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Effect of different organic nitrogen sources on growth and yield of wheat (*Triticum aestivum* L.)

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Abstract
The experiment was conducted during *rabi* season of 2016-17 at Agronomy Organic Farm, College of Agriculture, Pune and laid out in randomized block design with eight treatments and three replications. The treatments consisted of 4 different organic manures i.e. FYM, vermicompost, poultry manure and neem seed cake and their combinitions. Growth characters like plant height (78.51 cm), number of tillers m^{-1} row length (122.50), dry matter $plant^{-1}$ (16.31 g) and number of spikes m^{-2} (410) were significantly highest recorded in 100% RDN through vermicompost. The yield and yield attributing characters like grain yield and straw yield, length of spike, number of spikelets $spike^{-1}$, number of grain $spike^{-1}$, grain weight $spike^{-1}$ and test weight were maximum with application of 100% RDN through vermicompost.

Keywords: Wheat, vermicompost, FYM, poultry manure

Introduction
Wheat (*Triticum aestivum* L.) is world's most important widely cultivated food crop. It is originated in South West Asia. It is basically a short day crop and primarily grown in temperate region and also at higher region and also higher altitude under tropical climate areas in winter season. It requires relatively low temperature for satisfactory growth and development. Wheat is important staple food crop of India after rice. It is consumed as food by millions of people especially in developing countries. Therefore, it is called as "king of cereals". In Indian cropping system wheat ranks next to the rice in the food grain production. Wheat grain contains 60-80 per cent starch, 10-12 per cent protein, 1.5-2 per cent fat and 9-35 per cent gluten. Wheat is one of the major cereal crops with unique protein which is consumed by human and is grown around the world in diverse environment for its high nutritious value (Bos *et al*., 2005) [4].

The total area under wheat in world during 2015-16 was 304.7 million hectares with an annual production of 889.4 million tonnes and average productivity of 3.15 tonnes ha^{-1} (Anonymous, 2016) [2]. Wheat is ranking among the top three most produced cereal crops in the world along with corn and rice. In India during 2015-16 the area under wheat was 55.68 million hectares with production of 93.82 million tonnes and average productivity of 3.09 tonnes ha^{-1} (Anonymous, 2016) [2]. The states which have the sizable acreage under this crop are Utter Pradesh, Punjab, Haryana, Rajasthan, Bihar, Gujarat and Maharashtra. In Maharashtra, during 2015-16 wheat was grown on an area of 0.62 million hectares with production of 0.88 million tonnes and the average productivity of 1761 kg ha^{-1} (Anonymous, 2016) [2]. The productivity of wheat in Maharashtra state is very low as compared at national average.

Application of higher level of chemical fertilizers could lead to residues in grains, fruits and vegetables. The large scale use of chemical fertilizers causes the problems of environmental pollution and deterioration of soil health. There is also problem of loss of applied fertilizers through leaching, volatilization and denitrification of nitrogen. Besides, the prices of chemical fertilizers are increasing tremendously and due to inherent financial strain, the marginal farmers are unable to use such expensive input in time. To overcome this, use of organic sources is the solution which aims at cooperating rather than conforming with nature. Organic sources of nitrogen like FYM, vermicomposting, neem seed cake and poultry manure helps to improve the soil health and also sustain the productivity.

Nitrogen is the major nutrient, it is constituent of chlorophyll, proteins, enzymes, hormones, vitamins and alkaloids and involved in wide range of plant processes from plant growth to protein contents of grains. It is needed mostly by the young fast growing tissue and perform number of functions related to growth, development, photosynthesis, nodulation,

carbohydrates and protein content. FYM improves the physical condition of the soil by increasing water holding capacity for maximum utilization of water. Vermicompost have high levels of total nitrogen, phosphorous, potassium, micro nutrients and growth regulators (Chaoui *et al*., 2003) [5]. Continuous and adequate use with proper management can increases soil organic carbon, soil water retention and transmission and improvement in other physical properties of soil like bulk density, penetration resistance and aggregation as well as beneficial effect on the growth of variety of plants (Atiyeh *et al*., 2002) [3]. The poultry manure is relatively cheap source of both macro and micronutrients and can increases soil nitrogen and porosity and improve soil microbial activity. As poultry waste contains a high concentration of nutrients so addition of small quantity of poultry manure in an aggregated nutrient management system could meet the shortage of FYM to same extent (Ghosh *et al*., 2004) [7]. Poultry manure carried out rapid mineralization. Neem seed cake makes soil more fertile due to an ingredient that blocks soil bacteria from converting nitrogenous compounds into nitrogen gas. It is nitrification inhibitor and prolongs the availability of nitrogen.

Material and Methods

The field experiment was laid out during *rabi* season of 2016-17 at Agronomy Organic Farm, in Plot No. 3 'B' Division, College of Agriculture, Pune (M.S.) The experiment was laid out in randomized block design with eight treatments and three replications. The gross and net plot size were 4.00 m x 2.70 m and 3.60 m x 2.25 m, respectively. The eight treatment consisted of T_1 (100% RDN through FYM), T_2 (100% RDN through vermicompost), T_3 (100% RDN through poultry manure), T_4 (100% RDN through neem seed cake), T_5 (50% RDN through FYM + 50% RDN through vermicompost), T_6 (50% RDN through FYM + 50% RDN through poultry manure), T_7 (50% RDN through FYM + 50% RDN through neem seed cake) and T_8 (Absolute control).

Wheat variety NIAW-1994 (Phule samadhan) was sown @ 100 kg seed ha^{-1} at spacing of 22.5 cm by line sowing on 15th November, 2016 and harvesting was completed in 8th March, 2017. Nitrogen analysis of organic manures was carried out and applied @ 120 kg N ha^{-1} to soil before sowing through four organic sources as per treatments.

Results and Discussion

Effect of different organic nitrogen sources on growth:

The data presented in Table 1, the plant height recorded at harvest differed significantly due to various organic nitrogen management treatments. The treatment T_2 (100% RDN through vermicompost) recorded significantly higher plant height at harvest (78.51 cm) than rest of treatments. Whereas, treatment T_8 *i.e.* absolute control recorded lower values of plant height at all the growth periods. The significantly higher plant height with 100% RDN through vermicompost (T_2) might be due to immediate and optimum availability of nutrients. The availability of more N from vermicompost for early establishment of photosynthetic apparatus such as enzymes pigments mineralization was fast and other compounds needed for photosynthesis (Below, 1995).

The mean numbers of tillers plant^{-1} and dry matter plant^{-1} (From table 1.) were found maximum and statistically higher with application 100% RDN through vermicompost (T_2) than all other treatments under study at harvest. However it was at par with application of 100% RDN through poultry manure (T_3). Whereas, minimum number of tillers m^{-1} row length and dry matter plant^{-1} were recorded under absolute control (T_8) at all growth periods of crop. Maximum numbers of tillers plant^{-1} might be due to enrichment of earthworm casting having essential plant nutrients which helped for enhancing the more number of tillers m^{-1} row length. Tomati *et al*. (1990) [12] has revealed the beneficial influence of worm cast, to the biological factors like gibberellins, cytokinins and auxins released due to the metabolic activity of the microbes harboured in the cast. The dry matter plant^{-1} was found higher might be due to quick and readily available of plant nutrients from the vermicompost. The increased leaf area has increased photosynthetic activity and enhanced the carbohydrate metabolism in plant and accumulated greater dry matter per plant (Choudhary *et al.* 2007) [6].

The mean number of spikes m^{-2} at harvest (From table 1.) were significantly higher (410) with the application of 100% of RDN through vermicompost (T_2) than rest treatments however, it was on at par with application of 100% RDN through poultry manure (T_3). Whereas, absolute control (T_8) recorded lowest mean number of spikes m^{-2} (198.67) at harvest as compared to other treatments under study.

Table 1: Mean plant height (cm), number of tillers m^{-1} row length, dry matter plant^{-1} (g) and number of spikes m^{-2} influnced by different organic nitrogen sources at harvest

Treatments	Plant height (cm)	Number of tillers m^{-1} row length	Dry matter plant^{-1} (g)	Number of spikes m^{-2}
T_1	76.49	110.25	14.30	323
T_2	78.51	122.50	16.31	410
T_3	77.43	120.25	15.66	386
T_4	76.98	106.75	14.70	353.67
T_5	75.84	113.50	12.81	302.67
T_6	73.31	117.50	12.04	268.34
T_7	73.63	111.75	12.17	304
T_8	71.19	58.50	10.32	198.67
S.E.m ±	0.34	1.40	0.21	8.69
C.D. at 5%	1.02	4.24	0.63	26.37
General mean	75.42	107.63	13.48	318.25

Effect of different organic nitrogen sources on yield and yield attributes:

The data presented in Table 2 indicated that the mean length of spike, number of spikelets spike^{-1}, number of grain spike^{-1}, grain weight spike^{-1}, and test weight were significantly influenced by different organic nitrogen management treatments.

The mean length of spike, number of spikelets spike^{-1}, number of grain spike^{-1}, grain weight spike^{-1}, and test weight showed significantly highest in treatment T_2 i.e. 100% RDN through vermicompost (10.19 cm) than all other treatments

except treatment T_3i.e. 100% RDN through poultry manure (9.67 cm), where it was found at par with each other. Whereas, absolute control (T_8) recorded lowest length of spike (6.91 cm). Vermicompost contains more number of nitrogen-fixing, phosphate-solubilizing and other beneficial microbes, antibiotics, vitamins, hormones, enzymes etc. which has better effects on growth and yield of plants. Agrawal *et al.,* (2003) [1] observed that application of FYM (50%) + vermicompost (50%) recorded statistically higher number of grain weight.

The mean grain yield and straw yield differences of wheat were differed significantly due to different organic nitrogen management treatments under study.

The mean grain and straw yield of wheat were 28.95 q ha^{-1} and 52.11 q ha^{-1} respectively. The mean grain and straw yield of wheat differed significantly due to various organic nitrogen management treatments under study. The data summarized in Table 2, revealed that application of 100% RDN through vermicompost (T_2) produced significantly higher grain yield and straw yield (35.68 and 64.22 q ha^{-1} respectively) as compared to all other treatments however, it was at par with T_3, $T_1$and T4. Whereas, absolute control i.e. treatment T_8 produced lowest grain and straw yield (16.74 and 30.13 q ha^{-1} respectively).

The maximum values of grain and straw yield were recorded in Treatment T_2 i.e. 100% RDN through vermicompost might be due to and optimum availability of nutrients from RDN and improvement in growth and yield attributes. Among the organic nitrogen management treatments, significant improvement in grain and straw yield were also observed with 100% RDN through poultry manure and it might be due to nutritional richness, quick mineralization, balanced C: N ratio and more availability of nitrogen compounds from vermicompost. Vermicompost also contains more number of nitrogen-fixing, phosphate solubilizing and other beneficial microbes, antibiotics, vitamins, hormones, enzymes etc., which has better effects on growth and yield of plants (Nehara *et al.* 2001, Sharma and Banik 2014) [9, 10]. Agrawal *et al.* (2003) [1] evaluated effect of Vermicompost and FYM on growth and yield of wheat revealed that application of 75% RDN through vermicompost + 25% RDN through FYM registered higher values of yield attributes *viz.*, dry weight and test weight. These results are in agreement with the findings of Sangeetha *et al.* (2010) and Meena *et al.* (2012) [11, 8].

Table 2: Yield and yield attributes *viz.*, length of spike (cm), number of spikelets $spike^{-1}$, number of grain $spike^{-1}$, grain weight $spike^{-1}$ (g), test weight (g), grain yield (q ha^{-1}) and straw yield (q ha^{-1}) influnced by different organic nitrogen sources

Treatments	Length of spike (cm)	Number of spikelets $spike^{-1}$	Number of grain $spike^{-1}$	Grain weight $spike^{-1}$ (g)	Test weight (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
T_1	8.73	25.67	62.87	2.63	41.87	31.88	57.39
T_2	10.19	29.20	64.46	2.77	43.04	35.68	64.22
T_3	9.67	28.73	64.13	2.74	42.78	33.04	59.47
T_4	8.97	26.87	63.20	2.66	42.16	30.25	54.45
T_5	8.53	24.53	62.26	2.58	41.19	28.15	50.67
T_6	7.83	22.67	59.60	2.41	40.49	28.10	50.58
T_7	8.23	23.26	60.20	2.45	40.62	27.75	49.95
T_8	6.91	22.07	54.53	2.19	40.35	16.74	30.13
S.E.m ±	0.29	0.43	0.37	0.07	0.26	2.44	4.39
C.D. at 5%	0.87	1.31	1.12	0.10	0.79	7.39	13.31
General mean	8.63	25.37	61.41	2.55	41.59	28.95	52.11

Conclusion

Among the different organic nitrogen sources, application of 100% RDN through vermicompost favourably influenced the growth, yield and yield attributes of wheat during *Rabi* season.

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References

1. Agrawal SB, Anoop Sing, Dwivedi G. Effect ofvermicompost and FYM on growth and yield of wheat (*Triticum aestivum* L.). Plant Archives. 2003; 3(1):9-14.
2. Anonymous. Agricultural statistics at a glance. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Gov. of India, New Delhi, 2016.
3. Atiyeh RM, Lee S, Edwards CA, Arancon NQ, Metzger JD. The influence of humic acids derived from earthworms processed organic wastes on plant growth. Biores. Technol. 2002; 84:7-14.
4. Bos C, Juillet B, Fouillet H, Turlan L, Dare S, Luengo C *et al*. Postprandial metabolic utilization of wheat protein in humans. Am. J Clin. Nutr. 2005; 81:87-94.
5. Chaoui I, Zibiliske M, Ohno T. Effect of earthworm casts and compost on microbial activity and plant nutrient availability. Soil Biol. Biochem. 2003; 35:295-302.
6. Choudhary VS, Singh V, Gola RP, Kumar S. Influence of integrated nutrient management on the physiological growth of wheat. Res. Crops. 2007; 8(1):62-64.
7. Ghosh PK, Ramesh P, Bandyopadhyay KK, Tripathi AK *et al*. Comparative effectiveness of cattle manure, poultry manure, phosphocompost and fertilizer-NPK on three cropping system in vertisols of semi-arid tropics. Bio resource Technology. 2004; 95:77-83,
8. Meena RN, Singh K, Ranasingh N. Yield, economics and nutrient uptake of scented rice (*Oryza sativa* L.) as influenced by various organic nitrogen sources. Environ. and Ecology. 2012; 30(3):444-448.
9. Nehara AS, Hooda IS, Singh KP. Effect of integrated nutrient management on growth and yield of wheat. Indian J Agron. 2001; 46(1):112-117.
10. Sharma RC, Banik P. Vermicompost and Fertilizer application Effect on productivity of baby corn (*Zea mays* L.) and soil health. Compost Sci. and Utilization. 2014; 22:88-92.

11. Sangeetha SP, Balakrishnan A, Bhuvaneswari J. Organic nutrient sources on growth and yield of rice. Madras Agric. J. 2010; 97(7-9):251-153.
12. Tomati O, Galli E, Grapelli A, Dilena G. Effects of earthworm cast on protein synthesis in radish (*Raphanus sativum*) and lettuce (*Lactuca sativa*) seedlings. Biology and Fertility of Soils. 1990; 9:1-2.