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Effect of different organic manure on soil biological properties in chickpea (*Cicer arietinum* L.)

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Abstract
A field experiment was conducted during rabi season of 2016-2017 to find out effect of different organic manure on soil biological activity in chickpea (*Cicer arietinum* L.) at Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan). Results indicated that addition of different organic manure significantly increase the microbial population in chickpea. Vermicompost 2 t ha^{-1} recorded significantly higher bacterial, fungal and actinomycetes population in the soil at harvest compared to other organic manure treatments. Among liquid organic manures, application of panchagavya 3 per cent had recorded significantly higher bacterial, fungi and actinomycetes count in soil as compared to other treatments. Interaction effect between organic manure and liquid organic manures, application of vermicompost 2 t ha^{-1} with panchagavya 3 per cent had recorded significantly higher fungi count as compared to other treatments.

Keywords: Chickpea, organic manure, liquid organic manures, microorganism

Introduction
Organic farming is widely recognized as a sustainable system and there is also a growing interest from consumers in organic food because of the perceived advantages to the environment and human health. Every year the area of organic agriculture in the world is increasing. Soil health is the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health" (Doran and Parkin 1994) [6]. Several studies have reported that a positive effect of organic farming on soil health including microbial community traits (Lori *et al.,* 2017) [12]. The use of intensive crops, fertilizers and chemical plant protection products causes changes in the soil environment in agro-ecosystems (Gajda and Przewłoka 2012) [7]. The excess use of fertilizer has led to the entry of harmful compounds into food chain, death of natural microorganism so it is believed that application of organic fertilizer can solve many of these problems as this system is believed to maintain soil productivity and enhancing natural processes and cycles in harmony with environment. In organic farming, crop residues or livestock manure return to the fields, including multiannual crops and legumes. This improves soil quality by accumulating organic matter in the soil and by natural processes without chemical intervention. Pulse crops play an important role in Indian agriculture and India is the largest producer and consumer of pulses in the world. Pulses account for 35.2 per cent of the world area and 30 per cent of world's production. Pulses contain high percentage of quality protein nearly three times as much as cereals (Upadhayay *et al.,* 1999) [15]. Thus, they are cheaper source of protein to overcome malnutrition problem among human beings. In India chickpea are grown over an area of 10.17 m. ha with a production of 11.35 mt and a productivity of 1116 kg ha^{-1} (Directorate of Economics and Statistics, 2020). Important chickpea growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Andhra Pradesh, Uttar Pradesh and Karnataka. Organic manure (Vermicompos, farmyard manure) is becoming an important component of environmentally sound agriculture. Recently, the use of organic materials as fertilizers for crop production has received attention for sustainable crop productivity (Arif *et al.,* 2014) [2]. Organic manure act not only as a source of nutrients and organic matter, but also increase size, biodiversity and activity of the microbial population in soil, influence structure, nutrients get turnover and many other changes related to physical, chemical and biological parameters of the soil (Albiach *et al.,* 2000) [1]. Organic nutrition also enhanced the soil enzyme activities like dehydrogenase and phosphatase.

Dehydrogenase activity had been commonly used as indicator of biological activity in soils because of its occurrence only within living cells, unlike other enzymes which can occur in an extra cellular state.

Material and Method

The present study was undertaken to evaluate the response of different organic source on soil biological activity in chickpea. The experimental conducted at 24º35' N latitude and 74º42' E longitude and 579.5 meters above mean sea level and this region falls under agro-climatic zone IV a (Sub-humid Southern Plain and Aravalli Hills) of Rajasthan, India. The experiment was laid out in randomized block design (factorial) comprised of four organic manure treatments (control, FYM 5 t ha^{-1}, comopost 3 t ha^{-1}, vermicompost 2 t ha^{-1}) and four treatment of liquid manure spray (control, panchagavya 3 per cent, cowurine 10 per cent, vermiwash 10 per cent) with three replication. The soil was clay loam in texture, the pH of the soil was slightly alkaline (8.10) and it was medium in organic carbon (0.67%), low in available nitrogen content (280 kg ha^{-1}), medium in available phosphorus (18.90 kg ha^{-1}) and medium in available potassium (347 kg ha^{-1}). Organic manures were applied 30 days before sowing of crop. Liquid organic manures panchagavya 3 per cent, vermiwash 10 per cent, cow urine 10 per cent were applied as per the treatments at 50 per cent flowering. Vermiwash is liquid nutrient plant growth promoting substance obtained by the vermiculturing/vermicomposting which contains major nutrients, minor elements, PGRs antibiotics, microflora and others was extracted at advanced stage of vermicomposting by sprinkling water in vermitanks. Cow urine is directly collected from cow one day before spraying for the crop. Panchagavya was prepared by using 6 kg cow dung and 1 kg ghee mixed thoroughly and kept for 2 days, 4 litre cow urine + 10 litre water was added and was fermented for 15 days by stirring daily twice. Then 3 litre of sugarcane juice, 2 litre of cow milk, 2 liter of curds, 2 liter of coconut water, 250 g of jaggery and 10 No's ripened banana were added and mixture was allowed to ferment for 15 days. The numbers of bacteria, fungi and actinomycetes colony were determined in each plot by serial dilution and agar plate method (Pramer and Schmidt, 1964) [14]. The economics were worked out by considering the prevailing market price. Ideal weather conditions prevailed during experimental period. The crop growth was normal statistical analysis of the data was carried out by adopting the procedure of Gomez and Gomez (1984) [9].

Result and Discussion

Effect on soil biological activity

The obtained results (table 1) clearly indicated that among the organic manure treatment, application of vermicompost 2 t ha^{-1} had recorded significantly higher bacterial count (46.82 × 105 cfu g^{-1} of soil), fungi count (87.24 × 104 cfu g^{-1} of soil) and actinomycetes count (33.34 × 106 cfu g^{-1} of soil) as compared to control, FYM 5 t ha^{-1} and compost 3t ha^{-1} while actinomycetes count was found at par with compost 3 t ha^{-1} (31.80 × 106 cfu g-1 of soil). Under liquid organic manure application of panchagavya 3 per cent had recorded significantly higher bacterial count (41.42 × 105 cfu g^{-1} of soil), higher fungi count (80.59 × 104 cfu g^{-1} of soil) and higher actinomycetes count (33.83× 106 cfu g^{-1} of soil) as compared to control, cow urine 10 per cent and vermiwash 10 per cent however actinomycetes count was found at par with vermiwash 10 per cent (32.20 × 106 cfu g^{-1} of soil). The interaction effect between organic manure and liquid organic manures, application of vermicompost 2 t ha^{-1} with panchagavya 3 per cent (98.08× 104 cfu g^{-1} of soil) had recorded significantly higher fungi count as compared to other treatments. This could be due to cumulative effect of various sources of organic manures in increasing organic carbon content of soil which acted as carbon and energy source for microbes and their quick build up in the soil (Barik *et al.*, 2006, Palekar, 2006 and Kiran *et al*., 2015) [3, 13, 11] evolved. Application of vermicompost 2 t ha^{-1} also recorded significantly higher seed yield (1916 kg ha^{-1}) as compared to rest of the treatments. Likewise, in standing crop application of liquid organic manure spray panchagavya 3 per cent recorded significantly higher number of seed yield (1888 kg ha^{-1}) as compared to control.

Addition of FYM or vermicompost or other organic manure in soil which leads to an increase in microbial population and activity due to more amounts of available carbon, organic matter and nutrients available to soil micro-organism which provide more energy. The addition of all organic inputs enhanced the microbial counts in soil, which might be due to carbon addition and changes in physico-chemical properties of soil. The carbon and other nutrients in manure can increase microbial biomass and soil respiration rates by two to three times. Farm yard manure supplies nitrogen, phosphorus, potassium and many other micronutrients which improves physical and chemical properties and health of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increase in cation exchange capacity, stimulation of soil flora and fauna etc. The enzymatic activity in the soil is mainly of microbial origin and is derived from intracellular, cell-associated or free enzymes (Das and Verma 2011). Increased microbial biomass and diversity is an important attribute for soil organic matter quality because soil microorganisms play a key role in soil nutrient cycling. They accelerate the breakdown of organic substances and mineralize the organic nutrient contained in manures into inorganic forms which available to plant available. The application of vermicompost not only add plant nutrients and growth regulator to the soil but also increases soil water retention capacity, microbial population, humic content and aeration in the soil. Soil microorganisms are the main elements in the biochemical processes taking place in the soil and involved in the decomposition of organic residues, the formation of humus, the circulation of various biogenic components and their transformation into available forms to plants, as well as in the degradation of pollutants (Gałązka *et al.*, 2016) [8]. Enzymatic activity is one of the parameters measured in the assessment of soil fertility. Numerous research indicate that organic farming has a positive effect on the soil's microbial biomass carbon and nitrogen contents, compared to other farming systems (Kabiri *et al.*, 2016) [10].

Table 1: Effect of different organic manures on soil biological activity of soil after harvest of chickpea

Treatments	Microbial count (CFU g^{-1} of soil)			Seed Yield (Kg ha^{-1})
	Bacteria (No. X 10^5)	Fungi (No. X 10^4)	Actinomycetes (No. X 10^6)	
Sources of organic manures				
Control	28.70	66.02	25.62	1310
FYM 5 t ha^{-1}	33.49	69.35	30.74	1636
Compost 3 t ha^{-1}	40.26	81.31	31.80	1736
Vermicompost 2 t ha^{-1}	46.82	87.24	33.34	1916
S.Em±	0.46	0.61	0.65	54
CD (P=0.05)	1.32	1.75	1.86	156
Liquid organic manures spray				
Control	30.24	70.11	25.78	1371
Panchagavya 3 per cent	41.42	80.59	33.83	1888
Cow Urine 10 per cent	38.13	73.33	32.20	1556
Vermiwash 10 per cent	39.49	79.88	29.68	1783
S.Em±	0.46	0.61	0.65	54
CD (P=0.05)	1.32	1.75	1.86	156

Table 2: Interaction effect of source of organic manure and liquid organic manure spray on fungi count in soil

Treatments	Fungi (No. X 10^4 cfu g^{-1} of soil)			
	Control	FYM 5 t ha^{-1}	Compost 3 t ha^{-1}	Vermicompost 2 t ha^{-1}
Control	61.39	59.01	75.03	85.01
Panchagavya 3 per cent	68.61	72.57	83.12	98.08
Cow Urine 10 per cent	66.45	72.16	82.22	72.49
Vermiwash 10 per cent	67.62	73.68	84.84	93.39
S.Em±	1.210			
CD (P=0.05)	3.495			

Conclusion

Organic management practices have the potential to keep the soil health as well as sustain the crop yield over a longer period of time. After perusal of the results obtained in the study, it may be concluded that under different organic treatments the application of vermicompost 2 t ha^{-1} and under liquid organic manure panchagavya 3 per cent significantly increase the bacterial, fungi, actinomycetes count, enzymatic activity and yield of crop over control treatment. Since, agricultural sustainability is a priority in the modern day intensive agriculture, the positive effect of different organic manure treatments on the soil microbiological parameters and yield of chickpea is encouraging.

Reference

1. Albiach R, Canet R, Pomares F, Ingelmo F. Microbial biomass content and enzymatic activities after the application of organic amendments to a horticultural soil. Bioresearch Technology. 2000;75:43-48.
2. Arif M, Jalal F, Jan MT, Muhammad D. Integration of biochar and legumes in summer gap for enhancing productivity of cereal based cropping system. Sarhad Journal of Agriculture. 2014;30(4):393-403.
3. Barik AK, Arindam Das, Giri AK, Chattopadhyaya GN. Effect of integrated plant nutrient management on growth, yield and production economics of wet season rice. Indian Journal of Agriculture Science. 2006;76:657-660.
4. Das SK, Varma A. Role of enzymes in maintaining soil health.-In: Shukla G, Varma A. (eds.) Soil Enzymology, Soil Biology 22, Springer- Verlag Berlin Heidelberg USA. 2011.
5. Directorate of Economics and Statistics.. Agricultural Statistics at a Glance 2020. Department of Agriculture, Cooperation and farmer welfare. All India Area, Production and Yield of Gram. Table 4.13(b), 2020, 63pp.
6. Doran JW, Parkin TB. Defining and assessing soil quality. In: J.W. Doran, D.C. Coleman, D.F. Bezdicek, B.A. Stewart (eds.), Defining Soil Quality for a Sustainable Environment, Soil Science Society of America, Madison, 1994, 3-21.
7. Gajda AM, Przewłoka B. Soil biological activity as affected by tillage intensity. International Agrophysics. 2012;26(1):15-23.
8. Gałązka A, Łyszcz M, Abramczyk B, Furtak K, Grządziel J, Czaban J, *et al.* Biodiversity of the soil environment – review of parameters and methods in soil biodiversity analyses. Monografie i Rozprawy Naukowe IUNG–PIB, Puławy, 2016, 49. (in Polish).
9. Gomez KA, Gomez AA. Statistical Procedure for Agricultural Research, An International Rice Research Institute Book, A Wiley - Inter Science, John Wily and Sons Inc., New York, United States of America, 1984.
10. Kabiri V, Raiesi F, Ghazavi MA. Tillage effects on soil microbial biomass, SOM mineralization and enzyme activity in a semi-arid Calcixerepts. Agriculture, Ecosystems & Environment. 2016;232:73-84.
11. Kiran, Satyanarayana R, Ramesh kumar C. Effect of nutrient management practices through organics on growth, yield & economics of chickpea under rainfed condition. Green Farming, 2016;7, 880-883.
12. Lori M, Symnaczik S, Mader P, De Deyn G, Gattinger A. Organic farming en- hances soil microbial abundance and activity: A meta-analysis and meta-regression. PLOS ONE. 2017;12(7):e0180442.
13. Palekar S. Text book on shoonya bandovalada naisargika krushi, published by Swamy Anand, Agri Prakashana, Bangalore. 2006.
14. Pramer D, Schmidt EL. Experimental soil microbiology. Burgers Publication Minneapolis, Minnesota, USA. 1964.
15. Upadhayay RG, Sharma S, Drawal NS. Effect of Rhizobium inoculation and graded levels of P on the growth and yield of green gram. Legume Research. 1999;22:277-279.