straw (kg/ha) were recorded. Also, the per cent tiller survival at dough stage (from maximum) was noted. The soil of the experimental block was

Table 1 Effect of rates of nitrogen and varieties

	Yield (kg/ha)				Yield attributes	
	Grain		Straw		No. of spikes/2 m row length	
	70~71	71~72	70~71	71~72	70~71	71~72
N rates (kg/ha)						
0	1478	1023	2651	2492	66.0	67.8
40	2231	2072	3985	3941	83.3	83.9
80	2739	3057	5042	5202	96.4	94.9
120	3637	4043	6042	6520	116.4	130.1
160	4101	4304	6086	7172	129.8	135.7
200	4390	4361	7114	7462	131.7	137.8
C.D. at 5%	313	438	709	709	8.4	19.7
Varities						
Kalyan Sona	3507	3217	5940	6216	110.8	114.2
U.P. 301	2768	2826	4549	4984	100.0	102.0
H.D. 1941	3101	3391	4970	5201	100.8	109.0
C.D. at 5%	267	—	534	356	9.2	6.8

So far as Table No. 1 is concerned, all the heads other than the yield of grain and straw come under yield attributes. For calculations, it may explained that each rate of nitrogen interacts with each variety (six times) and the method of analysis of variance is employed to test the significance of N-rates, varieties and nitrogen rate x variety interactions separately over the errors a, b and c respectively. Differences among themselves are determined by implying critical difference as given in the Table No. 1.

a sandy loam with pH 7.4 and total nitrogen 0.042 per cent.

RESULTS AND DISCUSSION

The data presented in table 1 show that the applications of 160 and 200 kg N/ha were at par in influencing various characters contributing towards the yield. The maximum values (except the weight of 1000 grain) were recorded at 200 kg/ha. Beyond 120 kg/ha, the number of spikes per 2 meter row length was significantly superior to those at lower rates. More spikes were produced due to a higher percentage of surviving tillers (85.2) in the second year than the first year (74.2). Length of spikes, number of fertile spikelets and grains per spike increased with an increase in the rate of nitrogen and applications of 160 and 200 kg/ha were significantly superior to its lower ones. Weight of 1000 grain declined beyond 80 kg/ha recording maximum value of 42.00 and 39.02 gm in the first and second year respectively. A decrease in the weight of 1000 grain at the higher rates of application is attributed to an increase in

the number of grains per spike.

Response beyond 160 kg/ha was not obtained so far as the grain yield was concerned. The variation in grain yield between the years narrowed at higher applications and almost equal yield of 4390 and 4361 kg grain/ha in the first and second year respectively were observed at 200 kg/ha. More grains per spike and a higher weight of 1000 grain in the first year and a greater number of spikes and fertile spikelets per spike in the second year, resulted in an equal yield in both the years. This is possible because when one parameter increased, the others decreased. Among the varieties, Kalyan Sona was found superior to H.D. 1941 with respect to the number of spikes per 2 meter row length, length of spike, number of fertile spikelets and grains per spike. In contrast, both H.D. 1941 and U.P. 301 were significantly superior to Kalyan Sona in the weight of 1000 grain. While Kalyan Sona was significantly superior, U.P. 301 was inferior to H.D. 1941 with respect to the grain yield in the first year. Though the trend was the same, varieties did not differ significantly in the

on yield and yield attributes in wheat

Yield attributes							
Length of spike (cm)		No. of fertile spikelets per spike		No. of grains per spike		Weight of 1000 grain (gm)	
70~71	71~72	70~71	71~72	70~71	71~72	70~71	71~72
9.3	8.2	15.7	14.4	33.1	30.9	38.01	33.87
9.5	9.1	15.8	15.5	38.3	36.6	38.84	38.67
9.7	9.8	16.4	16.0	46.0	42.7	42.00	39.02
9.8	10.1	16.8	16.3	48.5	46.2	40.44	38.65
10.3	10.5	17.6	18.0	51.5	48.1	38.67	37.63
10.4	10.8	17.8	18.6	53.6	51.6	38.31	35.55
0.5	0.4	1.1	0.8	5.7	3.8	0.92	1.31
10.1	9.9	17.5	16.8	51.8	50.2	38.83	35.57
9.6	9.7	16.5	16.3	40.4	37.4	38.28	38.66
9.5	9.5	15.9	15.4	43.7	40.5	40.98	37.47
—	0.3	1.1	0.5	4.1	3.9	0.73	0.51

second year.

Over the years, both Kalyan Sona and H.D. 1941 were identical in grain yield and significantly superior to U.P. 301. In the first year, the variety Kalyan Sona yielded 406 kg/ha more grain as compared to H.D. 1941, mainly through an excess of 10 spikes per 2 meter row length. Contrary to the above observation, when the number of excess spikes reduced to 5, the yield was less by 174 kg/ha as compared to H.D. 1941, securing this margin through a higher weight of 1000 grain in the second year. More spikes and grains per spike affected a higher yield in H.D. 1941 than U.P. 301. Straw production increased with the increase in nitrogen application and the rates of 160 and 200 g/ha were equally effective. Variety Kalyan Sona yielded maximum straw followed by H.D. 1941 and U.P. 301, indicating a higher straw production by the taller varieties.

SUMMARY

A comparative account of yield and its contributing characters of dwarf wheat varieties Kalyan Sona, U.P. 301 and H.D. 1941 as affected by the rates of nitrogen application was worked out in a field experiment during the winter seasons of 1970~71 and 1971~72 at the Research Farm of the Department of Agronomy, Banaras Hindu University.

A significant increase in yield and the contributory characters (except the weight of 1000 grain) was observed due to application of nitrogen up to 160 kg/ha. The varietal differences were found mostly due to the two most important characters, i.e., number of spikes per 2 meter row length and the weight of 1000 grain. Both Kalyan Sona and H.D. 1941 performed equally well and were superior to U.P. 301. Number of spikes per 2 meter row length influenced the yield most in Kalyan Sona and the weight of 1000 grain in H.D. 1941.

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〔和 文 摘 要〕

窒素施用量と品種の相違がわい性コムギの収量と収量構成要素に及ぼす影響

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1970年から1972年にわたる冬季に、わい性コムギの Kalyan Sona, U.P. 301 および H.D. 1941 を用いて、窒素の施用量が収量および収量構成要素に及ぼす効果について品種比較試験を行った。ha 当り 160kg までは、窒素を増すほど千粒重を除いた他の収量構成要素および収量が増加した。品種間の差は、畦長 2m 当りの穂数および千粒重で最も著しく、Kalyan Sona と H.D. 1941 はともに U.P. 301 より優れていた。Kalyan Sona では畦長 2m 当りの穂数が、また、H.D. 1941 では千粒重が収量に対して最も著しく影響した。