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A Practice to Enhance Soil Physico-chemical Properties and Viable Microbial Count as Effected by Organic Nutrient Sources in Garden Pea under Mid Hill Zone of Himachal Pradesh

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ABSTRACT

Background: Excessive use of agrochemicals and fertilizers in the post era of green revolution has led to a long term toxic effect on soil and threatened the fragile ecosystem. Application of inorganic inputs has increased the productivity of produce, but has severely impacted environment and soil health. In the light of this view, there is a need to conserve soil by adopting organic farming systems.

Methods: The experiment was laid out in randomized complete block design (RCBD) factorial with three replications comprising of twelve treatment combinations of four levels of organic manure and three levels of liquid manure. Biofertilizers (Rhizobium + Phosphate solubilizing bacteria) were applied @ 200 g/10 kg as seed and 5 kg/ha as soil application uniformly to all the treatment combinations.

Result: Results revealed that treatment combination of M_3J_2 (FYM @ 15 t/ha + jeevamrit @ 10 per cent drenching) + biofertilizers resulted in maximum organic carbon (1.37%), nitrogen (375.31 kg/ha), phosphorus (62.62 kg/ha), potassium (345.33 kg/ha), viable microbial count (195.25 cfu/g of soil) along with lowest pH and electrical conductivity.

Key words: FYM, Garden pea, Jeevamrit, Organic, PSB, Rhizobium, Soil properties.

INTRODUCTION

Organic farming is not a destination to be reached, but it is a journey to accomplish a mission. Excessive use of agrochemicals and fertilizers in the post era of green revolution has polluted the environment and threatened the fragile ecosystem (Kannan *et al*., 2005). In developing countries, current agricultural practices are based on unsustainable practices which has led to a long term toxic residual effect on soil, water and air (Meena *et al*., 2020). About three million cases of agrochemical poisoning has been stated by World Health Organization (2006) every year, resulting in 2,50,000 deaths worldwide. The rising demand for food by the rapidly increasing population has pushed many nations for overwhelming application of inorganic fertilizers and other agrochemicals, that has disturbed the harmony existing among soil, plant, environment and humans (Bahadur *et al*., 2006). Application of inorganic inputs has increased the productivity of produce, but has severely impacted environment and soil health. In the light of this view, there is a need to conserve soil by adopting organic farming systems. There are many reports that indicate that organic sources of nutrient help in soil rejuvenation (Adeleye *et al*., 2010) Northbourne (2003) defined organic farming as 'an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity'. It is focused on minimal use of off-farm inputs and management practices that preserve, sustain and boost environmental harmony (Winter and Davis, 2006). Inorganic fertilizers can be substituted by organic manures (Naeem *et al*., 2006). Garden pea, being a leguminous crop, is preferred in organic farming because of its ability to fix atmospheric nitrogen, market potential and good economic return (Fernandez *et al*., 2012). On the basis of above said facts, present study was designed to evaluate the effect of organic nutrient sources on soil physico-chemical properties and viable microbial count under mid hill zone of Himachal Pradesh.

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MATERIALS AND METHODS

The present study was carried out in the *Rabi* season at Vegetable Research Farm, Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP) from October, 2020 to April, 2021 to investigate the effect of organic nutrient sources in garden pea on soil physico-chemical properties and viable microbial count. The experimental site is situated at an altitude of 1,270 meters above mean sea level lying between latitude of 30°5′ North and longitude of 77°11′ East. The area receives an annual rainfall of about 1100 mm and most of which is received during the monsoon period (mid June-mid September). The

layout of experiment was randomized complete block design (RCBD) factorial with three replications comprising of twelve treatment combinations of two factors-Factor I was farm yard manure (M) and Factor II was Jeevamrit (J). Treatment details are presented in Table 1.

Seeds of garden pea cv. Punjab 89 were sown on 21st October, 2020 at a spacing of 60 cm × 7.5 cm. Farm yard manure was applied at time of sowing. Jeevamrit was applied @ 5 and 10 per cent as soil drenching (5 times) at 15 days interval starting from 30 DAS. Biofertilizers (Rhizobium + PSB) were applied @ 200 g/10 kg as seed treatment and 5 kg/ha as soil application uniformly to all the treatment combinations. Before sowing of seeds, soil was low in organic carbon (0.98 %), normal in available nitrogen (327.16 kg/ha) and available potassium (309.19 kg/ha), high in available phosphorus (47.93 kg/ha), normal pH (6.95) and electrical conductivity (0.41 dS/m) along with (90.15 cfu/g of soil) viable microbial count.

Table 1: Detail of treatments.

Treatments	Treatment details
M_0J_0	No manure (control)
M_0J_1	No manure + jeevamrit @ 5% drenching
M_0J_2	No manure + jeevamrit @ 10% drenching
M_1J_0	FYM @ 5 t/ha + No jeevamrit
M_1J_1	FYM @ 5 t/ha + jeevamrit @ 5% drenching
M_1J_2	FYM @ 5 t/ha + jeevamrit @ 10% drenching
M_2J_0	FYM @ 10 t/ha + No jeevamrit
M_2J_1	FYM @ 10 t/ha + jeevamrit @ 5% drenching
M_2J_2	FYM @ 10 t/ha + jeevamrit @ 10% drenching
M_3J_0	FYM @ 15 t/ha + No jeevamrit
M_3J_1	FYM @ 15 t/ha + jeevamrit @ 5% drenching
M_3J_2	FYM @ 15 t/ha + jeevamrit @ 10% drenching

RESULTS AND DISCUSSION

Data on various soil physico-chemical properties and viable microbial count has been depicted in Table 2.

Organic carbon (%)

Significantly maximum organic carbon (1.37%), was recorded with the application of FYM @ 15 t/ha along with jeevamrit @ 10 per cent drenching (M_3J_2).

The increase in soil organic carbon with combined application of organic and liquid manure might be due to increased incorporation of organic materials and root growth. Decomposition of these materials may have resulted in increased soil organic carbon content (Kumari *et al*., 2019). The results are supported with the findings of Rai *et al*. (2014) and Singh *et al*. (2014).

pH and EC

Soil pH and EC were non significantly effected by the interaction effect of both manures. Low soil pH and EC are more desirable. The decrease in soil pH and EC may be due to release of organic acids during decomposition process of organic manures that led to decrease in pH level with the addition of FYM. This might be attributed to increase in soil permeability with the application of these manures. Rai *et al*. (2014) also observed decrease in soil EC and pH with the addition of organic manures.

Available NPK

Significantly maximum nitrogen (375.31 kg/ha), phosphorus (62.63 kg/ha) and potassium (345.33 kg/ha) was recorded with the application of FYM @ 15 t/ha along with jeevamrit @ 10 per cent drenching (M_3J_2).

Increase in available nitrogen might be due to slow release of nutrients through FYM that led to increase in available pool of nitrogen. Application of jeevamrit enhanced the

Table 2: Soil physico-chemical properties and viable microbial count as effected by different organic nutrient sources.

Treatments	Organic carbon (%)	pH	Electrical conductivity (dS/m)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Viable microbial count × 10^5 cfu/g of soil
M_0J_0	1.08 (1.44)*	6.87	0.38	336.75	43.91	312.14	127.33
M_0J_1	1.19 (1.48)	6.84	0.37	340.39	45.08	318.21	139.00
M_0J_2	1.25 (1.50)	6.83	0.36	344.45	46.93	315.53	142.12
M_1J_0	1.28 (1.51)	6.81	0.37	347.70	48.92	318.78	140.31
M_1J_1	1.29 (1.51)	6.81	0.35	352.80	49.34	325.65	161.65
M_1J_2	1.27 (1.51)	6.79	0.34	361.42	50.09	331.11	169.65
M_2J_0	1.29 (1.51)	6.76	0.34	363.58	52.55	326.75	162.73
M_2J_1	1.32 (1.52)	6.75	0.32	364.52	53.30	331.45	178.87
M_2J_2	1.34 (1.53)	6.75	0.31	369.75	55.56	334.92	188.86
M_3J_0	1.33 (1.53)	6.73	0.32	370.82	56.85	337.12	179.97
M_3J_1	1.35 (1.53)	6.73	0.30	371.01	60.17	339.34	184.64
M_3J_2	1.37 (1.54)	6.72	0.29	375.31	62.63	345.33	195.25
CD (0.05)	(0.02)	NS	NS	3.63	1.78	2.79	5.05
SEm	0.02	0.01	0.02	1.23	0.60	0.95	1.71
CV %	3.28	0.24	9.38	0.59	2.01	0.50	1.80

* Figures in parenthesis represent square root transformations.

conversion of organic form of nitrogen to inorganic form by multiplied soil microbes and synergistic effect of nitrogen fixing bacteria. Qureshi *et al*. (2015) reported that application of FYM, bio fertilizer and other fertilizers in field pea enhanced the nitrogen content that may be attributed to the greater multiplication of soil microbes. The results are in accordance with Rai *et al*. (2014).

The increase in availability of phosphorus in soil due to addition of these manures may be attributed to soil microbial activity resulting in release of organic acids during organic matter decomposition that ultimately helped in solublization of phosphates leading to increase in phosphorus content of soil. Similar findings were reported by Nitika *et al*. (2018).

Increase in available potassium content of soil may be due to direct addition of potassium through organic manures and interaction of organic matter with clay that led to release in K_2O. Similar results were reported by Suklabaidya *et al*. (2017) and Prativa and Bhattarai (2011).

Viable microbial count

Highest viable microbial count (195.25 cfu/g of soil) was recorded significantly with the application of FYM @ 15 t/ha along with jeevamrit @ 10 per cent drenching (M_3J_2).

Increase in soil viable microbial count might be due to conducive environment created by the application of organic and liquid manures that led to increased microbial proliferation in the presence of organic carbon, total and mineral nitrogen of soil (Nitika *et al*., 2018). Formulation of jeevamrit also contains microorganisms and their application with FYM had increased viable microbial population. Pati and Udmale (2016) reported enhanced microbial count with the application of FYM and jeevamrit along with other organic inputs in soybean.

CONCLUSION

It can be concluded that application of FYM @ 15 t/ha + jeevamrit @ 10 per cent drenching (5 times) at 15 days interval starting from 30 days after sowing along with biofertilizers (Rhizobium and Phosphate Solubilizing Bacteria) @ 200 g/10 kg as seed treatment and 5 kg/ha as soil application resulted in enhanced NPK content, organic carbon, viable microbial count along with lowest pH and electrical conductivity in garden pea under mid hill zone of Himachal Pradesh.

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Conflict of interest: None.

REFERENCES

Adeleye, E.O., Ayeni, L.S. and Ojeniyi, S.O. (2010). Effect of poultry manure on soil physico-chemical properties, leaf nutrients content and yield of yam (*Dioscorea rotundata*) on alfisol in South Western Nigeria. Journal of American Science. 6(10): 871-78.

Bahadur, A., Singh, J., Singh, K.P. and Rai, M. (2006). Plant growth, yield and quality attributes of garden pea as influenced by organic amendments and biofertilizers. Indian Journal of Horticulture. 63(4): 464-466.

Fernandez, A., Sheaffer, C., Wyse, D. and Michalaels, T. (2012). Yield and weed abundance in early-and late-sown field pea and lentil. Agronomy Journal. 104(4): 1056-1064.

Kannan, P., Saravanan, A., Krishnakumar, S. and Natarajan, S.K. (2005). Biological properties of soil as influenced by different organic manures. Research Journal of Agriculture and Biological Sciences. 1(2): 181-183.

Kumari, R., Thakur, K.S. and Lalhruaitluangi, N. (2019). Effect of different organic nutrient sources on soil properties in onion (*Allium cepa* L.). International Journal of Current Microbiology and Applied Sciences. 8(4): 1783-1792.

Meena, R.S., Kumar, S., Datta, R., Lal, R., Vijayakumar, V., Brtnicky, M., Sharma, M.P., Yadav, G.S., Jhariya, M.K. and Jangir, C.K. (2020). Impact of agrochemicals on soil microbiota and management: A review. Land. 9(2): 34.

Naeem, M., Iqbal, J. and Bakhsh, M.A.A. (2006). Comparative study of inorganic fertilizers and organic manures on yield and yield components of mungbean. Journal of Agriculture and Social Sciences. 2(4): 227-239.

Nitika, Thakur, K.S. and Mehta, D.K. (2018). Soil nutrient status, NPK uptake and viable bacterial count as influenced by different organic nutrient sources in European carrot. International Journal of Current Microbiology and Applied Sciences. 7(8): 1783-1789.

Nourthbourne, C.J., 5th Lord. (2003). Look to the Land, 2nd Rev Spec edn. Sophia Perennis, Hillsdale, NY; First Ed. 1940. J.M. Dent and Sons.

Pati, H.M. and Udmale, K.B. (2016). Response of different organic inputs on growth and yield of soybean on inceptisol. International Journal of Recent Scientific Research. 7: 14116-14120.

Prativa, K.C. and Bhattarai, B.P. (2011). Effect of integrated nutrient management on the growth, yield and soil nutrient status in tomato. Nepal Journal of Science and Technology. 12: 23-28.

Qureshi, F., Bashir, U. and Ali, T. (2015). Effect of integrated nutrient management on growth, yield attributes and yield of field pea (*Pisum sativum* L.) cv. Rachna. Legume Research. 38: 701-703.

Rai, S., Rani, P., Kumar, M., Rai, A.K. and Shahi, S.K. (2014). Effect of integrated use of vermicompost, FYM, PSB and Azotobacter on physico-chemical properties of soil under onion crop. Environment and Ecology. 32: 1797-1803.

Singh, S.N., Rai, J.P., Singh, S.R., Goyal, S.K. and Singh, S.P. (2014). Effect of integrated use of organic manures and fertilizers on yield, nutrient uptake and soil fertility in onion on red soils of Vindhyan region. Vegetable Science. 41: 150-154.

Suklabaidya, A., Datta, M. and Kandpal, B.K. (2017). Response of organic sources and biofertilizer in soil fertility and yield of cauliflower in the foot hills of Tripura. International Journal of Agriculture Sciences. 9: 4874-4875.

World Health Organization. (2006). The impact of pesticides on health: Preventing intentional and unintentional deaths from pesticide poisoning. *Geneva: WHO*.

Winter, C.K. and Davis, S.F. 2006. Organic food. Journal of Food Science. 71: 117-12.