Ann. Agric. Res. New Series Vol. 39 (1) : 8-11 (2018)

Economic utilization of organic and inorganic sources of nutrient and their response to yield and yield attributes of wheat (*Triticum aestivum* L.)

Kuldeep Singh, Rabish Datt Shukla*, Rahul Kumar Mishra and Vishram Singh

Department of Agronomy, C.S.A. University of Agriculture & Technology., Kanpur -208002 (U.P.)
e-mail: gargwanshirabish@gmail.com

Received : August 2017 ; Revised Accepted: January 2018

Abstract

Field study conducted at Students Instructional Farm (S.I.F.) of C.S. Azad University of Agriculture and Technology, Kanpur during *Rabi* 2015-16 to know the suitable combinations of these sources. Results showed that application of RDF+ Azotobacter + Vermicompost @ 5.0 t ha^{-1} produced significantly better yield contributing characters like total tillers per m^2 (490.29), productive tillers per m^2 (271.24), unproductive tillers m^2 (219.05), length of spike (9.67 cm), number of grain per spike (45.79), grain weight spike (2.45 g), and 1000 seeds weight (43.93g) besides producing highest grain yield (5557 kg ha^{-1}) and net return (Rs. 67094 ha^{-1}) in comparison to control and all other treatments.

Key words: Azotobacter, FYM, grain yield, RDF, vermi compost, wheat.

Wheat (*Triticum aestivum* L.) requires a huge amount of NPK and other nutrients for higher production and productivity. The combined application of organic and inorganic sources of nutrients is necessary to maintain health and ecosystem renvices of soil, and sustain crop yield (Dass *et al.*, 2013). The balanced application of fertilizer nutrients and combined use of manure and inorganic fertilizers enhances the grain quality of wheat over alone application of inorganic NPK fertilizers. Besides the positive effect of organic manure on soil structure lead to better root development that result in more nutrient uptake, compost not only releases nutrients slowly but also prevents the losses of nutrients from chemical fertilizers through denitrification and volatilization (Dass *et al.* 2008, Abedi *et al.,* 2010). While integrated use of organic wastes and chemical fertilizers is beneficial in improving crop yield, soil pH, organic carbon and available N, P and K in soil (Rautaray *et al.*, 2003). The basic objective of the combined nutrient supply and management is to supply balanced nutrients to crops that maintains the soil fertility and soil health for sustained crop productivity on a long-term basis, as plant nutrient source differ markedly in their nutrient contents, release efficiency or fixation, positional availability, crop specificity, farmers acceptability *etc.* Bio-fertilizers are inputs containing microorganisms which are capable of mobilizing nutritive elements from complex and non-usable form to simple and usable form through biological processes (Cakmakc *et al.*, 2007). The number of productive tillers, dry-matter and grain yield occurs in response to application of Azotobacter bio-inoculant (Shaharoona *et al.*, 2006; Yasari and Patwardhan, 2007). Azotobacter inoculation has

**Correspondence address :*
[1] *Department of Agronomy, IFTM University, Moradabad - 244 102. skd5799@gmail.com*
[2] *gargwanshirabish@gmail.com*
[3] *rahulm1792@gmail.com*
[4] *singhvishramcsau@gmail.com*

been earlier reported to influence seed germination, seedling growth, and increase in yield of cereals upto 30% (Gholami *et al.*, 2009). The present investigation is focused towards studying the effect of combined application of nutrient sources on wheat yield and economics.

Materials and Methods

The experiment was conducted at Students Instructional Farm Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during *Rabi* season of 2015-16. The experimental field comes under subtropical climate, located between from 25° 56' to 28° 58' North latitude and 79° 31' to 80° 34' East longitude and is located on an elevation of about 125.9 meters above mean sea level with the average rainfall during crop season was 816 mm. Soil of the experimental field was alluvial in origin having sandy loam texture, low in nitrogen (173 kg ha^{-1}), medium in phosphorus (16.8 kg ha^{-1}) and potassium (160 kg ha^{-1}) having a normal pH (7.3), and EC of (0.26 dSm^{-1}). The experiment was laid-out in a Randomized Block Design comprised of eight treatments, replicated three times. The RDF having 120:60:40 kg NPK ha^{-1}, vermicompost (3, 4 and 5 t ha^{-1}), FYM (4, 8 and 12 t ha^{-1}) and Azotobacter have applied as per the treatment. The treatments were T_1 (RDF - Control), T_2 (RDF + Azotobacter), T_3 (RDF + Azotobacter + Vermicompost @ 3.0 t ha^{-1}), T_4 (RDF + Azotobacter + Vermicompost @ 4.0 t ha^{-1}), T_5 (RDF + Azotobacter + Vermicompost @ 5.0 t ha^{-1}), T_6 (RDF + Azotobacter + FYM @ 4 tha^{-1}), T_7 (RDF +Azotobacter + FYM @ 8 t ha^{-1}), T_8 (RDF + Azotobacter + FYM @ 12 t ha^{-1}). Azotobacter was inoculated @ 200 g for 10 kg wheat seed by making the pest with the help of 500 ml water and 50g jaggery. The popular variety of wheat 'PBW-343' was sown on 30th November, 2015 during the *rabi* season at a row spacing of 22.5 cm and 4 cm deep in furrows made by country plough. The observations on yield and grain yield (kg ha^{-1}) were recorded at harvest of wheat crop. The cost of cultivation (Rs. ha^{-1}), gross returns (Rs. ha^{-1}) and net returns (Rs. ha^{-1}), and B: C ratio was also computed to work out the economics of the treatments using existing cost of cultivation during the crop season. The statistical analysis done as per standard method suggested by Fisher and Yates (1957).

Results and Discussion

Among the different combinations of various organic and inorganic sources of nutrients application of RDF (120:60:40 kg NPK ha^{-1}) in combination with Azotobactor and vermicompost @ 5 t ha^{-1} (T_5) recorded significantly superior tillers per m^2 (490.29), productive tillers per m^2 (271.24), spike length (9.67), grain per spike (45.79), grain weight per spike (2.45) and test weight (43.93) followed by T_4 (RDF + Azotobacter + Vermicompost @ 4.0 t ha^{-1}) over other integrated treatments. The higher yield attributes could be due to integration of different organic and inorganic sources of nutrients.

Table 1. Number of tillers, spike length, number of grain ($spike^{-1}$) grain weight ($spike^{-1}$) and test weight as influenced by different combinations of various organic and inorganic sources of nutrients.

Treatments	Tillers (m^2)			Sspike length (cm)	Grain ($spike^{-1}$)	Grain weight (g $spike^{-1}$)	1000-grain weight (g)
	Total	Productive	Unproductive				
T_1	355.1	190.5	164.6	7.4	42.6	1.4	40.5
T_2	372.3	212.5	159.8	7.9	43.4	1.6	40.7
T_3	411.5	245.2	175.0	8.7	44.7	2.0	42.6
T_4	458.4	256.2	202.2	9.1	45.4	2.3	43.4
T_5	490.3	271.2	219.1	9.7	45.8	2.5	43.9
T_6	393.9	219.0	166.2	8.1	43.6	1.7	41.8
T_7	403.0	230.2	172.9	8.5	43.9	1.8	42.1
T_8	441.7	252.2	189.5	8.7	45.2	2.0	43.1
SE±(d)	32.67	1.71	32.99	0.72	0.80	0.56	0.59
CD (P=0.05%)	70.75	3.71	NS	1.35	1.75	0.26	1.25

Table 2. Yield, harvest index and economics as influenced by different combinations of various organic and inorganic sources of nutrients.

Treatments	Yield (kg ha^{-1})			HI	Economics (Rs. ha^{-1})			
	Grain	Straw	Biological		Cost of cultivation	Gross returns	Net returns	B:C ratio
T_1	3861	5057	8918	43.29	37951	77546	39595	1.04
T_2	4139	5380	9519	43.48	38151	82985	44834	1.17
T_3	4910	6333	11243	43.67	41312	98270	56958	1.37
T_4	5211	6565	11776	44.25	42312	103748	61436	1.45
T_5	5557	6935	12492	44.48	43312	110406	67094	1.54
T_6	4357	5576	9933	43.86	39812	87049	47237	1.18
T_7	4720	5994	10713	44.05	42312	94139	51827	1.22
T_8	5083	6417	11500	44.20	44312	101246	56934	1.28
SE±(d)	443.26	702.41	345.14	2.42	-	2708	1248	0.02
CD (P=0.05%)	205.36	324.22	159.35	N / S	-	5866	2703	0.05

Effect on yield and harvest index

The results revealed that the utilization of various organic and inorganic sources of nutrients enhances not only the yield of wheat crop but also harvest index. A significant difference in grain yield (5557 kg ha^{-1}), biological yield (12492 kg ha^{-1}), straw yield (6935 kg ha^{-1}) and harvest index (44.48) were recorded with RDF (120:60:40 kg ha^{-1} NPK) in combination with Azotobactor and Vermicompost @ 5 t ha^{-1} (T_5) over the treatment but it was at par with T_4 (RDF + Azotobacter + Vermicompost @ 4.0 t ha^{-1}). The findings indicate that combined use of organic and inorganic sources of nutrients enhances the duration of nutrient availability because of slow decomposition rate of organic materials and also improves soil health leading to higher crop growth and yield (Dass *et al*. 2008). Similar finding was collaborated with the result of Gill and Rathore (2004), Pandey *et al.* (2009) and Polara *et al.* (2010).

Effect on economics

The data collected from the various treatments showed significant difference among all and the highest gross returns (Rs. 110406), net returns (Rs. 67094) and B: C ratio (1.54) recorded when fertilized with RDF (120:60:40 kg ha^{-1} NPK) in integration with Azotobactor and Vermicompost @ 5 t ha^{-1} (T_5) followed by T_4 (RDF + Azotobacter + Vermicompost @ 4.0 t ha^{-1}) and remaining other treatments, While highest cost of cultivation (Rs. 44312) was recorded from T_8 (RDF + Azotobacter + FYM @ 12.0 t ha^{-1}). Above finding indicate that utilization of organic sources of nutrient in supplement with inorganic nutrient sources had a least impact in improving the costs of cultivation and enhances the net return significantly. Similar results were elaborated by Rather and Sharma (2009).

Conclusion

The combined utilization of organic and inorganic sources of nutrients was found to be economical and enhances the total grain yield along with sustainable improvement of soil health. The adoption of RDF + Azotobacter + Vermicompost @ 5.0 t ha^{-1} helps to increasing yield besides enhancing income of the farmers.

References

Abedi T., Alemzadeh A. and Kazemeini S.A. 2010. Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. *Austrailian Journal of crop science,* **4**(6): 384-389.

Cakmakc, R., Donmez M.F. and Erdogan U. 2007. The effect of plant growth promoting rhizobacteria on barley seedling growth, nutrient uptake, some soil properties, and bacterial counts. *Turk. J. Agri. Forest.,* **31**: 189-199.

Dass, A., Lenka, N.K. Patnaik, U.S. and Sudhishri, S. 2008. Influence of integrated nutrient management on production, economics and soil properties in tomato under on-farm conditions in eastern ghats of Orissa. *Indian Journal Agricultural Sciences*, **78**(1): 40-43.

Dass, A., Sudhishri, S. and Lenka, N.K. 2013. Integrated nutrient management to improve fingermillet productivity and soil conditions in hilly region of eastern India. *Journal of Crop Improvement*, **57**(5): 528-546.

Fisher R. and Yate F. 1957. Statistical Tables for Biological Agricultural and Medical Research. Edinburgh: Oliver and Boyd.

Gholami A., Shahsavani S. and Nezarat S. 2009.The effect of plant growth promoting rhizobacteria (PGPR) on germination, seedling growth and yield of maize. *Int. J. Biol. Life Sci.*, **1**: 35-40.

Gill R. and Rathore M.S. 2004. Nutrient management for maximizing crop yield of wheat. *Eco. Physiology*, **7**(1-2): 77-88.

Pandey, I.B., Diwedi, D.K. and Pandey R.K. 2009. Integrated nutrient management for sustaining wheat *(Triticum aestivum)* production under late sown condition. *Indian Journal of Agronomy*, **54**(3): 306-309.

Polara K.B., Sardhana R.V., Pormar K.B., Babariya N.B. and Patel K.G. 2010). Given K uptake to produce grain and straw yield significantly. *Asian Journal of Soil Science*, **4**(2): 228-235.

Rather S.A. and Sharma N.L. 2009. The effect of integrated use of vermicompost, bio fertilizer and inorganic fertilizers (NPK and Zn) on yield and nutrient and their uptake by wheat. *International J. of Agri. Science*, **5**(2): 371-373.

Rautaray S.K., Ghosh B.C. and Mittra B.N. 2003. Effect of fly ash, organic wastes and chemical fertilizers on yield, nutrient uptake, heavy metal content and residual fertility in a rice-mustard cropping sequence under acid lateritic soils. *Biores. Tech*, **90**: 275-283.

Shaharoona, B., Arshad M., Zahir Z.A. and Khalid A. 2006. Performance of Pseudomonas spp. containing ACC-deaminase for improving growth and yield of maize (*Zea mays* L.) in the presence of nitrogenous fertilizer. *Soil Biol. Biochem.*, **38**: 2971-2975.

Yasari E. and Patwardhan A.M. 2007. Effects of Aztobacter and Azospirillium inoculations and chemical fertilizers on growth and productivity of Canola. *Asian J. Plant. Sci.*, **6**: 77-82.