Article AR1981 DOI: HTTPS://DOI.ORG/10.23910/IJBSM/2019.10.3.1981

International Journal of Bio-resource and Stress Management

June 2019

Crossref

Print ISSN 0976-3988

Online ISSN 0976-4038

IJBSM 2019, 10(3):257-260

Research Article *Natural Resource Management*

Impact of Organic Nutrient Management Practices on Yield Attributes, Yield and Economics of Wheat (*Triticum aestivum* L.)

Hanuman Prasad Parewa[1]*, Moola Ram[2], Lokesh Kumar Jain[1], Anirudh Choudhary[1] and S. D. Ratnoo[1]

[1]College of Agriculture, (Agriculture University, Jodhpur) Sumerpur, Pali Rajasthan (306 902), India
[2]Agricultural Research Station, (Agriculture University, Jodhpur) Mandor, Jodhpur, Rajasthan (342 304), India

Corresponding Author
Hanuman Prasad Parewa
e-mail: haniparewa@gmail.com

Citation: Parewa et al., 2019. Impact of Organic Nutrient Management Practices on Yield Attributes, Yield and Economics of Wheat (*Triticum aestivum* L.). International Journal of Bio-resource and Stress Management 2019, 10(3):257-260. HTTPS://DOI.ORG/10.23910/IJBSM/2019.10.3.1981

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared no conflict of interests exist.

Abstract

The field experiment was conducted during *rabi* 2013-14 and 2014-15 at Agricultural Research Station, Sumerpur, Pali (Rajasthan), India to find out suitable organic nutrient management practices for higher productivity and economics of wheat in Luni basin region of Rajasthan. The experiment was laid out in RBD with seven treatments. The results in terms of growth and yield attributes, grain yield and economics of wheat under different treatments were significantly different than control. Pooled data of two years' experimentation revealed that the maximum plant height (85.83 cm), number of tillers per meter row length (91.00), number of seed per ear head (55.18), ear head length (9.60 cm), test weight (37.17 g) and grain yield (39.14 q ha^{-1}) were recorded with application of FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} followed by treatment FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}. Net return was recorded significantly highest with FYM @ 10 t ha^{-1}+ Vermicompost @ 1.25 t ha^{-1} whereas B:C ratio (2.43) was highest with FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}. Application of FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} led to increase grain yield by 94.84% significantly over control (19.0 q ha^{-1}). Hence, the finding suggested that the integration of FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} increased yields of organic wheat in semi arid regions.

Keywords: FYM, Nutrient management, Vermicompost, Yield, Wheat

1. Introduction

Wheat (*Triticum aestivum* L.) is the most important crop among all cereals used as a food grain in the world. It is cultivated in almost all part of the country and occupied 30.60 mha with the production of 98.38 million tonne in 2016-17 (Agricultural Statistics at a Glance, 2017). Wheat is a good supplement for nutritional requirement of human body as it contains 8.0-15.0% protein, 60-68% starch, 1.5-2.0% fat, 2.0-2.5% cellulose and 1.5-2.0% minerals (Sharma, 2000). Intensive agriculture with high yielding varieties has led to heavy withdrawal of nutrients from the soil and injudicious application of chemical fertilizers decreased the biological power of soil lowering the soil fertility and crop productivity (Chand, 2008). The adverse affects due to use of high analysis chemical fertilizers on soil productivity and environment made an energy crisis

Article History
RECEIVED in 09th April 2019 RECEIVED in revised form 30th May 2019 ACCEPTED in final form 08th June 2019

with unsustainability issue in agriculture. Indiscriminate and continuous use of inorganic fertilizers has shown negative effect on physico-chemical and biological properties of soil, thereby affecting the crop productivity (Prajapat et al., 2016; Meena et al., 2018), besides causing environmental pollution (Virmani, 1994). The excessive use of pesticides also resulted in residues much above the safety levels and this brought to the attention of ill-effects of modern agriculture and paved the way for organic based farming which will not only give rich nutrients produce but also quality food devoid of any chemical residue (Mengi et al., 2016). Nowadays, increasing concern for environmental safety, global demand for pesticide residue free and organic food has evoked keen interest in crop production (Prasad, 2005, Sivakumar, 2014).

Organic farming often has to deal with a scarcity of readily available nutrients in contrast to inorganic farming which relies widely available on soluble fertilisers (Davari et al., 2012). The use of FYM or vermicompost alone is not be enough to maintain the present levels of crop productivity of high yielding varieties of crops. Many attempts were therefore made to find out substitutions of chemical fertilizers by introduction of organic manure such as FYM, vermicompost, goat manure, wood ash and others to achieve sustainable production of crops (Moyin-Jesu, 2007, Singh et al., 2004). Collective application of organic manures mostly compost, vermicompost and gliricidia green manure (GLM) produced higher yield and maintain soil health (Babalad et al., 2009). The contribution of various sources of organic nutrients had traditionally been considered to be the best option to increase the crop productivity. The integration of organic manures (farmyard manure, vermicompost or green manure) not only supplies all essential nutrients but also increased the crop productivity (Bana et al., 2012, Kumar et al., 2015), besides minimizing the pollution hazards as well as reduce the requirements of fertilizer (Singh et al., 2004; Ahmad et al., 1996).

Moreover, use of various sources of organics can also help in improving water holding capacity of soil, root growth and leaves residual effect on soil fertility for longer period, thus organic sources of nutrients are important tool of sustainable farming. Since information on organic nutrient management in wheat through organic sources is meagre, the present study is carried out to find out suitable organic nutrient management practices for higher productivity and economics of wheat in southern western region of Rajasthan.

2. Materials and Methods

The experiment was carried out for two consecutive years of *rabi* 2013-14 and 2014-15 at Agricultural Research Station, Sumerpur (25.09° N and 73.05° E) in the Pali District, Rajasthan, India. Fifteen core soil samples were collected randomly from 0-15 cm depth on the site using soil auger, mixed thoroughly, bulked, air dried and sieved to pass through a 2 mm sieve for chemical analysis. The soil of experimental field was sandy loam in texture having low soil organic carbon (0.34%), low available N (198 kg ha^{-1}), medium available P (17.0 kg ha^{-1}) and K (230 kg ha^{-1}), bulk density (1.28 mg M^{-3}), particle density (2.64 mg M^{-3}), water holding capacity (46 %) with slightly alkaline in nature pH 8.3 (1:2.5 soil: water ratio). All these parameters were estimated following the standard procedures (Jackson, 1967). Neem green leaves, FYM, Vermicompost and Wheat (Raj, 4120) seeds were obtained from the Agricultural Research Station, Sumerpur. The land was cleared, ploughed and harrowed, divided into plots and each plot size was kept 14×13.55 m^2 (189 m^2). Wheat variety (Raj 4120) seed was sown in November, 2013 and 2014 at appropriate spacing. There were seven treatments namely Control (T_1), FYM @ 15 t ha^{-1} (T_2), Neem green leaves @ 6 t ha^{-1} (T_3), FYM @ 10 t ha^{-1}+Neem green leaves @ 2 t ha^{-1} (T_4), FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_5), Neem green leaves @ 4 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_6) and FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_7), replicated three times and arranged in a randomized block design (RBD). The different organic nutrient sources alone and in combinations were applied uniformly as per the treatment and incorporated into the soil three weeks before sowing. The irrigation and all other operations were performed as per recommendation for the crop. The data on various growth, yield attributes and yield were recorded in different treatments. The economic parameters like cost of cultivation, net return and benefit: cost (B:C) ratio were worked out based on prevailing market prices of inputs, outputs and labour wages. Data obtained from all the observation were statistically analysed, applying the randomized block design (RBD). The critical difference (CD) values were calculated to test the significance of treatment difference and CD values were evaluated at 5% level of significance.

3. Results and Discussion

The data of the results of growth, yield attributes, yield and economics have been presented in tabular and graphical forms for the convenient of presentations. The plant height (Table 1) varied significantly with the treatments. Plant height, number of effective tillers and test weight are an important growth parameter of plant which is an expression of vegetative growth that directly linked with grain and stover yield. Pooled data of plant height at harvest of the crop revealed that among all the treatments, T_5 was found significantly superior (Table 1). At the time of harvest of wheat, maximum plant height was recorded under treatment (T_5) FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (85.83 cm) followed by treatment (T_7) FYM @ 5 t ha^{-1}+ Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (83.50 cm). The T_5 treatment was found at par with T_7, T_2, T_4 and T_6. While, the pooled minimum plant height (70.0 cm) was recorded at harvest in control (T_1). The higher plant height in FYM + vermicompost (T_5) may be due to rapid mineralization of the manure. The results are in conformity with those of Channabasanagowda et al., 2008 and Hadis

Table 1: Effect of organic nutrient sources on growth and yield attributes, grain yield and economics of wheat (Pooled data)

Treatments	Plant height (cm)	No. of tillers m^{-1} row	No. of grains ear^{-1} head	Ear head length (cm)	Test weight (g)	Grain yield (q ha^{-1})	Net return (₹ ha^{-1})	B:C ratio
T_1	70.00	70.50	44.58	8.31	31.72	19.00	21632	2.19
T_2	81.17	84.83	50.83	9.40	34.90	33.09	36362	2.09
T_3	72.17	75.67	48.07	9.07	32.73	27.87	33178	2.29
T_4	77.00	81.83	50.05	9.49	33.22	30.18	32745	2.06
T_5	85.83	91.00	55.18	9.60	37.17	39.14	47752	2.38
T_6	73.33	79.00	48.75	9.15	33.23	29.25	32194	2.09
T_7	83.50	87.33	51.65	9.42	35.03	37.02	45853	2.43
SEm±	2.14	2.55	1.81	0.26	1.07	1.31	2749	0.09
CD (*p*=0.05)	6.50	7.72	5.49	0.78	3.24	3.98	8336	0.29

T_1: control; T_2: FYM @ 15 t ha^{-1}; T_3: Neem green leaves @ 6 t ha^{-1}; T_4: FYM @ 10 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}; T_5: FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}; T_6: Neem green leaves @ 4 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}; T_7: FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}

et al., 2018. The beneficial effect of organic nutrients in combination with each other and alone was also noticed in the yield components namely, number of tillers per meter row length, number of grains per ear head, ear head length and test weight (Table 1). Significantly higher number of tillers per meter row length were recorded with treatment (T_5) FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (91.00) followed by (T_7) FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (87.33). Similarly, number of grains ear^{-1} head (55.18), ear head length (9.60 cm) and test weight (37.17 g) were significantly higher with treatment combination of FYM @ 10 t ha^{-1} +Vermicompost @ 1.25 t ha^{-1} over control and at par with the treatment FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_7). The result of the experiment in terms of grain yield of wheat under different treatments showed significantly difference over control (T_1). Pooled data of two years' experimentation revealed that the maximum grain yield (39.14 q ha^{-1}) was recorded with treatment (T_5) FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}. However, it was statistically at par with treatment (T_7) (Table 1). The results are in akin with Patil and Bhilare, 2000 and Hammad et al., 2011. Yadav et al. (2016) reported that application of enriched compost (1/3)+vermicompost (1/3)+Glyceridia green leaf manure (1/3) equivalent to 50 kg P_2O_5 with 5 t FYM ha^{-1} recorded significantly higher yield attributes characters and yield as compared to organics alone. Similarly, Verma et al. (2018) reported that combination of mustard oil seed cake plus *Azotobacter* followed by neem oil seed cake plus *Azotobacter* found suitable organic nutrient management practice for obtaining highest productivity and growth of wheat.

The higher yield may be due to fact that these organic nutrient sources supplied direct available nutrients to the plant and improved water stable aggregates of the soil. This was attributed to cementing action of polysaccharides and other organic compounds released during the decomposition of various organic sources thus leading to taller plants, increased number of tillers, ear head length and final yield (Hendrix et al., 1994). Net return and benefit:cost ratio increased with application of organic sources of nutrients. Pooled data of two years' experimentation (Table 1) revealed that the maximum benefit cost ratio (2.43) was obtained with the application of FYM @ 5 t ha^{-1} + Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_7) which was at par with the treatment (T_5) FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1}. Although net returns were higher in treatment T_5 (₹ ha^{-1} 47752), whereas B:C ratio was obtained higher in FYM @ 5 t ha^{-1}+Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} (T_7) as compared to treatment (T_5) FYM @ 10 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} due to high expenditure on procuring more FYM for the wheat crop. Similar results were also obtained by Verma et al. (2013), Davari et al. (2012) and Kumar et al. (2018).

4. Conclusion

FYM @ 5 t ha^{-1} + Neem green leaves @ 2 t ha^{-1}+Vermicompost @ 1.25 t ha^{-1} was found to be the best combination of organic sources of nutrient for obtaining the high yield (37.02 q ha^{-1}) of wheat and highest benefit:cost ratio (2.43) under organic condition.

5. References

Anonymous, 2018. Agricultural Statistics at a Glance 2017. Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare. Fourth Advance Estimates of Production of Foodgrains for 2016-17. Government of India, Ministry of Agriculture & Farmers Welfare. www.agricoop.nic.in & http://eands.dacnet.nic.in

Ahmad, N., Rashid, M., Vaes, A.G., 1996. Fertilizers and Their Uses in Pakistan, 142–149. NFDC.

Babalad, H.B., Kambale, A.S., Bhat, S.N., Patil, R.K., Math, K.K., Shivanalli, G., Palakshappa, M.G., 2009. Sustainable groundnut production through organic approach. Journal of Oilseeds Research 26, 365–367.

Bana, R.S., Gautam, R.C., Rana, K.S., 2012. Effect of different organic sources on productivity and quality of pearlmillet (*Pennisetum glaucum*) and their residual effect on wheat (*Triticum aetivum*). Annals of Agricultural Research New Series, 33(3), 126–130.

Chand, T.K., 2008. Analysis of fertilizer use by crops. Indian Journal of Fertilizers 4, 11–16.

Channabasanagowda, N.K., Patil, B., Patil, B.N., Awaknavar, J.S., Ninganur, B.T., Hunje, R., 2008. Effect of organic manures on growth, seed yield and quality of wheat. Karnataka Journal of Agricultural Sciences 21(3), 366–368.

Davari, M.R., Sharma, S.N., Mirzakhani, M., 2012. The effect of combinations of organic materials and biofertilisers on productivity, grain quality, nutrient uptake and economics in organic farming of wheat. Journal of Organic Systems 7(2), 26–35.

Hadis, M., Meteke, G., Haile, W., 2018. Response of bread wheat to integrated application of vermicompost and NPK fertilizers. African Journal of Agricultural Research 13(1), 14–20.

Hendrix, P.F., Callaham, M.A., James, S.W., 1994. Ecology of nearetic earthworms in the Southern USA-I. characteristics of diplocardia longa surface casts in grass, hardwood and pinc microhabitats on the lower pied mount of Georgia, Megadrilogica, 5, 45–51.

Jackson, M.L., 1967. Soil chemical analysis. Prentice- Hall of India Pvt. Ltd., New Delhi.

Kumar, D., Purakayastha, T.J., Shivay, Y.S., 2015. Long-term effect of organic manures and biofertilizers on physical and chemical properties of soil and productivity of rice-wheat system. International Journal of Bio-resource and Stress Management 6(2), 176–181.

Kumar, S., Satyavan, Bishnoi, D.P., Kumar, N., Dhillion, A., 2018. Effect of integrated nutrient management on yield and yield attributes and economics of wheat (*Triticum aestivum* L.) under saline and non-saline irrigation water. International Journal of Current Microbiology and Applied Sciences 7(5), 618–628.

Meena, K.B., Alam, M.S., Singh, H., Bhat, M.A., Singh, A.K., Mishra, A.K., Thomas, T., 2018. Influence of farmyard manure and fertilizers on soil properties and yield and nutrient uptake of wheat. International Journal of Chemical Studies, 6(3), 386–390.

Mengi, L., Sarkar, N.C., Verma, H., Longkumer, L.T., 2016. Influence of different organic sources of nutrient on the productivity of upland rice (*Oryza sativa* L.). International Journal of Bio-resource and Stress Management 7(3), 450–454.

Moyin-Jesu, E.I., 2007. Evaluation of different organic fertilizers on the soil fertility, leaf chemical composition and growth performance of coffee seedlings. African Journal of Science & Technology 2, 1–6.

Patil, V.S., Bhilare, R.L., 2000. Effect of vermicompost prepared from different organic sources on growth and yield of wheat. Journal of Maharashtra Agricultural University 25, 305–306.

Prajapat, K., Vyas, A.K., Dhar, S., 2016. Root growth and productivity of wheat, chickpea and potato as influenced by nutrient management practices. International Journal of Bio-resource and Stress Management 7(1), 052–059.

Prasad, R., 2005. Organic farming vis-à-vis modern agriculture. Current Science 89, 252–253.

Sharma, S.N., 2000. Wheat, In: Techniques and management of field crop production, ed, Rathore, PS, Agrobios, 96-120, 2000.

Singh, Y., Singh, B., Ladha, J.K., Khind, C.S., Khera, T.S., Bueno, C.S., 2004. Effect of residue decomposition on productivity and soil fertility in rice-wheat rotation. Soil Science Society of America Journal 68, 854–864.

Sivakumar, T., 2014. Review on Panchagavya. International Journal of Advanced Research in Biological Sciences 1(8), 130–154.

Verma, S., Singh, H.V., Saxena, R., 2013. Relative performance of sesame (*Sesamum indicum*) under organic, inorganic and integrated nutrient management. Indian Journal of Agricultural Sciences 83(3), 143–149.

Verma, S.B., Singh, D., Chauhan, R.M., 2018. Effect of neem (*Azadirachta indica* L.), mustard (*Brassica juncea*) de-oiled seed cake and bio-fertilizer on the growth and yield of wheat (*Triticum aestivum* L.). Journal of Pharmacognosy and Phytochemistry, 7(5), 2416–2427.

Virmani, S.M., 1994. The twenty first-Dr. R.V. Tamhane memorial Lecture: UNCEED Agenda 21: The new challenge for soil research. Journal of Indian Society of Soil Science 42, 516–523.

Yadav, S.K., Babalad, H.B., Sharma, S.K., Choudhary, R.S., Kumar, N., 2016. Impact of organic nutrient management practices on yield attributes and yield of summer mungbean. International Journal of Bio-resource and Stress Management 7(5), 1136–1139.

Hammad, H.M., Khaliq, A., Ahmad, A., Aslam, M., Malik, A.H., Farhad, W., Laghari, K.Q., 2011. Influence of Different Organic Manures on Wheat Productivity. International Journal of Agriculture & Biology 13(1), 137–140.