International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(1): 968-971

Received: 05-11-2018
Accepted: 08-12-2018

Kuldeep Singh
Department of Agronomy,
C.S.A. University of Agriculture & Technology., Kanpur,
Uttar Pradesh, India

Akanksha Singh
Department of Microbiology,
DDU University Gorakhpur,
Uttar Pradesh, India

Shubham Singh Rana
Department of Agronomy,
C.S.A.U.A&T Kanpur,
Uttar Pradesh, India

Correspondence
Kuldeep Singh
Department of Agronomy,
C.S.A. University of Agriculture & Technology., Kanpur,
Uttar Pradesh, India

Effect of treatments on yield attributes of irrigated wheat (*Triticum aestivum* L.)

Kuldeep Singh, Akanksha Singh and Shubham Singh Rana

Abstract
The field experiment was conducted during *Rabi* season of 2015-2016 to observe the effect of Vermicompost, FYM, Azotobacter and inorganic fertilizers on yield of wheat (*Triticum aestivum* L.). The 8 treatments were tested in Randomized Block Design with three replication (T_1 RDF 120:60:40 Kg NPK), T_2 RDF + Azotobacter, T_3 RDF+Azotobacter+ Vermicompost @ 3.0 t/ha, T_4 RDF +Azotobacter+ Vermicompost @ 4.0 t/ha, T_5 RDF +Azotobacter+ Vermicompost @ 5 t/ha, T_6 RDF +Azotobacter+ FYM @ 4.0 t/ha, T_7 RDF + Azotobacter+FYM @ 8.0 t/ha, T_8 RDF +Azotobacter+ FYM @ 12.0 t/ha) The soil of field was sandy loam The pH of soil was 7.30. The wheat variety PBW-343 was sown on 30 of Nov. 2015 at row spacing 20 cm with seed rate of 100 kg/ha. Full dose of phosphorus and potash was applied as basal doses at the time of sowing and the nitrogen was applied as per treatment. The source of nitrogen, phosphorus and potash was organic and inorganic fertilizers respectively. Result showed that the treatment T_5 gave the significantly better growth of plant yield contributing characters. The treatment T_5 recorded the highest grain yield (55.57 q/ha). The minimum grain yield (38.61 q/ha) was recorded under the treatment T_1 (RDF 120:60:40 NPK kg/ha).

Keywords: Yield, wheat, FYM, nitrogen, vermicompost

1. Introduction

Bread wheat (*Triticum aestivum* L.) is one of the most important cereal crops in the world in terms of area coverage and production. It is a major source of nutrition for humans and livestock, estimated to contribute as much as 60 million tonnes of protein per year (Shewry, 2009) [16]. The total worldwide production of wheat in 2012 was around 671 million tonnes on an area of 215 million ha (FAOSTA, 2014) [5]. Data aggregated at a worldwide level over several decades have shown a strong link between agriculture production and fertilizer use (Tilman *et.al* 2002) [18]. Out of the nutrients, nitrogen (N) is frequently regarded as the single most important mineral nutrient limiting crop production in many agricultural crops worldwide, and it is needed in large amount, as it constitutes 1–4% of the plant dry matter (Good *et al*. 2004) [7]. The major wheat producing states of India are U.P. Punjab, M.P. with production of (30.05, 16.5, 14 mt) and the U.P. ranked first in percentage share of wheat production (31.6%) with the second (17.4%) Punjab and third of Madhya Pradesh (14.7%), (Economic survey of India 2015-2016). In Uttar Pradesh, the productivity of wheat is low which needs improvements. One of the main causes of low productivity of wheat in U.P. is its delayed sowing of sizeable area after harvesting of toria. Sometime sown varieties give high production like PBW-343, PBW-435, and Raj-3077 any one of them can be grown under timely sown in U.P. for obtaining maximum yield.

The low mean national yield of wheat is mainly the result of depleted soil fertility, especially nitrogen (N) deficiency, which is often encountered in cool wet areas or in soils that are frequently water logged such as the highland *Vertisols*. Therefore, greater usage of chemical fertilizer has been advocated as a primary means of increasing wheat grain yield in Uttar Pradesh. Although Nitrogen, phosphorus, and potassium is the key element in increasing productivity and the increase of agricultural food production worldwide over the past four decades, a small fraction of this fertilizer is taken up by the plant (Carranca 2012) [4] being 33% for wheat (Raun *et al.* 1999) [15] and FYM and vermicompost are the rich mixture of these elements. Biofertilizers are recognized as important component of sustainable agriculture. These biofertilizers are used to inoculate cereal crop for increasing the growth, yield attributes and yield (Biswas *et.al.* 1985) [1] Thus, keeping in view the above stated fact, the present investigation was carried out to find out the response of different combinations of organic and inorganic fertilizers on wheat crop.

2. Methodology
2.1 The study site
The experiment was conducted in field No. 7/5 at Students Instructional Farm (SIF) at C. S. Azad University of Agriculture and technology, Kanpur (U.P.) during *rabi* season of 2015-16. The experimental farm falls under the Indo-Gangetic alluvial tract and irrigated by tube well. Figure 1 shows monthly total rainfall and monthly mean temperatures at the experimental site over the study period. Prior to planting, the soil of the experimental field was alluvial in origin. Surface soil sample (15 cm) depth were initially drawn from randomly selected part of the field before sowing and after harvesting of the crop with the help of soil augur and the composite sample was obtained by mixing them thoroughly. The quantity of soil sample was reduced to about one kg through quartering technique.Values for the selected physicochemical properties are presented in Table 1.

Table 1: Physico-chemical properties of experimental field

S. No.	Soil Properties	Values	Method of determination	Reference
(A)	**Mechanical Analysis**			
1	Coarse sand **Table** (%)	0.72	International Pipette Method	Piper 1950
2	Fine sand (%)	54.80	International Pipette Method	Piper 1950
3	Silt (%)	22.50		
4	Clay (%)	22.80	International Pipette method	Piper 1950
5	Texture class	Sandy loam	USDA, Triangle	Soil survey staff 1975
(B)	**Physical Analysis**			
1	Bulk density (g cm^{-3})	1.357	Core Cutter Sampler Method	USDA Handbook (LA Richards 1954)
(C)	**Chemical Analysis**			
1	Organic Carbon (%)	0.46	Walkley and Black Rapid Titration Method	Walkley and Black (1934)
2	Available N (kg ha^{-1})	173.0	Alkaline Potassium Per magnate Method	Subbiah and Asija (1973)
3	Available P_2O_5 (kg ha^{-1})	16.8	Olsen's Method	Olsen *et al.* 1954
4	Available K_2O (kg ha^{-1})	164.0	Flame Photometer Method	Jackson (1967)
5	pH	7.3	Electronic Glass Electrode Method	Piper 1950
6	EC (dsm^{-1})	0.26	Electrical Conductivity bridge method	Jackson (1967)
7	Zn (kg-ha-^{1})	1.1	Extracted by DTPA & Analysed on AAS	

2.2 Description of the study materials
Treatment sources is shown in Table 2 given below

Table 2: Experimental Treatment Combination with symbols

S. No.	Treatment Combination	Symbol
1	RDF (120:60:40 NPK Kg/ha)	T_1
2	RDF+Azotobacter	T_2
3	RDF+Azotobacter + Vermicompost @ 3.0 t/ha	T_3
4	RDF+Azotobacter + Vermicompost @ 4.0 t/ha	T_4
5	RDF+Azotobacter+ Vermicompost @ 5.0 t/ha	T_5
6	RDF +Azotobacter + FYM @ 4 t/ha	T_6
7	RDF +Azotobacter + FYM @ 8 t/ha	T_7
8	RDF + Azotobacter + FYM @ 12 t/ha	T_8

*RDF – Recommended Dose of Fertilizer, RDF – N:P:K @ 120:60:40 kg- ha^{-1}

2.3 Crop variety under study
PBW-343: It is widely adaptable and having high yielding potential variety used under investigation. It is double-gene dwarf variety developed from PAU Ludhiana (Punjab) during 1994-95 which is most suited to normal sown condition, fertilizers, irrigation, lodging resistant and mature in about 120-122 days after sowing. It is resistant to important pest and disease of wheat. The yield potentiality of this variety is about 55-60 q ha^{-1}.

2.4 Treatments and experimental design
The treatments consisted of complete factorial combinations FYM applied 20 days before sowing for getting good result. It was applied @ 4, 8 & 12 t/ha, respectively and whole quantity of FYM applied before sowing of crop, Vermicompost applied 20 days before sowing for getting good result. It was applied in two doses @ 3, 4 and 5t/ha, respectively and Half amount of Nitrogen together with full amount of Phosphorus, Potash and were applied as basal at the time of sowing in the form of Urea, DAP and MOP, respectively. Remaining half dose of nitrogen was top dressed into two split doses at 32 and 56 days after sowing (DAS).

Table 3: Chemical composition of FYM, Vermicompost and inorganic fertilizers

S. No.	Nutrient applied	Source	Nutrient
1.	Nitrogen	Urea	46% N
2.	Phosphorus	DAP	18% N and 46% P_2O_5
3.	Potash	MOP	60% K_2O
4.	Organic manure	FYM	0.5% N, 0.2% P and 0.5% K
5.	Organic manure	Vermicompost	1.7% N, 0.8% P and 1.10%K
6.	Biofertilizer	Azotobacter	N Fix.(30-40 kg /ha)

2.5 Data collection and measurements
In order to secure the effect of different treatments the following observation such as number of grains per spike, grains weight per spike, test weight, biological yield, grain yield, straw yield and harvest index etc. recorded treatment wise.

2.5.1 Yield attributes studies
2.5.1.1 Grain Yield
The grain yield obtained after threshing of crop produce of each net plot and was recorded in kilogram per plot and later on converted into quintal per hectare.

2.5.1.2 Straw Yield
The straw yield worked out by subtracting the grain yield from the weight of harvested material (Biological Yield) per plot in kilograms. It was further converted into quintal per hectare.

2.5.1.3 Harvest Index (HI)
The harvest index was computed with the help of formula as suggested by Singh and Staskofif (1971).

$$\text{Harvest Index} = \frac{\text{Economic yield (q/ha)}}{\text{Biological yield (q/ha)}} x100$$

3. Results and Discussion

3.1 Effect on grain yield (q/ha)

The average grain yield (q/ha) of wheat affected by use of different sources of nutrient and data are presented in Table 4 and depicted in Fig. 1**.** The perusal of data presented in Table 4 reveals that grain yield of wheat enhanced with the use of different sources of nutrient. The maximum grain yield of wheat (55.57) per hectare was recorded in RDF + Azotobacter + vermicompost @ 5.0 t/ha followed by RDF+ Azotobacter +vermicompost @ 4.0 t/ha (52.11), RDF + Azotobacter + FYM @ 12.0t/ha (50.83), RDF + Azotobacter+ vermicompost @ 3.0 t/ha (49.10), RDF + Azotobacter + FYM @ 8.0 t/ha (47.20),, RDF + Azotobacter + FYM @ 4.0 t/ha (43.57), RDF +Azotobacter (41.39), and minimum average grain yield was recorded in RDF (120: 60: 40 kg NPK/ha) with mean value (38.61).RDF +Azotobacter + vermicompost @ 5.0 t/ha was significantly superior to RDF + Azotobacter + FYM @ 12.0t/ha, RDF + Azotobacter+ vermicompost @ 3.0 t/ha, RDF + Azotobacter + FYM @ 8.0 t/ha, RDF + Azotobacter + FYM @ 4.0 t/ha, RDF +Azotobacter and RDF (120: 60: 40 NPK/ha) respectively but statistically at par with RDF+ Azotobacter +vermicompost @ 4.0 t/ha and the result is in the favor of Kaderkan *et al.*(1998), Sharma and Bhagat (2000), Yadav *et al.* (2002), Akmal *et al.*(2007), Singh *et al.*(2008) and Polara *et al.*(2010) [12].

3.2 Effect on straw yield (q/ha)

The straw yield (q/ha) of wheat affected by use of different sources of nutrient are presented in Table 4 and depicted in Fig... 1 The perusal data presented in Table 4 reveals that straw yield of wheat enhanced with the application different sources of nutrient. The maximum straw yield of wheat (69.35) per hectare was recorded in RDF +Azotobacter + vermicompost @ 5.0 t/ha followed by RDF+ Azotobacter +vermicompost @ 4.0 t/ha (65.65), RDF + Azotobacter + FYM @ 12.0t/ha (64.17), RDF + Azotobacter+ vermicompost @ 3.0 t/ha (63.33), RDF + Azotobacter + FYM @ 8.0 t/ha (59.94), RDF + Azotobacter + FYM @ 4.0 t/ha (55.76), RDF +Azotobacter (53.80), and minimum average straw yield was recorded in RDF (120: 60: 40 kg NPK/ha) with mean value (50.57).The RDF + vermicompost @ 5.0 t/ha was significantly superior to RDF + Azotobacter + FYM @ 8.0 t/ha,, RDF + Azotobacter + FYM @ 4.0 t/ha RDF +Azotobacter, and RDF (120: 60: 40 kg NPK/ha) respectively but statistically at par with RDF+ Azotobacter +vermicompost @ 4.0 t/ha. RDF + Azotobacter + FYM @ 12.0t/ha, RDF + Azotobacter+ vermicompost @ 3.0 t/ha results are related to the findings of results of Gill and Rathore (2004) [6], Pandey *et al.* (2004), Singh *et al.* (2006) [17], Tulasa and Mir (2006) [19], Gupta *et al.* (2009) [8], Pandey *et al.*(2009) [11] and Rathore and Sharma (2010).

3.3 Effect on biological yield (q/ha)

The average biological yield (q/ha) of wheat was affected by increasing different sources of nutrient and data are presented in Table 4 and depicted in Fig.1 The perusal data presented in Table 4 reveals that biological yield of wheat enhanced with the application of different sources of nutrient. The maximum biological yield of wheat (124.92) per hectare was recorded in RDF + Azotobacter + vermicompost @ 5.0 t/ha followed by RDF+ Azotobacter + vermicompost @ 4.0 t/ha (117.76), RDF + Azotobacter + FYM @ 12.0t/ha (115.00), RDF + Azotobacter + vermicompost @ 3.0 t/ha (112.43), RDF + Azotobacter + FYM @ 8.0 t/ha (107.14), RDF + Azotobacter + FYM @ 4.0 t/ha (99.33), RDF + Azotobacter (95.19) and minimum average biological yield was recorded in RDF (120: 60: 40 kg NPK/ha) with mean value (89.18). RDF + Azotobacter + vermicompost @ 5.0 t/ha was significantly superior to RDF+ Azotobacter + vermicompost @ 4.0 t/ha, RDF + Azotobacter + FYM @ 12.0t/ha, RDF + Azotobacter + vermicompost @ 3.0 t/ha, RDF + Azotobacter + FYM @ 8.0 t/ha, RDF + Azotobacter + FYM @ 4.0 t/ha RDF +Azotobacter, and RDF (120: 60: 40 kg NPK/ha) respectively and Similar finding was collaborated with the result of Kathmale *et al.* (2000) [9], Bhagat (2001) [2], Katyal *et al.* (2002) [10], Gill and Rathore (2004) [6] and Pandey *et al.* (2009) [11].

3.4 Effect on harvest index (%)

The average harvest index (%) of wheat was affected by increasing different sources of nutrients and data are presented in Table 4 and depicted in Fig.. 1 The perusal data presented in Table 4 reveals that harvest index of wheat enhanced with the increasing different sources of nutrient. The maximum harvest index was recorded in wheat (44.48) per hectare was recorded in RDF + Azotobacter + vermicompost @ 5.0 t/ha followed by RDF+ Azotobacter + vermicompost @ 4.0 t/ha (44.25), RDF+ Azotobacter + FYM @ 12.0 t/ha (44.20), RDF+ Azotobacter + FYM @ 8.0t/ha (44.05), RDF + Azotobacter + FYM @ 4.0t/ha (43.86), RDF + Azotobacter + vermicompost @ 3.0 t/ha (43.67), RDF + Azotobacter (43.48) and minimum harvest index was recorded in RDF (120: 60: 40 kg NPK/ha) with mean value (43.29).The result revealed that harvest index of wheat was not influenced significantly due to use of different sources of nutrients (organic and inorganic) combination. It means those harvest indexes were not affected by different treatments.

Table 4: Effect of treatments on biological yield, grain yield, straw yield and harvest index in wheat

Treatments	Biological yield (q ha^{-1})	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest Index (%)
T_1 RDF(12O:60:40)	89.18	38.61	50.57	43.29
T_2 RDF + Azotobacter	95.19	41.39	53.80	43.48
T_3 RDF + Azotobacter +Vermicompost@3.0t/ha	112.43	49.10	63.33	43.67
T_4 RDF + Azotobacter + Vermicompost @4.0t/ha	117.76	52.11	65.65	44.25
T_5 RDF + Azotobacter + Vermicompost @ 5.0t/ha	124.92	55.57	69.35	44.48
T_6 RDF + Azotobacter + FYM @ 4.0 t/ha	99.33	43.57	55.76	43.86
T_7 RDF + Azotobacter + FYM @ 8.0 t/ha	107.13	47.20	59.94	44.05
T_8 RDF + Azotobacter + FYM @ 12.0 t/ha	115.00	50.83	64.17	44.20
SE±(d)	3.45	4.43	7.02	N/S
C.D. (P=0.05)	1.59	2.05	3.24	2.42

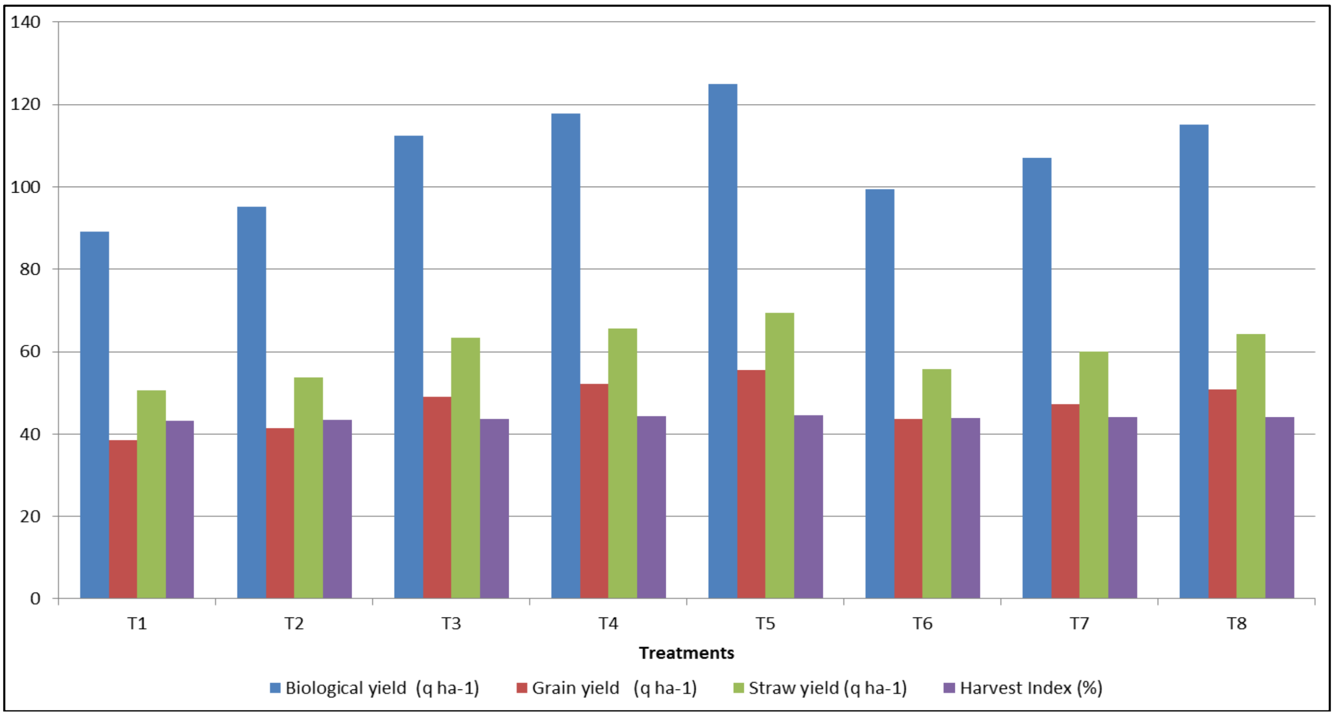

Fig 1: Effect of various treatments on yield attributes

4. Conclusion

The results of this study have demonstrated that application of an integrated nutrient management significantly yield attributes and yield of wheat crop. The superior growth, yield attributes and highest grain yield (55.57) q/ha was received in RDF + Azotobacter + vermicompost @ 5.0 t/ha application of RDF + Azotobacter + vermicompost @ 5.0 t/ha was found superior among rest of the treatment.

5. References

1. Biswas BC, Yadav DS, Satish Maheswari. Biofertilizers in Indian Agriculture. Fertilizer News. 1985; 30(10):20-28
2. Bhagat RK. Integrated nutrient management in groundnut-wheat cropping system. Journal of Research, Birsa Agriculture University. 2001; 13(2):137-139.
3. Bhakar JR, Sharma OP, Jat BC. Effect of nitrogen and FYM on yield and yield attributes of barley in a loamy sand soil. Annals of Agril. Research. S.K.N College of Agriculture, RAU, Jobner Campus - 303329, Rajasthan, India. 1997; 18(2):244-245.
4. Carranca C. Nitrogen use efficiency by annual and perennial crops. In: Lichtfouse E, editor. Farming for food and water security. Berlin: Springer, 2012, 57-82.
5. FAOSTAT. Online [Internet]. 2014 [cited 2015 Mar 6]. Available from: http:// faost at.fao.org/site/291/default.aspx.
6. Gill R, Rathore MS. Nutrient management for maximizing crop yield of wheat. Journal of Eco. Physiology. 2004; 7(1-2):77-88.
7. Good A, Shrawat K, Muench G. Reducing nutrient input into the environment compatible with maintaining crop production. Trends Plant Science. 2004; 9(12):597-605.
8. Gupta A, Gupta M, Bali AS. Effect of different nitrogen doses on durum wheat (*Triticum durum* Dest.) cultivars under the subtropical condition of Jammu. Advances on Plant Sciences. 2009; 22(2):469-470.
9. Kathmale DK, Khadtare SV, Kamble MS, Patil RC. Integrated nutrient management in groundnut (*Arachis hypobea*)- wheat (*Triticum aestivum*) cropping system on vertisols of Western Maharastra Plains Zone. Indian Journal of Agronomy. 2000; 45(2):248-252.
10. Katyal V, Gangwar B, Ganwar KS. Yield trends and soil fertility changers in Pearl millet - Wheat cropping system under long term integrated nutrient management. Annals of Agriculture Research. 2002; 23(2):201-205.
11. Pandey IB, Diwedi DK, Pandey RK. Integrated nutrient management for sustaining wheat (*Triticum aestivum*) production under late sown condition. Indian Journal of Agronomy. 2009; 54(3):306-309.
12. Polara KB, Sardhana RV, Pormar KB, Babariya NB, Patel KG. Given K uptake to produce grain and straw yield significantly. Asian Journal of Soil Science. 2010; 4(2):228-235.
13. Polara KB, Sardhara RV, Parmar KB, Babariya NB, Patel KE. Effect of potassium on inflow rate of N, P, K, Ca, S, Fe, Zn and Mn at various growth stages of wheat. Asian Journal of Soil Science. 2009; 4(2):228-235.
14. Rather SA, Sharma NL. Effect of integrated nutrient management (INM) on productivity and nutrient in wheat and soil fertility. Asian Journal of Soil Science. 2010; 4(2):208-210.
15. Raun WR, Johnson GV. Improving nitrogen use efficiency for cereal production. Agronomy Journal. 1999; 91:357-63.
16. Shewry PR. Wheat. J Exp Bot. 2009; 60(6):1537-53.
17. Singh G, Singh OP, Singh RK, Mehta RK, Kumar V, Singh RP. Effect of integrated nutrient management on yields and nutrient uptake of rice (*Oryza sativa*) – wheat (*Triticum aestivum* L.) cropping system in low lands of Eastern Uttar Pradesh. Indian Journal of Agronomy. 2006; 51(2):85-88.
18. Tilman D, Cassman K, Matson P, Naylor R, Polasky S. Agricultural sustainability and intensive production practices. Nature. 2002; 418:671-7.
19. Tulasa R, Mir MS. Effect of integrated nutrient management on yield and yield attributing character of wheat (*Triticum aestivum*). Indian Journal of Agronomy. 2006; 51(3):189-192.