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Effect of Nutrient Management Modules on Growth, Yield Attributes and Yield of Wheat

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The field experiment was conducted to study the effect of nutrient management modules on wheat (variety NW-1014) at student's instructional farm, Narendra Deva university of Agriculture and Technology, Narendra Nagar, Faizabad during *Rabi* season of 2014-15 and 2015-16. The experimental soil was silty loam having OC 3.4 g kg^{-1} with pH 8.58, available N 170.50, P 11.80 and K 215.50 kg ha^{-1}, S 6.10 and Zn 0.38 ppm. The experiment consists of fourteen treatments viz. T_1: RDF (150:60:40 kg ha^{-1} N, P_2O_5 and K_2O), T_2: RDF + 20kg $ZnSO_4$ ha^{-1}, T_3: RDF + 5 t FYM ha^{-1}, T_4: RDF + 2.5 t VC ha^{-1}, T_5: RDF + 5 t FYM + 20 kg $ZnSO_4$ ha^{-1}, T_6: RDF +2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}, T_7: 75% RDF, T_8: 75 % RDF +20kg $ZnSO_4$ ha^{-1}, T_9: 75 % RDF + 10 t FYM ha^{-1}, T_{10}: 75 % RDF + 5 t VC ha^{-1}, T_{11}: 75 % RDF +10 t FYM + 20 kg $ZnSO_4$ ha^{-1}, T_{12}: 75 % RDF + 5 t VC + 20 kg $ZnSO_4$ ha^{-1}, T_{13}: 125 % RDF, T_{14}: 125 % RDF + 20 kg $ZnSO_4$ ha^{-1}. The results revealed that the application of 100% recommended dose of fertilizer (RDF) + vermicompost @ 2.5 t ha^{-1} + $ZnSO_4$ @ 20 kg ha^{-1} as well as 100% RDF + FYM @ 2.5 t ha^{-1} + $ZnSO_4$ @ 20 kg ha^{-1} recorded higher yield attributes and yield than rest of the treatments.

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops of the world. Among the world's most important food grains, it ranks next to rice. It is eaten in various forms by more than one billion in the world. Wheat straw is a good source of feed for a large population of the cattle in our country. It ranks second in the world among the cereals both in respect of acreage (231.0 m ha) and production (727.87 metric t.) (Ministry of Agri. GOI 2015-16). India is the second largest producer of wheat in the world. It is a pre-dominant winter season crop of north western plain zones and during 2015-16, production in India was 95.85 million tons from an area of 30.47 million hectares with productivity of 2.99 tones ha^{-1} (Economic survey, GOI, 2015-16).

UP ranks first in respect of crop coverage area (9.64 million hectares) and production (30.00 million tons) but average productivity is low (3.11 t ha^{-1}) (FAO, STATE -2014-15). The most significant results are obtained, when we

use organic manures in the combination of inorganic fertilizers (Patra *et al.,* 1999). Nitrogen is major structural nutrient of the cell along with P and K. It helps in building up vegetative growth of plants. The deficiency of nitrogen badly affects the crop growth and causes shrivelling of grain and poor crop yield. Phosphorus is also important major plant nutrient for better crop production. It is necessary for photosyntehsis. Potassium is the third major plant nutrient and plays very important role in photosynthesis and translocation of nutrients from leaves to the seed. Organic manures with the combination of chemical fertilizers, increases growth, grain and straw yield of wheat crop. Zinc is involved in protein and carbohydrate metabolism through several enzyme systems. Zinc increases the grain and straw yield of wheat with increasing levels of zinc application.

Materials and Methods

Field experiments were conducted during the rabi season 2014-15 and 2015-16 at students instructional farm, Narendra Deva university of Agriculture & Technology Narendra Nagar Faizabad. The experimental soil was silty loam having organic carbon 3.40 g kg^{-1} with pH 8.58, available N 170.50, P 11.80 and K 215.50 kg ha^{-1}, S 6.1 and Zn 0.38 ppm.

The experiment was laid out in randomized block design with three replications. Vermicompost and FYM were applied 15 days before sowing as per treatment. Wheat cultivar NW-1014 was sown in rows 20 cm apart on 26th November in 2014 and 17th November in 2015 and harvested on 14th April 2015 and 29th April in 2016, respectively. Half of nitrogen and full dose of phosphorus and potash were applied at the time of sowing as per treatment combination. The remaining nitrogen as per treatment was top dressed after first irrigation. N, P, K and Zn were applied through urea, DAP, muriate of potash and zinc sulphate, respectively. The crop received four uniform irrigations (at crown root initiation, tillering, flowering and milking stages). The yield parameters and yields were recorded and analyzed as per Gomez and Gomez (1984). The treatment comparisons were made using t-test at 5% level of significance.

Results and Discussion

Effect on growth, yield attributes and yield

Two years (2014-15 and 2015-16) pooled data (Table 1) revealed that the maximum plant height (97.45 cm) recorded with the treatment T_6 (100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}) was statistically at par with T_4, T_5, T_{11} and T_{12} and significantly superior over rest of the treatments. Higher plant height in T_4, T_5, T_6, T_{11} and T_{12} might be due to higher nitrogen content applied through inorganic and organic sources. Similar kind of result has been reported by Roberts *et al.,* (2007).

The data with respect to effective shoots m^{-2} as influenced by various treatments have been presented in Table 1. It clearly indicates that the maximum effective shoots (423.05) recorded with T_6 (100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}) was statistically at par with T_4, T_5, T_{11} and T_{12} and significantly superior over rest of the treatments.

The data with respect to no. of grains $spike^{-1}$ as influenced by various treatments have been presented in Table 1. It clearly indicates that the maximum no. of grains (52.67) recorded with T_6 (100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}) was statistically at par with T_4, T_5, T_{11} and T_{12} and significantly superior over rest of the treatments. Number of grains $spike^{-1}$ also increased significantly by integrating FYM and vermicompost or supplementary nutrients like, zinc with NPK. Maximum values of

yield contributing characters were recorded under combined application of 100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}, indicating the supplementing the inorganic fertilizers with FYM and vermicompost improved the general soil environment, which help to improve the wheat growth and yield contributing characters. Similar findings were also reported by Nehra *et al.*, (2001) and Chandel *et al.*, (2014).

Table.1 Effect of nutrient management modules on growth, yield attributes and yield of wheat (pooled of two years)

Treatments	Plant height (cm)	Effective shoot m^{-2}	No. of grains $spike^{-1}$	Test weight (g)	Yield (q ha^{-1})	
					Grain	Straw
T_1	82.94	360.05	41.93	38.65	41.78	62.67
T_2	87.65	380.50	44.62	39.37	42.73	66.23
T_3	89.54	388.69	46.30	39.66	45.10	67.17
T_4	90.95	394.82	48.64	39.90	45.81	68.21
T_5	96.13	417.33	51.33	40.82	48.05	69.28
T_6	97.45	423.05	52.67	41.99	50.80	71.07
T_7	79.66	345.83	39.63	37.74	35.61	56.97
T_8	81.19	352.44	39.78	38.33	36.22	57.96
T_9	82.27	357.15	40.92	38.49	36.92	59.26
T_{10}	84.82	368.23	43.28	39.30	42.35	64.09
T_{11}	92.36	400.96	49.98	40.08	46.53	67.31
T_{12}	93.31	405.05	50.66	40.57	47.95	68.24
T_{13}	83.88	364.14	42.75	39.14	42.06	63.67
T_{14}	88.12	382.55	45.29	39.56	44.39	66.59
SEm±	2.71	11.78	1.42	1.23	1.34	1.89
C.D. at 5%	7.70	33.44	4.03	NS	3.79	5.35

T_1: RDF (150:60:40 kg ha^{-1} NPK), T_2 : RDF + 20kg $ZnSO_4$ ha^{-1}, T_3 : RDF + 5 t FYM ha^{-1}, T_4 : RDF + 2.5 t VC ha^{-1}, T_5: RDF + 5 t FYM + 20 kg $ZnSO_4$ ha^{-1}, T_6: RDF +2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}, T_7: 75% RDF(112.50:50:45 kg ha^{-1}), T_8: 75 % RDF +20kg $ZnSO_4$ ha^{-1}, T_9: 75 % RDF + 10 t FYM ha^{-1}, T_{10}: 75 % RDF + 5 t VC ha^{-1}, T_{11}: 75 % RDF +10 t FYM + 20 kg $ZnSO_4$ ha^{-1}, T_{12}: 75 % RDF + 5 t VC +20 kg $ZnSO_4$ ha^{-1}, T_{13}: 125 % RDF(187.50:75:50 kg ha^{-1}), T_{14}: 125 % RDF + 20 kg $ZnSO_4$ ha^{-1},

The data with respect to test weight as influenced by various treatments have been presented in Table 1. It clearly indicates the non-significant differences on test weight that the maximum test weight (41.99 g) recorded with T_6 (100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}) was significantly superior over rest of the treatments. Test weight and no. of grain $spike^{-1}$ also increased significantly by integrating FYM and vermicompost or supplementary nutrients like, zinc with NPK. However, maximum values of yield contributing characters were recorded under combined application of 100% RDF+2.5 t VC+20 kg $ZnSO_4$ ha^{-1}, indicating that supplementing the inorganic fertilizers with FYM and vermicompost improved the general soil environment, which helped to improve the wheat growth and yield contributing characters.

The grain and straw yield were significantly influenced by different nutrient management modules. Treatment T_6 (100% RDF+2.5 t VC + 20 kg $ZnSO_4$ ha^{-1}) recorded highest grain and straw yield (50.81 and 71.07 q ha^{-1},

respectively) which were statistically at par with T_5 (100% RDF + 5 t FYM + 20 kg $ZnSO_4$ ha^{-1}), T_{11} (75 % RDF +10 t FYM + 20 kg $ZnSO_4$ ha^{-1}) and T_{12} (75 % RDF+5 t VC+20 kg $ZnSO_4$ ha^{-1}) and significantly superior over rest of the treatments. T_7 (75% RDF) was recorded lowest grain and straw yield (35.61 and 56.97 q ha^{-1}, respectively). Higher grain and straw yield in treatments T_6, T_5, T_{12} and T_{11} is might be due to the combined effect of availability of various nutrients to the plant at proper growth stages through the various means i.e. chemical (macro and micro nutrients) and organic sources (FYM and vermicompost). Treatment T_6 showed highest yield which might be due to the balanced use of essential macro and micro nutrients through inorganic and organic sources. Patil and Bhilare (2000), Davari *et al.*, (2012) and Kausik and Ray (2008) reported similar results in conformity with the results of present study.

On the basis of results summarized above, it may be calculated that the treatment module of T_6-100% RDF +2.5 t VC + 20 kg $ZnSO_4$ ha^{-1} resulted highest growth, yield attributes and yield of wheat.

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