JOURNAL OF PURE AND APPLIED MICROBIOLOGY, June 2016. Vol. **10**(2), p. 1619-1622

Growth, Yield and Quality of Wheat (*Triticum aestivum* L.) as Influenced by Integrated Nutrient Management

R.N. Maurya[1], Shiv Bahadur[2]*, Mani Ram[1], R.A. Yadav[1], Lala Ram[2] and Arvind Kumar[2]

[1]Department of Agronomy, N. D. University of Agriculture & Technology, Kumarganj, Faizabad, Uttar Pradesh - 224 229, India.
[2]Department of Agronomy, Institute of Agricultural Sciences, B.H.U., Varanasi, Uttar Pradesh - 221 005, India.

(Received: 28 January 2016; accepted: 06 March 2016)

A field experiment was conducted during winter (*rabi)* season of 2013-14 at Agronomy Research Farm of N. D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) to study the "Effect of integrated nutrient management on the growth, yield and quality of wheat (*Triticum aestivum* L.)". Treatments consist of 12 levels of fertility were evaluated in a randomized block design. The plant height, dry matter accumulation, no. of effective tillers m^{-2} and grain yields were significantly higher under incorporation of 125% recommended dose of fertilizer + 25% N through vermicompost, however, test weight, nitrogen and protein content were shows no significant differences.

Keywords: INM, FYM, Bio-compost, Growth Yield.

Wheat is the most important staple food of the world. India is one of the principal wheat producing and consuming countries in the world. Its importance in Indian agriculture is second after rice. It has significantly contributed in the success of the green revolution and has greatly helped to transform to our country from a situation of ship to mouth to being self-sufficient. It contains 9-10 % protein and 60-80 % carbohydrates, so it is good supplement for nutritional requirement of human body (Sharma and Jain 2014). About 55% of the world population depends on wheat for intake about 20% of food calories. Globally, wheat is being grown in 122 countries and occupies area of 215.61 million ha and production nearly 696.64 million tonnes. In India, total area under wheat is 29.65 million ha with the total production of 92.46 million tonnes with productivity 3.12 tonnes ha^{-1}. It contributes about 34 % of the total food grain production of the country. Wheat is the most important in Indian diet and source of protein and calories for huge population of about 1.3 billion (Singh *et al*. 2015 and Kumar *et al*. 2015). With the introduction of high yielding dwarf varieties coupled with increased use of chemical fertilizers, micronutrient deficiency problem in soil increased tremendously. The integrated nutrient supply including the use of chemical fertilizers, organic manures like FYM along with bio-fertilizers helps not only in bridging the existing gap between the nutrient removal and addition but also in ensuring balanced nutrient proportion as well as boost the productivity of wheat. Organic matter is the substrate for a large number of soil living beneficial organisms which are essential to keep the plant healthy (Kumar *et al*. 2015).

* To whom all correspondence should be addressed.
E-mail: rbsbmaurya@gmail.com

MATERIALS AND METHODS

The field experiment was carried out during the winter season of 2013-14 at Agronomy Research Farm of N. D. University of Agriculture

& Technology, Kumarganj, Faizabad, Uttar Pradesh. Geographically experimental site is situated at 26^0 47' N latitude and 82^0 12 'E longitude at an elevation of about 113 meters above mean sea level in Indo-gangetic regions of eastern Uttar Pradesh. The experimental site was fairly uniform in topography and well drained. It has sub-tropical type of climate with hot summer and cold winter. The total rainfall in the study area during the crop growing season (5th November to 1st April) was recorded 155.4 mm. besides the crop was irrigated four times, coinciding with the critical stages of the plant growth. The average weekly maximum and minimum temperatures during the crop growing period ranged from 35.8 ^{0}C to 15.50^{0}C and 15.7^{0}C to 5.9^{0}C respectively. The relative humidity ranged between 49.8% to 87.9%, wind speed between 1.7 to 4.4 km hours^{-1} average evaporation was 1.2 to 6.4 mm day^{-1} and bright sunshine between 0.4 to 8.1 hours day^{-1}. The soil was silt loam in texture with 7.9 pH and available nitrogen (180.4 kg ha^{-1}), phosphorus (18.4 kg ha^{-1}) and potassium (290 kg ha^{-1}). The experiment consisted of 12 treatments *viz.* T_1 (75% RDF), T_2 (100% RDF), T_3 (125% RDF), T_4 (75% RDF + 25% FYM), T_5 (75% RDF + 25% bio-compost), T_6 (75% RDF+25% vermicompost), T_7 (100% RDF+ 25% FYM), T_8 (100%+ 25% bio-compost), T_9 (100% RDF+25% vermicompost), T_{10} (125% RDF+25% FYM), T_{11} (125% RDF+ 25% bio-compost) and T_{12} (125% RDF+25% vermicompost). The inorganic manures singly and in combinations were applied uniformly as per treatment and incorporated into the soil three week before sowing. Full dose of phosphorus and potassium and half dose of nitrogen were given just before sowing and remaining half dose as top dress at 30 days after sowing through urea full dose in the treatment having RDF. The irrigation was given at 21 days interval. All other operations were performed as per recommendation for the crop. The row spacing was 20 cm. The data on various growth stages, seed yield and quality attributes were recorded in different treatments.

RESULTS AND DISCUSSION

Growth attributes

Plant height and dry matter accumulation under different treatments have been presented in Table 1. The plant height and dry matter accumulation at all growth stages was significantly influenced by different treatments except at 30 DAS. 125% RDF+25% vermicompost (T_{12}) produced the highest plant height and dry matter production and it was at par with to application of 100% RDF (T_2), 125% RDF (T_3), 100% RDF+25% FYM (T_7), 100%+25% bio-compost (T_8), 100% RDF+25% vermicompost (T_9), 125% RDF+25% FYM (T_{10}) and 125% RDF+ 25% bio-compost (T_{11}). The greater availability of nutrients in soil due to increasing application might have enhanced multiplication and elongation of cells leading to increased plant height and dry matter production. Significantly improvement in chlorophyll content in leaves might have resulted in better interception and utilization of solar energy leading to higher photosynthetic rate and finally more accumulation of dry matter by the crop. These results are in line with the (Sharma and Jain, 2014, Shekhar *et al*. 1992 and Bhagwati *et al.* 1992).

Number of effective tillers

Table 2 shows the treatment 125% RDF+25% vermicompost (T_{12}) registered highest number of effective tillers which was significantly superior over others, however, application of 100% RDF (T_2), 125% RDF (T_3), 100% RDF+ 25% FYM (T_7), 100%+ 25% bio-compost (T_8), 100% RDF+25% vermicompost (T_9), 125% RDF+25% FYM (T_{10}) and 125% RDF+ 25% bio-compost (T_{11}). It is well known that adequate fertilization to crop improves various physiological and metabolic processes in the plant system. Under the present investigation, profound influence of increasing levels of fertility up to 125% RDF on crop growth seem to be due to maintaining nutritional environment of plant system on account of their greater availability from soil media might have enhanced meristmatic activity leading to increased number of effective tillers. The improvement in this yield attributes with fertility levels are in closely supported with the findings of (Sharma and Jain, 2014 and Upadhyay and Tiwari, 1996).

Test weight

Among the treatments, 1000 grain weight was not statistically different Table 2. The present finding is in conformity with the earlier results reported by (Patel *et al.* 1995). Who reported that 1000 grain weight is a genetic trait widely used in yield estimation in wheat, and environmental factors have minimum influence on it. Table 2

revealed that treatment 125% RDF+25% vermicompost (T_{12}) registered significantly highest grain yield (36.8 q ha^{-1}), however, it was found at par with the application of 100% RDF+ 25% FYM (T_7), 100%+25% bio-compost (T_8), 100% RDF+25% vermicompost (T_9), 125% RDF+25% FYM (T_{10}) and 125% RDF+25% bio-compost (T_{11}). The minimum grain yield was observed under 75% RDF (T_1) (24.1q ha^{-1}). Yield of crop at various nitrogen levels can be attributed to produce the dry matter and it's partitioning to economically important plant parts like ear. The capacity of plant to produce dry matter depends not only upon the size of photosynthetic system, but also depends upon efficiency and length of time for which it remains active. The grain yield significantly increased only up to 125% RDF + 25% Vermicompost (T_{12}). This might be due to more ear length, number of grains ear^{-1}, grain weight

Table 1. Growth attributes of wheat as influenced by integrated nutrient management

Treatments	Plant height (cm)				Dry matter accumulation (g m^{-2})			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
T_1- 75%RDF	21.9	41.2	66.7	78.0	97.9	297.5	501.5	620.5
T_2- 100%RDF	22.2	48.9	79.3	92.7	111.1	353.5	595.9	737.3
T_3- 125%RDF	22.3	50.9	82.4	96.3	115.5	367.5	619.5	766.5
T_4- 75%RDF+25%FYM	22.7	43.7	70.7	82.6	99.0	315.0	531.0	657.0
T_5- 75%RDF+25%Bio-compost	23.0	44.6	72.2	84.4	101.2	322.0	542.8	671.6
T_6- 75%RDF+25%Vermicompost	23.1	45.1	73.0	85.3	102.3	325.5	548.7	678.9
T_7- 100%RDF+25%FYM	23.2	46.9	80.9	94.5	112.8	360.5	607.7	751.9
T_8- 100%RDF+25%Bio-compost	23.4	50.4	81.6	95.4	113.9	364	613.6	759.2
T_9- 100%RDF+25%Vermicompost	23.5	50.9	82.4	96.3	114.4	367.5	619.5	766.5
T_{10}- 125%RDF+25%FYM	23.6	51.4	83.2	97.3	116.6	371.0	625.4	773.8
T_{11}- 125%RDF+25%Bio-compost	23.8	51.9	83.9	98.2	117.2	374.5	631.3	781.1
T_{12}- 125%RDF+25%Vermicompost	23.9	52.7	85.6	100.0	118.3	381.5	643.1	795.0
SEm±	0.17	1.98	3.54	4.52	5.40	15.90	29.90	33.90
C.D.at 5%	NS	5.79	10.37	13.25	NS	46.50	87.70	99.40

Table 2. Yield attributes, yield, N and protein content of wheat as influenced by integrated nutrient management

Treatments	Yield attributes		Grain yield q ha^{-1}	N content (%)		Protein content (%)	
	Effective tillers m^{-2}	Test wt. (g)		Grain	Straw	Grain	Straw
T_1- 75%RDF	321.5	33.5	24.10	1.65	0.43	10.31	2.69
T_2- 100%RDF	382.0	35.4	27.55	1.80	0.47	11.25	2.94
T_3- 125%RDF	397.2	35.6	29.20	1.85	0.49	11.56	3.06
T_4- 75%RDF+25%FYM	340.4	33.6	25.75	1.75	0.46	10.93	2.88
T_5- 75%RDF+25%Bio-compost	348.0	33.8	26.40	1.76	0.46	11.00	2.88
T_6- 75%RDF+25%Vermicompost	351.8	34.0	26.75	1.77	0.47	11.06	2.94
T_7- 100%RDF+25%FYM	389.6	35.8	34.45	1.81	0.48	11.31	3.00
T_8- 100%RDF+25%Bio-compost	393.4	35.9	35.85	1.82	0.48	11.34	3.00
T_9- 100%RDF+25%Vermicompost	397.2	35.9	36.45	1.82	0.48	11.38	3.00
T_{10}- 125%RDF+25%FYM	401.0	36.0	34.80	1.87	0.49	11.69	3.06
T_{11}- 125%RDF+25%Bio-compost	404.7	36.1	36.10	1.88	0.49	11.72	3.06
T_{12}- 125%RDF+25%Vermicompost	412.2	36.2	36.80	1.88	0.50	11.75	3.13
SEm±	16.23	1.76	0.82	0.03	0.01	0.21	0.16
C.D.at 5%	47.61	NS	2.39	NS	NS	NS	NS

ear^{-1} and 1000 grain weight. Similar findings were reported by (Khaddar *et al.* 2004).

Nitrogen and protein content

The effect of different integrated nutrient management practices on nitrogen and protein content in grain and straw are presented in Table 2. No significant differences were observed in quality of wheat. The maximum Nitrogen and protein content was recorded under application of 125% RDF+25% vermicompost (T_{12}) however, minimum was recorded under 75% RDF (T_1).

REFERENCES

1. Bhagwati, P.C., Faroda, A.S., Malik, R.K. Response of wheat and associated weeds to application of nitrogen and isoproturon. *Ind. J. Agron.*, 1992; **37**(4): 721-728.
2. Khaddar, S.J., Chaudhary, V.K., Phadnish, S.K., Nagar, S.R. Effect of organic and chemical fertilizer on growth, yield attribute and yield soybean-wheat cropping sequence. *Res. on crops*, 2004; **5**(1): 22-30.
3. Kumar, A., Kumar, An., Dwivedi, A., Dhyani, B.P., Shahi, U.P., Sengar, R.S., Singh, A., Tomar, S.S. Production potential, nutrient uptake and factor productivity of scented rice in rice-wheat cropping system along with physico-chemical and microbiological properties under site specific integrated plant nutrient management. *J Pure & App. Micro.*, 2015; **9**(2): 1487-1497.
4. Kumar, S.A., Bhagavan, B.V.K., Vani, V.S., Reddy, A.R., Nagalakshmi, R. Effect of integrated nutrient management on yield and quality of Elephant Yam var Gajendra. *Environ. & ecology*, 2015; **33**(2): 645-648.
5. Patel, N.M., Sadaria, S.G., Keneria, B.B., Khanpara, V.D. Effect of nitrogen, potassium and zinc on growth and yield of wheat. *Ind. J. Agron.*, 1995; **40**(2): 290-292.
6. Sharma, S.K., Jain, N.K. Nutritional management in wheat-based cropping system in sub humid southern zone of Rajasthan. *Ind. J. Agron*., 2014; **59**(1): 26-33.
7. Shekhar, C., Varshney, M.L., Singh, J., Singh, S.K. Response of wheat varieties to different levels of nitrogen. *Narendra deva J. Agri. Res.*, 1992; **7**(1): 169-171.
8. Singh, V., Ali, J., Seema, Kumar, A., Chauhan, T.M. Productivity, nutrient uptake and economics of wheat under potassium and zinc nutrition. *Ind. J. Agron*., 2015; **60**(3): 426-430.
9. Upadhyay, V.B., Tiwari, J.P. Influence of nitrogen, seed rate and mulch on wheat (*Triticum aestivum* L.*)* varieties under late-sown conditions. *Ind. J. Agron.*, 1996; **41**(4): 562-565.