The Pharma Innovation Journal 2021; 10(8): 1337-1340

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(8): 1337-1340

www.thepharmajournal.com
Received: 02-06-2021
Accepted: 10-07-2021

Lokendra Singh Gurjar
M.Sc. Student, School of Agriculture ITM University Gwalior, Madhya Pradesh, India

Girish Goyal
Assistant Professor, School of Agriculture ITM University Gwalior, Madhya Pradesh, India

SS Tomar
Dean, School of Agriculture ITM University Gwalior, Madhya Pradesh, India

Mayank Chaturvedi
Dean, School of Agriculture, MVN University, Palwal, Haryana, India

Ashok Kumar
Department of Soil Science, C. S. Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh, India

Shailendra Singh
School of Agriculture ITM University Gwalior, Madhya Pradesh, India

Sumant
M.Sc. Student, School of Agriculture ITM University Gwalior, Madhya Pradesh, India

Corresponding Author:
Girish Goyal
Assistant Professor, School of Agriculture ITM University Gwalior, Madhya Pradesh, India

Effect of organic, inorganic fertilizers and *Azotobacter* on productivity and quality of wheat (*Triticum aestivum* L.) in alluvial soil

Lokendra Singh Gurjar, Girish Goyal, SS Tomar, Mayank Chaturvedi, Ashok Kumar, Shailendra Singh and Sumant

Abstract
The present study was conducted for evaluate the organic manures (FYM and vermicompost) with 100% NPK and *Azotobacter* on yield, protein content and its economics in wheat crop during *Rabi* – 2019-20 at experimental Farm, Faculty of Agricultural Sciences, ITM University, Gwalior (Madhya Pradesh). The findings of the present study indicated that application of 100% NPK (150: 60: 40 kg ha^{-1}) along with 9 t FYM or 04 t Vermicompost ha^{-1} produced higher growth and yield attributes of wheat. The maximum grain yield (4323.3 kg ha^{-1}) recorded with treatment T_5 (100% NPK + Azoto + 04 t VC ha^{-1}) closely followed 100% NPK + Azoto + 9 t FYM ha^{-1} (T_8) with 4197.2 kg ha^{-1} grain yield. Application of organic manure (FYM/VC) along with *Azotobacter* with 100% NPK recorded significantly higher as protein content and protein yield as compared to 100% NPK alone treatment. The maximum net return (Rs.63035 ha^{-1}) and B:C ratio (3.10) were recorded under T_7 (100% NPK + Azoto + 6 t FYM ha^{-1}) and T_6 (100% NPK + Azoto + 3 t FYM ha^{-1}) respectively.

Keywords: *Azotobacter*, FYM, NPK, Protein content, Vermicompost, wheat

Introduction
Wheat (*Triticum aestivum* L.) is the second most important staple food crop of the world after rice and cultivated in almost all countries. In India, it is one of the most important staple food crops and occupies a notable position among the food grain crops not only in area and production but also in its versatility in adaptation to a wide range of agro-climatic conditions. It grown in diverse agro-climatic conditions from 11°N- 35°N latitude and 72°E- 92°E longitudes. Its productivity has played a key role in making the country self-sufficient in food grain. This crop occupies an area of about 30.0 million hectare with total production of 98.6million tonnes and a productivity of 2.89 tonnes/ha during 2018-19 which share about 12.72% of total production of the world (Anonymous, 2019) [1].
Increased use of chemical fertilizers in an unbalanced manner has created problem of multiple nutrient deficiencies, particularly micronutrients, diminishing soil fertility and unsustainable crop yields. Due to the increased productivity of the crops, the native soils have begun depleting their nutrient reserves and the crops started responding to application of micronutrient fertilizers (Sharma *et al*., 2013) [9]. Addition of organic manures along with chemical fertilizers sustained the yield through increased nutrients availability and nutrient use efficiency. Productivity of wheat or any other crop can only be pushed up by integration of inorganic, organic and bio-fertilizer application. Keeping these views the present study was carried out.

Materials and Methods
The present experiment was conducted during the *Rabi* season of 2019-20 at experimental farm, school of Agriculture, ITM University Gwalior, Madhya Pradesh to evaluate the combined effect of organic manure and inorganic fertilizers doses on the growth and yield of wheat (Variety, MP-3382). The experiment was laid out in Randomized Block Design (RBD) having three replications. The experiment comprises of eight different treatmentsT_1: 100% NPK T_2: 100% NPK + *Azotobacter*, T_3: 100% NPK + *Azotobacter* +VC @2t/ha, T_4: 100% NPK + *Azotobacter* +VC @3t/ha, T_5: 100% NPK + *Azotobacter* +VC @4/ha, T_6: 100% NPK + *Azotobacter* + FYM @3t/ha, T_7: 100% NPK + *Azotobacter* + FYM @6t/ha and T_8: 100% NPK + *Azotobacter* + FYM @9t/ha.

The soil of the experimental site was Sandy Loam in texture, low in available nitrogen and medium in phosphorus and potash. Wheat variety MP-3382 was sown with 20 cm row spacing with 100 kg seed rate on 28 November 2019 The recommended dose of fertilizers (RDF) for wheat is 120 kg N and 60 kg P_2O_5 and 40 kg K_2O ha^{-1} but status of available nitrogen in low therefore present study 150 kg N and 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was used as a 100% NPK. The nitrogen, Phosphorus and potassium were applied through urea, DAP and MOP. The full dose of phosphorus, potassium and half dose of nitrogen were given below the seed at the time of sowing as basal. Whereas, the remaining half dose of nitrogen was top-dressed after first irrigation. In manure treatments FYM and vermicompost were applied before field preparation or before sowing of crop and *Azotobacter* was used as soil applications @ 5 kg ha^{-1} with FYM or vernicompost as per treatments. All other agronomic practices were kept uniform for all treatments. All data related to growth and yield of wheat crop collected were statistically analysed by using the analysis of variance technique (Fisher, 1958) [4].

Result and Discussion

Growth and yield attributed characters

It is clear from results (Table-1) that allocation of 100% NPK with *Azotobacter* and either vermicompost or farm yard manure increased the plant height, spike length, grains $spike^{-1}$ and the test weight. The enhanced early vegetative growth in terms of height, dry matter accumulation and vigorous root system resulted in more spikes which consequently increased the number of spike bearing tillers significantly. Number of spike m^{-2} area produced by the application of 100% NPK along with vermicompost 4 t ha^{-1}(418.0 spike m^{-2}) or FYM 9 t ha^{-1}(410.9spike m^{-2}) were found to be the highest and the lowest from only 100% NPK (330.2 spike m^{-2}). It might be due to stimulated vegetative growth of wheat on account of adequate and prolonged supply of essential nutrients. The probable reason may be that adequate supply of all the nutrients, resulted in greater accumulation of carbohydrates, amino acids and their translocation to the productive organs, which, in-turn improved all the growth and yield attributing characters. Results confirm the finding of Tripathi and Kumar (2007) [12] and Faujdar and Sharma (2013) [3]. Similarly, the grains $spike^{-1}$and test weight produced by the application100% NPK + 4t vermicompost or 100% NPK+9 t FYM ha^{-1}were found to be significantly higher than the other treatments and the lowest in 100% NPK treatment. These results are in confirmatory with the findings of Kumar *et al*. (2005) [6], Kaushak *et al*. (2006) [5] and Rather and Sharma (2009) [8].

Table 1: Effect of different treatments on growth and yield attributed characters of wheat

Treatments	Plant height (cm)	Number of spike m^{-2}	Spike Length (cm)	Number of grains $spike^{-1}$	Test weight (g)
T_1: 100% NPK (150: 60: 40 kg ha^{-1})	88.05	330.2	8.75	24.96	36.46
T_2: 100% NPK + *Azotobacter*	91.41	354.9	9.27	26.83	36.62
T_3: 100% NPK + *Azoto* +VC @2t/ha	99.31	372.8	9.95	28.41	37.77
T_4: 100% NPK +*Azoto* +VC@3t/ha	102.14	391.6	10.37	29.69	39.01
T_5: 100% NPK + *Azoto* +VC @4/ha	104.00	418.0	10.56	30.14	41.01
T_6: 100% NPK + *Azoto*+ FYM@3t/ha	97.25	375.9	9.86	28.80	38.09
T_7: 100% NPK +*Azoto* + FYM@6t/ha	105.16	400.1	10.26	29.96	40.55
T_8: 100% NPK + *Azoto* + FYM@9t/ha	105.67	410.9	10.42	30.77	40.97
S.Em. (±)	1.56	7.9	0.19	0.58	0.73
C.D. at 5%	4.58	23.2	0.55	1.71	2.13

Yield parameters

The grain yield varied from 3531.7 to 4323.3 kg ha^{-1} under different treatments and the magnitude of increase in yield due to various organic manure and bio fertilizers treatments with 100% NPK was 6.37 to 22.41 per cent over 100% NPK alone treatment (Table-2). The maximum grain yield (4323.3 kg ha^{-1}) recorded with treatment T_5(100% NPK +Azoto + 04 t VC ha^{-1}) closely followed 100% NPK+ Azoto + 9 t FYM ha^{-1}(T_8) with 4197.2 kg ha^{-1}grain yield. Minimum grain yield (3531.7 kg ha^{-1}) was observed in 100% NPK treatment (T_1). The increase in grain and biological yield with combined application of organic manure, *Azotobacter* with 100% NPK as inorganic fertilizers might be due to adequate quantities and balanced proportions of all the essential plant nutrients supplied to the crop as per need during the growth period resulting in favourable increase in yield attributing characters which ultimately led towards an increase in economic yield. On the other hand improved physico-chemical properties of the soil through the application of organic manure and supply micronutrients to plants might be the other possible reason for higher productivity. The findings confirm the results of Ram and Mir *(*2006) [7] and Devi *et al.* (2011) [2].

Table 2: Effect of different treatments on yield parameters of wheat

Treatments	Yield parameters			
	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T_1: 100% NPK (150: 60: 40 kg ha^{-1})	3531.7	5190.0	8721.7	40.49
T_2: 100% NPK + *Azotobacter*	3756.6	5385.0	9141.6	41.09
T_3: 100% NPK + *Azoto* +VC @2t/ha	3998.7	5322.3	9321.0	42.90
T_4: 100% NPK +*Azoto* +VC@3t/ha	4195.4	5502.7	9698.1	43.26
T_5: 100% NPK + *Azoto* +VC @4/ha	4323.3	5563.4	9886.7	43.73
T_6: 100% NPK + *Azoto*+ FYM@3t/ha	3995.5	5218.4	9213.9	43.36
T_7: 100% NPK +*Azoto* + FYM@6t/ha	4141.8	5368.7	9510.5	43.55
T_8: 100% NPK + *Azoto* + FYM@9t/ha	4197.2	5338.3	9535.5	44.02
S. Em. (±)	69.9	137.9	171.0	0.65
C.D. at 5%	204.9	NS	501.6	1.88

Quality parameters and economics

The maximum protein content (11.57 per cent) was observed under 100% NPK + Azoto + 9 t FYM ha^{-1}(T_8) which was statistically at par with all the treatments except 100% NPK applied alone or with Azotobacter (T_1 and T_2). It is clear from results (Table-3) that application of organic manure (FYM/VC) along with *Azotobacter* with 100% NPK recorded significantly higher as protein content and protein yield as compared to 100% NPK alone treatment. This might be due to that application of FYM or Vermicompost supplied Zn and *Azotobacter* increased N-metabolism, which enhanced accumulation of amino acids and drastically increased the rate of protein synthesis and consequently, protein content in grain. FYM or Vermicompost application in soil enhanced the Zn concentration in the plant which associated with RNA and ribosome induction the result of which accelerates protein synthesis (Sharma *et al*., 2013) [9].

Table 3: Quality parameters and economics in wheat as influenced by different treatments

Treatments	Quality parameters		Economics		
	Protein content (%)	protein yield (kg ha^{-1})	Gross income Rs ha^{-1}	Net income Rs ha^{-1}	B:C ratio
T_1: 100% NPK (150: 60: 40 kg ha^{-1})	10.10	356.67	80960	54242	3.03
T_2: 100% NPK + *Azotobacter*	10.33	387.91	85777	58259	3.12
T_3: 100% NPK + *Azoto* +VC @2t/ha	11.03	441.17	90281	58763	2.86
T_4: 100% NPK +*Azoto* +VC@3t/ha	11.31	475.19	94518	61000	2.82
T_5: 100% NPK + *Azoto* +VC @4/ha	11.53	498.53	97132	61614	2.73
T_6: 100% NPK + *Azoto*+ FYM@3t/ha	11.06	441.73	89959	60941	3.10
T_7: 100% NPK +*Azoto* + FYM@6t/ha	11.41	472.41	93151	62633	3.05
T_8: 100% NPK + *Azoto* + FYM@9t/ha	11.57	485.72	94142	62124	2.94
S. Em. (±)	0.31	16.05	-	-	-
C.D. at 5%	0.91	47.08	-	-	-

Basic cost of cultivation = Rs 20800/ ha
Price of grain= Rs. 1925q^{-1}
Price of straw= Rs. 250 q^{-1}

Economics

The maximum gross income of Rs.97132 ha^{-1} was recorded under T_5 (100% NPK + *Azoto*+ 04 t VC ha^{-1}) followed by 100% NPK + Azoto + 03 t VC ha^{-1} (T_4) with gross income of Rs. 94518 ha^{-1}) and minimum (Rs. 80960 ha^{-1}) under 100% NPK (150: 60: 40 kg ha^{-1}) treatment. Highest net return of Rs.62633 ha^{-1} was recorded under T_7 (100% NPK + *Azoto*+ 6 t FYM ha^{-1}) followed by T_8 (100% NPK + *Azoto*+ 9 t FYM ha^{-1}) with Rs. 62124 ha^{-1} and minimum (Rs. 54242 ha^{-1}) under 100% NPK (150: 60: 40 kg ha^{-1}) treatment (Table-3). However, The maximum benefit cost ratio of 3.12 was recorded with T_2 (100% NPK + *Azotobacter*) treatment followed by T_6 (100% NPK + *Azoto*+ 3 t FYM ha^{-1}) with B:C ratio of 3.10. Minimum B: C ratio (2.73) was obtained in T_5 (100% NPK + *Azoto*+ 04 t VC ha^{-1}) treatment. These results are similar to yield of crop obtained from different treatments and confirm to the findings of Rather and Sharma (2009) [8] and Singh and Singh (2012) [10]. The net returns and benefits obtained were lowest in vermicompost applying treatments due to the high production cost of vermicompost (Rs. 2000 t^{-1}). The additional cost of organic manures (FYM) was compensated by the additional yield of wheat. Integrated application of NPK fertilizers along with FYM and *Azotobacter* in field crops not only influences growth and production of plant but at the same time also reduces the production budget (Suthar, 2006) [11].

Conclusion

On the basis of economical yield of wheat (i.e benefit cost ratio) under different treatment, from the present study, we can concluded that application of 100% NPK (150: 60:40 kg ha^{-1}) along with 3 - 6 t FYM ha^{-1} produced higher growth and economic yield of wheat. This treatment gave more net returns and higher benefit cost ratio in wheat under alluvial soils of Northern Madhya Pradesh.

References

1. Anonymous. Economic Survey 2018-19. (*In*): Statistical Tables, Selected Indicators, 1950-51 to 2018-19. Ministry of Finance, Government of India 2019.
2. Devi KN, Singh MS, Singh NG, Athokpam S. Effect of integrated nutrient management on growth and yield of wheat *(Triticum aestivum* L.) Journal of Crop and Weed 2011;7(2):23-27.
3. Faujdar RS, Sharma, Mahendra. Effect of FYM, bio fertilizers and zinc on yield of maize and their residual effect on wheat. J. Soils and Crops 2013;23(1):41-52.
4. Fisher RA. Statistical Methods for Research Workers. Oliver and Boyd., Edinburgh 1958.
5. Kaushak N, Choudhary A, Koy AKS. Effect of integrated nutrients management on growth and yield of late sown wheat. Environment and Ecology 2006;24(Special 1):78-79.
6. Kumar Ashok, Gautam RC, Singh Ranbir, Rana KS. Growth, yield and economics of maize-wheat cropping sequence as influenced by integrated nutrient management of New Delhi. Indian J Agric. Sci 2005;75(1):709-711.
7. Ram T, Mir MS. Effect of integrated nutrient management on yield and attributing characters of wheat (*Triticum aestivum*). Indian Journal of Agronomy 2006;51(3):189-192.
8. Rather SA, Sharma NL. Effect of Integrated Nutrient Management (INM) on yield and economics of wheat. An Asian Journal of Soil Science 2009;4(1):15-17.
9. Sharma GD, Thakur, Rishikesh, Somraj, Kuaraw DL, Kulhare PS. Impact of integrated nutrient management on yield, nutrient uptake, protein content of wheat (*Triticum astivam*) and soil fertility in a Typic Haplustert. The Bioscan 2013;8:1159-1164.
10. Singh, Sandeep and Singh, Jag Pal. Effect of organic and inorganic nutrient sources on some soil properties and wheat yield. Journal of the Indian Society of Soil Science 2012;60(3):237-240.
11. Suthar S. Effect of vermicompost and inorganic fertilizer on wheat (*Triticum aestivum*) production, Nature, Env.

and Poll. Technol 2006;5:197-201.
12. Tripathi HP, Kumar A. Effect of Integrated nutrient management on rice-wheat cropping system in Eastern Plain Zone of Uttar Pradesh. J. Farming Systems Research and Development 2007;13(2):198-203.