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Response of durum and aestivum wheat varieties to nutrient management under late sown condition

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ABSTRACT

A field experiment was conducted at Rajasthan College of Agriculture, Udaipur, Rajasthan during *rabi* 2014-15 to assess the performance of durum and aestivum wheat varieties and nutrient management under late sown condition. The experiment consisted 16 treatment combinations comprising four varieties *viz*. aestivum: Raj-4079, HD-2932; durum: HI-8713, HI-8498 and four level of nutrient management *viz*. 100% N, P & K, 125% N, P & K, 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} and 100% N, P & K + 1% K. Combination of these treatments was evaluated under factorial randomized block design (FRBD) with three replications. Durum wheat variety HI-8713 gave highest plant height (90.5 cm), number of tillers (180.5 m^{-1} row), dry matter (311.6 g m^{-2}) and flag leaf area at 50% heading (31.5 cm^2) over rest of varieties. Variety HI-8713 gave maximum grain yield (5724 kg ha^{-1}), straw yield (8073 kg ha^{-1}), net returns (₹ 76582 ha^{-1}) and B:C ratio (1.88). Variety Raj-4079 was at par with variety HD-2932 in case of net returns. Among the nutrient management, application of 125% NPK gave highest plant height, number of tillers, dry matter and flag leaf area over rest varieties. Application of 125% N, P & K recorded significantly higher grain yield (5620 kg ha^{-1}), straw yield (8192 kg ha^{-1}), net returns (₹ 76030 ha^{-1}) and B:C ratio (1.90) over 100% N, P & K and 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1}. Application of 100% N, P & K + 1% K recorded significantly higher grain yield over 100% N, P & K by 6.9 per cent. 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} was at par with 100% N, P & K.

Key words: Late sown wheat, grain, yield, variety, durum, aestivum, nutrient management, net return.

In Rajasthan due to one or the other reasons many times farmers are unable to sow the wheat crop in time and compel to sow the crop under late sown condition. It is due to intensive cropping system, which pushes the grain filling stage to high temperature stress. Increased temperature not only hastens the phenological stages of crop development but also reduces duration of grain filling stages (Farooq *et al.* 2011). It has been estimated that delay in sowing of wheat beyond 15 December resulted in yield reduction of 50 kg grain day^{-1} ha^{-1} (Singh *et al.* 2001). Heat stress may be mitigated either by the use of suitable varieties or alter the fertilizer doses through the use of macro-and micro-nutrients. Nitrogen, phosphorous and potassium are the main macro-nutrients that are taken by plants in comparatively large quantities. Nitrogen is one of the essential nutrient applied to the crop for the higher vegetative growth, productivity and quality. Phosphorous stimulates flowering and seed formation. Potassium is involved in growth of meristematic tissue and is indispensable for the maintenance of cell turgor pressure, which is required for cell expansion (Rogalski, 1994). Foliar application of K may delay high

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temperature induced leaf senescence and thus improved yield of wheat (Benbella and Paulse, 1998). Zinc is also involved in key metabolic process such as respiration, photosynthesis and assimilation of same major nutrients. It plays important role in activation (Rajput *et al.* 1995). Therefore, present investigation was taken to find out the effect of nutrient management on durum and aestivum wheat varieties under late sown condition.

Materials and Methods

The experiment was conducted during *rabi* season of 2014-15 at Rajasthan College of Agriculture, Udaipur (24°35' N latitude, 73°42' E longitude, 582.17 m above mean sea level). Soil of the experimental site was clay loam in texture, having slight alkaline reaction (pH 8.0), medium in available nitrogen (281.4 kg ha^{-1}), phosphorus (19.5 kg ha^{-1}) and high in available potassium (369.2 kg ha^{-1}). The experiment consisted of 16 treatment combinations, comprising four varieties *viz*. aestivum: Raj-4079, HD-2932; durum: HI-8713, HI-8498 and four level of nutrient management *viz*. 100% N, P & K, 125% N, P & K, 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} and 100% N, P & K + 1% K. The experiment was laid-out in a factorial randomized block design with three replications. Fertilizer application was made through urea, DAP and MOP, $ZnSO_4$ and foliar spray of KCl. Full dose of phosphorus (40 kg P_2O_5 ha^{-1}), potash (30 kg P_2O_5 ha^{-1}), zinc sulphate (25 kg ha^{-1}) and half dose of nitrogen were applied as basal. Remaining ¼ dose of nitrogen was top dressed at first irrigation and ¼ at second irrigation. Foliar spray of 1% KCl was done at milking stage (83 DAS). Flag leaf blade area determined by a method described by Quarrie and Jones (1979) using the proposed equation. The crop was sown on 17 December 2014 using seed rate of 125 kg ha^{-1} and six irrigation were applied to the crop. All the observations in yield attributes are recorded at harvest except flag leaf area which was calculated at 50 % heading stage. Flag leaf area was calculated as per the following formula.

$$\text{Flag leaf area } (cm^2) = \text{Length (cm)} * \text{Breadth (cm)} * 0.75$$

Results and Discussion

Effect of varieties

Data presented in Table 1 indicate that durum wheat variety HI-8713 registered maximum plant height (90.5 cm), number of tillers (180.8 m^{-1} row), dry matter accumulation (311.6 g m^{-1} row), flag leaf area (31.5 cm^2), which was significantly superior to Raj-4079 by 12.9, 7.8, 9.1 and 17.1 per cent, respectively and it was at par with variety HI-8498 in case of plant height and with variety HD-2932 and HI-8498 in case of number of tillers and dry matter accumulation. Similar results had

Table 1. Effect of varieties and nutrient management on different growth parameters of wheat.

Treatments	Plant height (cm)	Tillers (m^{-1} row)	Dry matter (g m^{-1} row)	Flag leaf area (cm^2)
Varieties				
Raj-4079	80.1	167.7	285.4	26.9
HD-2932	81.8	172.6	300.3	28.9
HI-8713	90.5	180.8	311.6	31.5
HI-8498	86.2	175.0	306.6	29.2
SEm±	1.9	3.2	5.1	0.6
CD (P = 0.05)	5.6	9.2	14.6	1.7
Nutrient management				
100% R.D of N, P and K	83.2	170.5	291.8	27.6
125% R.D of N, P and K	88.6	183.6	312.0	32.2
100% R.D of N, P and K + 25 kg $ZnSo_4$	83.5	170.6	297.0	28.3
100% R.D of N, P and K + Foliar spray of 1% K	83.2	171.4	303.0	28.3
SEm±	1.9	3.2	5.1	0.6
CD (P=0.05)	5.6	9.2	14.6	1.7

Table 2. Effect of varieties and nutrient management on yield attributes yields, net returns and B:C ratio of wheat.

Treatments	Spikelets ear^{-1}	Ear length (cm)	Grains ear^{-1}	1000-grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net returns (₹ ha^{-1})	B:C
Varieties								
Raj-4079	16.0	7.9	28.6	41.9	4973	7130	61462	1.51
HD-2932	17.8	8.2	31.4	44.3	4996	7517	62821	1.54
HI-8713	19.3	9.2	38.9	47.5	5724	8073	76582	1.88
HI-8498	18.4	8.0	34.6	55.4	5569	7912	76552	1.81
SEm±	0.5	0.2	0.8	0.5	135	205	1926	0.05
CD (P = 0.05)	1.4	0.6	2.4	1.4	389	593	5560	0.14
Nutrient management								
100% R.D of N, P and K	17.0	8.1	29.8	45.8	5067	7442	65859	1.69
125% R.D of N, P and K	18.9	8.7	37.9	49.0	5620	8192	76030	1.90
100% R.D of N, P and K + 25 kg $ZnSo_4$	17.8	8.2	31.3	47.1	5161	7465	66556	1.67
100% R.D of N, P and K + Foliar spray of 1% K	17.8	8.2	34.5	47.2	5414	7533	65971	1.47
SEm±	0.5	0.2	0.8	0.5	135	205	1926	0.05
CD (P=0.05)	NS	NS	2.4	1.4	389	593	5560	0.14

also been reported by Tomar *et al.* (2014) Amarawat *et al.* (2014).

Data on yield attributes (Table 2) reveals that variety HI-8713 registered maximum number of spikelets (19.3 ear^{-1}), ear length (9.2 cm), number of grains ear^{-1} (38.9), grain yield (5724 kg ha^{-1}) and straw yield (8073 kg ha^{-1}), which was significantly superior over Raj-4079 by 20.3, 16.4, 36.0, 15.1 and 13.2 per cent, respectively and it was at par with variety HI-8498 in respect to spikelets, ear length and grain yield. Variety HI-8498 recorded maximum 1000-grain weight (55.4 g) which was significantly superior over Raj-4079, HD-2932 and HI-8713. Variety HI-8713 registered maximum net returns (₹ 76582 ha^{-1}) and B:C ratio (1.88) which was significantly superior over Raj-4079 and HD-2932. These results are in line with those of Jat and Singhi (2004), Mattas *et al.* (2011) and Amarawat *et al.* (2014).

Effect of nutrient management

Application of 125% N, P & K recorded maximum plant height (88.6 cm), number of tillers (183.6 m^{-1} row), dry matter accumulation (312.0 g m^{-1} row) and flag leaf area (32.2 cm^2) which was significantly superior over 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} but it was at par with 100% N, P & K with respect to plant height and 100% N, P & K + 1% K with respect to dry matter accumulation. These findings are similar to that of Jat and Singhi (2004) and Verma *et al.* (2006).

Data presented in Table 2 indicate that application of 125% N, P & K registered maximum number of spikelet ear^{-1} (18.9) and ear length (8.7 cm) but was at par with rest of treatments. Similarly, application of 125% N, P & K registered maximum number of grains (37.9 ear^{-1}), 1000-grains weight (49.0 g), grain yield (5620 kg ha^{-1}), straw yield (8192 kg ha^{-1}), net returns (₹ 76030 ha^{-1}) and B:C (1.90) which was significantly superior over 100% N, P & K and 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} but it was at par with 100% N, P & K + 1% K with respect to grain yield. However, 100% N, P & K + 25 Kg $ZnSO_4$ ha^{-1} was found statistically at par with 100% N, P & K and 100% N, P & K + 1% K. Significant improvement in productivity of wheat crop with higher level of NPK fertilization is in close agreement with findings of Kumar and Dhar (2010), Laghari *et al.* (2010).

Conclusions

On the basis of one year field experimentation, it was concluded that under late sown condition, durum wheat varieties yielded higher grain (HI-8713; 5724 kg ha^{-1} and HI-8498; 5569 kg ha^{-1}) and higher net returns (HI-8713; ₹ 76582 ha^{-1} and HI-8498; ₹ 76552 ha^{-1}) in comparison to aestivum varieties (Raj-4079; 4973 kg ha^{-1}, ₹ 61462 ha^{-1} and HD-2932; 4996 kg ha-1, ₹ 62821 ha^{-1}) and the crop should be fertilized with 125% NPK (150, 50 and 37.5 kg ha^{-1}).

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