International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1523-1526

Received: 02-05-2018
Accepted: 04-06-2018

Shivraj Choudhary
M.Sc. Scholar, Department of Soil Science and Agricultural Chemistry, Udaipur, Rajasthan, India

DP Singh
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Udaipur, Rajasthan, India

SL Mundra
Professor, Department of Agronomy Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Hemraj Jat
Ph. D Scholar, Department of Soil Science and Agricultural Chemistry, Udaipur, Rajasthan, India

Piyush Choudhary
M.Sc. Scholar, Department of Agronomy Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Correspondence
Shivraj Choudhary
M.Sc. Scholar, Department of Soil Science and Agricultural Chemistry, Udaipur, Rajasthan, India

Effect of vermicompost, biofertilizer and fertility levels on growth and yield of wheat [*Triticum aestivum* L.]

Shivraj Choudhary, DP Singh, SL Mundra, Hemraj Jat and Piyush Choudhary

Abstract
A field experiment was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur during *rabi* 2015-16. The experiment consisted of treatments such as application of different vermicompost levels (V_0, V_1 and V_2), bio-inoculation of seeds with *Azatobactor* + PSB, different fertility levels (F_1, F_2 and F_3). The experiment was conducted in factorial randomized block design and replicated thrice. Results of field experiment revealed that application of 4 t vermicompost (V_2), bio-inoculation of seed with Azotobactor + PSB (B_1) and in fertility level 100 % RDF had significant effect on various growth parameter viz., plant height at harvest (V_2 = 97.04, B_1 = 96.27 & 100 % RDF = 97.10), dry matter accumulation (at 60 DAS, 90 DAS & harvest) and in yield parameter viz., total number of tillers at harvest, grain yield (V_2 = 5210, B_1 = 5155 & 100 % RDF = 5468 Kg ha^{-1}), straw yield (V_2 = 8104, B_1 = 7901 & 100 % RDF = 8243 Kg ha^{-1}) and biological yield (V_2 =13314, B_1 = 13056 & 100 % RDF = 13712 Kg ha^{-1}) and the test weight is statistically at par with 2 t ha^{-1} vermicompost (V_1), without inoculation of seed (B_0) and 75 % RDF. Harvest index was non effected by various treatments.

Keywords: Effect of vermicompost, fertility levels, yield of wheat

Introduction

The cruising population is now confronted by a major shortage of plant produce and there is a worldwide demand to produce high yielding quality crops to meet the ever increasing population requirements. Better soil, crop and nutrient management practices play a pivotal role to achieve this. This would narrow down the yield gap between achievable and actual yields besides furnishing valuable feedback information regarding yield sustainability. To meet the world's future food security and sustainability needs, food production must grow substantially while agriculture's environmental impact must shrink dramatically at the same time (Foley *et al*., 2011) [3]. The indiscriminate use of inorganic fertilizers for the past 50 years without any organic manures resulted in the large scale deficiency of micro nutrients which play an important role in enhancing the quality and quantity of the agriculture produce though their increment in enzyme system and photosynthesis. Further, nutrient loses in inorganic fertilizer is very high and loss of nutrients like NO_3 sometime leads to water pollution.

The integrated use of organic materials and inorganic nitrogenous fertilizers has received considerable attention in the past with a hope of meeting the farmers' economic need as well as maintaining favorable ecological conditions on long-term basis (Kumar *et al.*, 2007) [6]. The integrated nutrient management helps to restore and sustain fertility and crop productivity. It may also help to check the emerging deficiency of nutrients other than N, P and K. Further, it brings economy and efficiency in fertilizers. The integrated nutrient management favorably affects the physical, chemical and biological environment of soils. Integrated nutrient supply involving conjunctive use of fertilizers and organic sources of nutrients (Roy, 1992) [9] assumes greater significance. The major components of organic integrated nutrient management system involves the organic manures with variable nutrient release patterns mainly compost, green manures, vermicompost, crop residue and bio-fertilizers along with natural soil reserves. Farmyard manure improves the physical condition of soil by increasing water holding capacity for maximum utilization of water. It also improves the chemical and biological condition of soil by increasing cation exchange capacity and providing various vitamins, hormones and organic acids which are very important for soil aggregation and for beneficial micro-organism which are involved in various biochemical processes and release of nutrients.

Soils containing a high microbial diversity are characteristic of a healthy soil plant relationship, whereas those with low microbial diversity are characterized as an unhealthy soil that often hardly responds to environmental changes (Tejada *et al*., 2011). Soil enzymatic activities can be used as an index of soil fertility and microbial functional diversity (Nannipieri *et al*., 2002; Maurya *et al.*, 2011) [8, 7] in catalyzing several biochemical reactions which are necessary for the life processes of soil microorganisms, organic wastes decomposition, organic matter formation and nutrients cycling. Incorporation of organic manures influenced soil enzymatic activity either because of the composition of the added materials themselves or because increased microbial activity of the soil (Deforest *et al*., 2012) [2].

Material and Methods

A field experiment was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur during *rabi* 2015-16. The experiment comprised of three vermicompost level (V_1= control, V_2 = 2 t ha^{-1} and V_3= 4 t ha^{-1}) two biofertilizer levels (B_0= control and B_1= *Azotobector* + PSB) and three fertility levels (F_1= 25% RDF, F_2=75 % RDF and F_3 = 100% RDF) with three replications. The net plot size was 4.00m x 2.25m during the experiment. The variety of wheat was Raj-4037 and seed rate @ 100 kg ha^{-1}. The wheat crop was sown by drilling method and spacing was 22.5 cm. and seven irrigation were given during crop growth period.

Result and Discussion

Growth

The result of experiment revealed that effect of Vermicompost, Biofertilizer and Fertility levels on plant height, dry matter accumulation at successive stages, total number of tillers at harvest and test weight of wheat was found significant. Among the different treatments application of vermicompost @ 4 t ha^{-1}, Inoculation with biofertilizers and 100 % RDF registered maximum value for plant height (97.04, 96.27 and 97.10 cm, respectively), dry matter accumulation at successive stages, total number of tillers at harvest (498.52, 494.62 and 496.58, respectively) and test weight (39.66, 39.65 and 39.64 g, respectively) and pant height, dry matter accumulation at 60 DAS, total numbers of tillers and test weight remained at par with 2 t ha^{-1} vermicompost, inoculation with biofertilizer and 75% RDF.

An application of vermicompost 4 t ha-1 was found significantly superior over control with respect to plant height, higher dry matter accumulation at all stages of growth, total number of tillers and test weight. The same results were obtained during the experiments conducted by Jaga and Singh (2010) [4], Singh *et al.* (2012) [13] and Choudhary *et al.* (2017) [1]. Under present investigation, distinct superiority of *Aztobactor* + PSB in improving growth could be ascribed to the better establishment of microorganisms population in the rhizosphere besides providing physical properties of soil and also ensured availability of nutrients through PSB, which enhanced availability of phosphorus from soil. It has been well emphasized that dual inoculation of beneficial microbes plays a vital role in improving three major aspects of yield determination *i.e*. formation of vegetative structure for higher photosynthesis, strong sink strength through development of reproductive structure and production of assimilates to fill economically important sink. (Jaga and Singh 2010 [4] and Shukla *et al.*, 2013). An adequate supply of phosphorus early in the life of a plant is important in laying down the primordial for its reproductive parts. Similar results were obtained by Kashyap *et al.* 2017 and Choudhary *et al.*, 2017 [1].

Table 1: Effect of vermicompost, biofertilizer and fertility level on plant height (cm), dry matter accumulation (g plant^{-1}), total number of tillers and test weight of wheat

Treatments	Plant height at harvest (cm)	Dry matter accumulation (g meter^{-1} row length)			Total no. of tillers plant^{-1} at harvest	Test weight (g)
		60 DAS	90 DAS	At harvest		
Vermicompost						
Control	90.27	150.79	191.67	226.83	473.53	37.16
2.0 t ha^{-1}	96.54	162.24	197.67	238.39	484.95	38.58
4.0 t ha^{-1}	97.04	165.78	203.44	252.00	498.52	39.66
SEm±	1.32	2.43	1.31	3.40	5.43	0.51
CD (P=0.05)	3.79	7.00	3.76	9.76	15.59	1.46
Biofertilizer level						
B_0	92.96	156.00	195.59	231.52	476.71	37.28
B_1	96.27	163.20	199.59	246.63	494.62	39.65
SEm±	1.08	1.99	1.07	2.77	4.43	0.42
CD (P=0.05)	3.10	5.71	3.07	7.97	12.73	1.19
Fertility level						
50 % RDF	91.19	153.15	195.17	232.46	475.72	37.47
75 % RDF	95.55	161.92	197.50	238.55	484.70	38.28
100% RDF	97.10	163.74	200.11	246.21	496.58	39.64
SEm±	1.32	2.43	1.31	3.40	5.43	0.51
CD (P=0.05)	3.79	7.00	3.76	9.76	15.59	1.46

Application of 100 per cent RDF along with bio-fertilizers significantly recorded the highest plant height (98.97 cm), dry mater accumulation at harvest and test weight compared to all other treatments and found significant over 50 per cent RDF with and without bio-fertilizer.

Table 1.1: Combined effect of biofertilizer & fertility level on plant height (cm) at harvest of wheat

Bioferilizers Ferlility level	Plant height (cm)		Dry matter accumulation (g plant^{-1})		Test weight (g)	
	B_0	B_0	B_1	B_0	B_0	B_1
50 % RDF	89.83	36.58	226.79	238.13	36.58	38.36
75 % RDF	93.80	37.09	230.67	246.44	37.09	39.47
100 % RDF	95.24	38.16	237.09	255.32	38.16	41.13
SEm±	1.8671		4.8042		0.7191	
CD (P=0.05)	5.3660		13.8075		2.0666	

Yield

The result of experiment revealed that effect of Vermicompost, Biofertilizer and Fertility levels on yield (grain, straw and biological) and harvest index of wheat was found significant. Among the different treatments, application of vermicompost @ 4 t ha^{-1}, Inoculation with biofertilizers and 100 % RDF registered maximum value for grain yield (5210.30, 5155.1 and 5468.4 kg ha^{-1}, respectively), straw yield (8104.4,7901.8 and 8243.8 kg ha^{-1}, respectively) and biological yield (13314.7, 13056.9 and 13712.2 kg ha^{-1}, respectively). The effect of different treatments on harvest index was non-significant and grain yield, straw yield and biological yield remained at par in treatment 2 t ha^{-1} vermicompost, inoculation with biofrtilizer and 75% RDF. The significant increase in grain and straw yields of wheat under the influence of vermicompost was largely a function of improved growth and consequent increase in different yield attributes. The possible reason could be ascribed to the favorable effect on soil properties due to formation of more humus colloidal complex coupled with higher nutrient content of vermicompost. The same results were obtained by Sheoran *et al.* (2015) [11]. The significant increase in straw yield under dual inoculation of *Azotobacter* + PSB seems to be due to their direct effect in improving biomass plant-1, while indirect effect might be on account of increase in morphological parameters. (Jaga and Singh, 2010) [4]. However, when N2 fixers and PSB were used together there was significant additive effect. Biofertlizer application significantly improved grain and straw yield of wheat was also reported by (Verma *et al.*, 2014). The uptake of N, P and K increased with progressive increase in the supply of NPK to the crops because of higher availability of these nutrients resulting in higher biomass yield. The obtained results were in agreement with Sepehya *et al.*, (2016) [10] and Yadav *et al.*, (2017) [1].

Table 2: Effect of vermicompost, biofertilizer and fertility level on grain, straw and biological yield (kg ha^{-1}) and harvest index (%) of wheat

Treatments	Yield (kg ha^{-1})			Harvest index (%)
	Grain	Straw	Biological	
Vermicompost level				
Control	4841.0	7161.8	12002.8	40.41
2.0 t ha^{-1}	5036.6	7720.2	12756.8	39.50
4.0 t ha^{-1}	5210.3	8104.4	13314.7	39.21
SEm±	99.5	189.9	212.0	0.78
CD (P=0.05)	286.0	545.8	609.2	NS
Biofertilizers				
B_0	4903.5	7422.4	12325.9	39.91
B_1	5155.1	7901.8	13056.9	39.50
SEm±	81.3	155.1	173.1	0.64
CD (P=0.05)	233.5	445.6	497.4	NS
Fertility level				
50 % RDF	4558.7	7017.3	11576.0	39.45
75 % RDF	5060.8	7725.2	12786.0	39.69
100 % RDF	5468.4	8243.8	13712.2	39.98
SEm±	99.5	189.9	212.0	0.78
CD (P=0.05)	286.0	545.8	609.2	NS

Application of 100 per cent RDF along with bio-fertilizers significantly recorded the highest plant height (98.97 cm), dry mater accumulation at harvest and test weight compared to all other treatments and found significant over 50 per cent RDF with and without bio-fertilizer.

Table 2.1: Combined effect of biofertilizer and fertility level on biological yield (kg ha^{-1}) of wheat

Bioferilizers Ferlility level	Biological yield (kg ha^{-1})	
	B_0	B_1
50 % RDF	11240.74	11911.35
75 % RDF	12449.42	13122.58
100 % RDF	13287.61	14136.84
SEm±	299.7624	
CD (P=0.05)	861.5255	

Conclusion

It is concluded that wheat crop supplied with ve-rmicompost 4 t ha^{-1}, 100 per cent RDF and *Azotobacter* + PSB observed highest growth, yield and grain attributes. Combine effect of *Azotobacter* + PSB and 100 per cent RDF gave significant effect on plant height, dry matter accumulation, test weight and biological yield. There was no significant effect of vermicompost, biofertilizer and fertility levels on harvest index.

References

1. Choudhary RR, Yadav HL, Choudhary SL, Prajapat AL, Choudhary R. Effect of Integrated Nutrient Management on Growth of Wheat (*Triticum aestivum*) Cultivars. International Journal Current Microbiology Applied Science. 2017; 6(8):2369-2374.
2. Deforest JL, Smemo KA, Burke DJ, Elliott HL, Becker JC. Soil microbial responses to elevated phosphorus and pH in acidic temperate deciduous forests. Biogeochemistry. 2012; 109:189-202.

3. Foley JA, Ramankutty N, Brauman KA, Cassidy ES, Gerber JS, Johnston M *et al.* Solutions for a cultivated planet, 2011. https://escholarship.org/uc/item/6xw5g085.
4. Jaga PK, Singh V. Effect of biofertilizer, nitrogen and sulphur on sorghum–mustard cropping system. Proceedings of National Seminar on Soil Security for Sustainable Agriculture held at College of Agriculture, Nagpur, 2010, 37-40.
5. Kashyap AK, Bahadur L, Tewari SK. Integrated nutrient management in oat (*Avena sativa* L.) under reclaimed sodic soil, Indian Journal of Agricultural Research, 2017; 51(1):78-81.
6. Kumar A, Tripathi HP, Yadav DS. Correcting nutrient for sustainable crop production. Indian Journal of Fertilizer, 2007; 2:37-44.
7. Maurya BR, Vimal S, Dhyani PP. Enzymatic activities and microbial population in agri-soils of Almora district of centralHimalaya as influenced by altitudes. International Journal of Soil Science. 2011; 6:238-248.
8. Nannipieri P, Kandeler E, Ruggiero P. Enzyme activities and microbial and biochemical processes in soil. In: Burns, RG and Dick RP (Eds.), Enzymes in the Environment: Activity, Ecology and Applications. Marcel Dekker, New York, 2002, 1-33.
9. Roy RN. Integrated Plant Nutrition System.An overview. In: Fertilizers, Organic Manure, Recyclable Wastes and Bio-Fertilizers, Tandon, H.L.S. (Ed.). Fertilizer Development and Consultation Organization, New Delhi, 1992.
10. Sepehya S, Subehia SK, Kurbah I, Dhiman S. Long-term effect of integrated nutrient management on chemical and microbial properties of soil under rice (*Oryza sativa* L.) - wheat (*Triticum aestivum* L.) system in an acid alfisol. International Journal of Plant & Soil Science. 2016; 17(3):1-9.
11. Sheoran S, Raj D, Antil RS, Mor VS, Dahiya DS. Productivity, Seed Quality and Nutrient Use Efficiency of Wheat *(Triticum aestivum)* under organic, inorganic and integrated nutrient management practices after twenty years of fertilization. Cereal Research Communications, 2015; 45(2):315-32.
12. Shukla L, Tyagi SP, Manjunath R, Jeetender J, Saxena AK. Effect of vermicompost and microbial inoculants on soil health, growth and yield of HD 2687 wheat (*Triticum aestivum*). The Indian Journal of Agricultural Sciences. 2013; 83(3):43-48.
13. Singh KL, Nandal KP, Hari Om DP, Thakral SK. Effect of organic and inorganic sources of fertilizer on growth parameters and productivity of wheat in rice-wheat system. Annals of Biology. 2012; 28(1):36-40.
14. Singh RV, Kumar R. Effect of organic and inorganic fertilizers on growth yield and quality and nutrients uptake of wheat under late sown condition. Progressive Agriculture. 2010; 10(2):341-344.
15. Verma VK, Chaudhary S, Singh V, Gupta SK, Kumar H. Effect of integrated soil fertility management practices on production and productivity of wheat (*Triticum aestivum*) in alluvial soils of central plain zone of Uttar Pradesh. International Journal of Agricultural Sciences. 2014; 10(2):735-738.
16. Yadav A, Kumar A, Prakash V, Kumar N, Tiwari A, Yadav RK. Effect of integrated nutrient management on soil properties, yield attributes and yield of wheat (*Triticum aestivum*). International Journal of Current Microbiology and Applied Sciences. 2017; 6(10):225-228.