Original Research Article

Different organic manures and their levels affected nutrient status and soil microbial activity under Rose(*Rosa bourboniana*Desportes) cultivation

Abstract

A field experiment was conducted to study Effect of Different Organic Manures and their levels on nutrient status and soil microbial activity in Rose (*Rosa bourboniana*Desportes) in DeenDyalUpadhyay Center of Excellence for Organic Farming, CCS Haryana Agricultural University, Hisar during 2020-21. The experiment was conducted by using different types of organic manures viz., farm yard manures, vermicompost and poultry manure @ control, 4 kg/m^2, 5 kg/m^2 and 6 kg/m^2 were applied. It was carried out in the split plot design with three replication comprising 12 treatments. Observation on various parameters of microbial activity of soil e.g. organic carbon, dehydrogenase activity and alkaline phosphatase activity , N, P & K content present in leaves of rose and available N, P & K presented soil at the time of harvest were observed. Organic carbon in soil was observed maximum (0.93%) with the application of vermicompost while dehydrogenase and alkaline phosphatase activity was observed highest with the application of Farmyard manure and poultry manure respectively. Nitrogen (2.17%) and phosphorus (0.27%) content was found maximum in rose leaves at harvesting stage with the application of poultry manure while Potassium(1.41%) content was recorded maximum in leaves of rose with the treatment of vermicompost. Same trend was followed by the nutrient status of soil by the application of different organic manures. Hence, it could be concluded that the treatment combination of Poultry manures was found to have pronounced effect with respect tomicrobial activity and nutrient status in rose (*Rosa bourboniana*Desportes).

Keywords:Rose, organic carbon, microbial activity, dehydrogenase activity, alkaline phosphatase activity

1. Introduction

One of the most important activities in organic agriculture is maintaining and enhancing the soil health respectively the soil organic matter. In the same time, as it is stated by the principle of ecology (IFOAM, 2010), the organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. An important component for increasing the soil fertility and health can be green manure, cover crops, living mulch (Crosslan*det al.*, 2015). Different kind of organic matter can bring additional positive effects on yield through amelioration of soil life, water retention, humus content (van Opheusden*et al.*, 2012; Butcaru*et al.*, 2016).

The present paper presents the results of the microbiological activity and nutrient status (N, P and K) in the soil after using an alternative and innovative method for improving the soil activity by using threedifferent organic manures: farmyard manure, vermicompost and poultry manure at different levels i.e control, 4 kg/m^2, 5 kg/m^2 and 6 kg/m^2 beforethe plantation of rose (Rosa bourbonianaDesportes). The research analyses the effect of different organic manures and their levels on nutrient status and soil microbial activity in Rose (Rosa bourbonianaDesportes).

2. Material and Method

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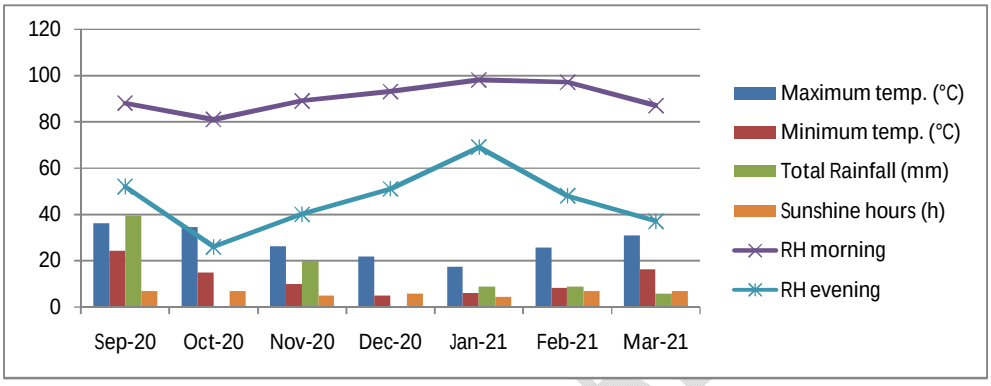
The investigation entitled, **"Effect of different organic manures on nutrient status and soil microbial activity in Rose (*Rosa bourboniana*Desportes)"**was carried out at DeenDayalUpadhayay Centre of Excellence for Organic Farming, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana) located in the sub tropiocsat 29°08' North latitude and 75°42' East longitude at an altitude of 215.20 meters above mean sea level. The information of various climatic factors viz., minimum and maximum temperature, rainfall, bright sunshine hours and relative humidity for the cropping season presented in Figure 1

Figure 1: **Meteorological conditions during growth and development of Rose**



2.1 Experimental detail

The present investigation was conducted on one year old plantation of Rosa bourbonianaDesportes during 2020-21.

Table 1: Physicochemical properties of soil

Properties	Value
Soil Texture	Loam
Soil pH	8.00
EC(dS/m)	0.49
Organic carbon (%)	0.85
Available N (kg/ha)	178.70
Available P (kg/ha)	23.80
Available K (kg/ha)	371.02
Dehydrogenase activity (µg TPF/g/day)	43.97
Alkaline phosphatase activity (µg PNP/g/hr)	115.65

The crop was planted at a spacing of 75 cm between rows and 60 cm for plant to plant. Soil analysis was determined at the initial stage of the experiment. A study of data presented in Table 1 showed that soil of the experimental field was loamy in texture, basic in reaction (pH 8.0), high in organic carbon (0.85%) and exhibited a low availability of nitrogen (178.70 kg/ha), medium phosphorus (23.80 kg/ha) and high potassium (371.02 kg/ha). Microbial activities of the soil were also examined at the initial stage. Dehydrogenase activity of the soil was 43.97 TPF/g/day and phosphotase activity was 115.65 µg PNP/g/hr.

The experiment was laid out in split plot design (SPD) in the month of September with three replications having 12 treatment combination of *Rosa bourboniana*Desportes. In the study we have used different organic manures viz., Farm yard manures, vermicompost and poultry manures at their different levels i.e. control, 4kg/m^2, 5kg/m^2 and 6kg/m^2. The total area used for each plot size 4.05 m^2 and each plot having 9 plants. The flood irrigation method was used for irrigating the field and irrigated when required.

2.2 Soil and microbial activity analysis

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For soil analysis, soil samples were taken from were taken from experimental plots after flower harvesting and dried at room temperature for 3 days and ground to pass a 30 mesh screen. The analysis of available N was done by distilling the 2 g soil with alkaline potassium permanganate solution and determining the ammonia liberated (Subbiah and Asija, 1956). For available of P Olsen's method of extraction with $NaHCO_3$ at pH 8.5 (Olsen et al., 1954) and available K with flame photometer method (Jackson, 1973) was used. The organic carbon was analyzed by Walkley's and Black wet digestion method (1934) and for Dehydrogenase activity method given by Casida*et al.*, 1964 and for alkaline phosphatase activity method given by Evazi and Tabatabai (1979) was used. Soil texture and pH was estimated by International pipette method (Piper, 1966) and Potentiometric method (Jackson, 1973) respectively.

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2.3 Statistical analysis

Statistical analysis of recorded information on different parameters of *Rosa bourboniana*Desportes were subjected to statistical standard analysis of variance (ANOVA) utilizing the software OPSTAT (Sheoran*et al.*, 1998) and strategy as applicable for the split plot design (SPD) was used with three replication. Variation among treatment were assessed at 5% probability (P= 0.05)

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3. Results and Discussion

3.1 Soil organic carbon content (%), Dehydrognase activity (µg TPF/g/day) and Alkaline phosphatase activity (µg PNP/g/hr)

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Table 2 represents that organic carbon was significantly increased with the application of various organic manures. Maximum organic carbon (0.93 %) was observed in vermicompost which was found significantly at par with the application of FYM (0.92 %). Minimum organic carbon was recorded in poultry manure (0.88 %). In case of levels of organic manures, maximum organic carbon (0.97 %) in soil was found when organic manures was applied @ 6 kg/m^2 area which was found significant with the application of organic manure @ 5 kg/m^2 area (0.94 %). Minimum organic carbon (0.82 %) was recorded in control. Interaction between organic manures and their levels was found non-significant. However, maximum organic carbon (0.98 %) was observed when vermicompostapplied@ 6 kg/m^2 followed by application of FYM @ 6 kg/m^2 (0.97 %).

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Table 2: Effect of organic manures and their levels on Organic carbon (%), Dehydrognase activity (µg TPF/g/day) and Alkalinephosphatase activity (µg PNP/g/hr)in rose.

	Organic carbon (%)					Dehydrognase activity (µg TPF/g/day)					Alkaline phosphatase activity (µg PNP/g/hr)				
Treatments	**Levels of Organic Manures (kg/ha)**														
Organic manures (M)	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**
FYM	0.86	0,91	0.95	0.97	**0.92**	45.62	61.33	66.18	70.13	**61.82**	119.75	136.93	147.25	155.50	**139.86**
Vermicompost	0.82	0.94	0.96	0.98	**0.93**	35.18	53.58	57.45	61.56	**51.93**	123.08	146.50	155.80	165.33	**147.68**
Poultry Manure	0.78	0.88	0.92	0.95	**0.88**	43.12	56.95	62.50	66.33	**57.22**	128.95	152.70	164.55	171.20	**154.35**
Mean	**0.82**	**0.91**	**0.94**	**0.97**		**41.31**	**57.29**	**62.04**	**66.01**		**123.93**	**145.38**	**155.87**	**164.01**	
C.D. (P= 0.05)	Organic manures (M) = 0.01					Organic manures (M) = 1.80					Organic manures (M) = 0.47				
	Organic manures levels (L) = 0.02					Organic manures levels (L) = 1.36					Organic manures levels (L) = 0.90				
	Factor (L) at same level of M = NS					Factor (L) at same level of M= NS					Factor (L) at same level of M = 1.59				
	Factor (M) at same level of L = NS					Factor (M) at same level of L = NS					Factor (M) at same level of L = 1.43				

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The maximum dehydrogenase activity was observed in FYM (61.82µg TPF/g/day) followed by application of poultry manures (57.22µg TPF/g/day) and minimum was recorded in vermicompost (51.93µg TPF/g/day).Among the levels of organic manures maximum dehydrogenase activity (66.01µg TPF/g/day) was recorded with the application of organic manure @ 6 kg/m^2 area and minimum (41.31µg TPF/g/day) was observed in control. Interaction between the organic manures and their levels was found non-significant.

Alkaline phosphatase activity shown in Table 2 was significantly increased with the application of various organic manures and their levels. Maximum alkaline phosphatase activity (154.35µg PNP/g/hr) was observed in poultry manures followed by application of vermicompost (147.68µg PNP/g/hr) and minimum alkaline phosphatase activity was recorded in FYM (139.86µg PNP/g/hr).

Among the levels of organic manures maximum alkaline phosphatase activity (164.01µg PNP/g/hr) was recorded with the application of organic manure @ 6 kg/m^2 area and minimum alkaline phosphatase activity (123.93 µg PNP/g/hr) was observed in control. Interaction between various organic manures and their level shows maximum alkaline phosphatase activity was observed with the application of poultry manure @ 6 kg/m^2 (171.20 µg PNP/g/hr) which was found significantly higher than application of vermicompost @ 6 kg/m^2 (165.33 µg PNP/g/hr). In case of FYM, maximum alkaline phosphatase activity (155.50 µg PNP/g/hr) was recorded with FYM application @ 6 kg/m^2.

The higher value of soil organic carbon content with the application of vermicompost might be due to the reason that it enhanced the soil health, microbial population, biological immobilization and mineralization in soil. Soil enzymatic activities are affected by decomposition of organic matter and recycling of organic carbon. Indicator of overall microbial activity is dehydrogenase activity as it occurs in cells of living organisms. It is possible that the greater impacts of FYM on dehydrogenase activity are related to more readily decomposable organic matter in soil and hence it influences microbial activity directly and indirectly. Application of poultry manure significantly increased alkaline phosphatase activity over control. Alkaline phosphatase activity is influenced by the quality organic matter incorporated into soil. Poultry manure have more impact on alkaline phosphatase activity might be due to the reason that it is easily decomposable. These results are in line with the findingsofRathore*et al*. (2018), Malik *et al.* (2012) in alkaline soils and Manna *et al.* (2001) in soyabean-wheat rotation.

Interaction was found non-significant in influencing the soil organic carbon and dehydrogenase activity while found significant for alkaline phosphatase activity. However, maximum organic carbon (0.98 %), dehydrogenase activity (66.33 µg TPF/g/day) and alkaline phosphatase activity (171.20 µg PNP/g/hr) were recorded with the application of poultry manure @ 6 Kg/m^2. The results are in accordance with the earlier findings of Katkar*et al.* (2011) in sorghum-wheat system and Basak*et al.* (2013) in maize-wheat rotation. Alkaline phosphatase activity was significantly increased

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by the application of poultry manure which might be due to the reason that nutrient composition of poultry manure was higher than others.

3.2 N, P and K (%) content in leaves of rose

Increased nutrient availability in organic matter treatment was also due to increased dehydrogenase and phosphatase activity in the present study, an indication of increased soil biological activity (Parham *et al.*, 2002). Ramesh *et al.* (2006) also reported the enhanced level of soil enzymatic activity; addition of organic manures promotes the recycling of nutrients in the soil ecosystem. The manurial effect of certain botanicals has also been observed by Knox *et al.* (2011). It is a well established fact that growth and yield is the outcome of complementary interaction between vegetative and reproductive growth of crop. Thus the better performance of growth parameters seems to promote yield attributes and thereby crop productivity (Bhati& Prasad, 2005). Gireesh (2009) also reported the direct relationship between photosynthetic pigment, such as chlorophyll content, and productivity of Dunaliellasalina.

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Table 3: Effect of organic manures and their levels on N, P and K (%) content in leaves of rose

	Nitrogen content (%) in leaves					Phosphorus content (%) in leaves					Potassium content (%) in leaves				
Treatments	**Levels of Organic Manures (kg/m^2)**														
Organic manures (M)	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**
FYM	1.94	1.99	2.03	2.06	**2.01**	0.23	0.23	0.24	0.25	**0.24**	1.32	1.35	1.39	1.42	**1.37**
Vermicompost	1.95	2.15	2.23	2.27	**2.15**	0.22	0.24	0.26	0.27	**0.25**	1.33	1.39	1.43	1.47	**1.41**
Poultry Manure	1.88	2.20	2.28	2.35	**2.17**	0.23	0.26	0.28	0.29	**0.27**	1.32	1.33	1.38	1.39	**1.36**
Mean	**1.92**	**2.10**	**2.18**	**2.23**		**0.23**	**0.24**	**0.26**	**0.27**		**1.32**	**1.36**	**1.40**	**1.43**	
C.D. (P= 0.05)	Organic manures (M) = 0.06					Organic manures (M) = 0.01					Organic manures (M) = 0.01				
	Level of organic manures (L) = 0.06					Organic manures levels (L) = 0.01					Organic manures levels (L) = 0.01				
	Factor (L) at same level of M = 0.13					Factor (L) at same level of M = 0.01					Factor (L) at same level of M = 0.01				
	Factor (M) at same level of L = 0.12					Factor (M) at same level of L = 0.01					Factor (M) at same level of L = 0.01				

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Maximum nitrogen content in leaves of rose was observed with the application of poultry manure (2.17 %). Minimum nitrogen content was observed with the application of FYM (2.01 %). Among the different levels of organic manures maximum nitrogen content (2.23 %) in leaves was found when organic manure was applied @ 6 kg/m^2 area and minimum nitrogen content (1.92 %) was recorded in control. Among the interaction, highest amount of nitrogen content (2.35 %) was observed with the application of poultry manure @ 6 kg/m^2. Phosphorus content in leaves was significantly increased with the application of various organic manures and their levels. The maximum phosphorus content in leaves was observed in poultry manure (0.27 %). Among the levels maximum phosphorus content (0.27 %) in leaves was found when organic manure was applied @ 5 kg/m^2 and found statistically at par with the application of organic manure @ 5 kg/m^2 (0.26 %). Among the interaction,

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highest amount of phosphorus content was observed with the application of poultry manure @ 6 kg/m^2 (0.29 %) which was found statistically at par with the application of poultry manure @ 5 kg/m^2 (0.28 %). Maximum potash content was observed with the application of vermicompost (1.41 %) followed by FYM (1.37 %). Minimum potash content (1.36 %) was observed with the application of poultry manure.

Potash content in leaves of rose increased with the increasing dose of organic manures up to the level of 6 kg/m^2. Maximum potash content (1.43 %) was recorded with the application of organic manure @ 6 kg/m^{2}area which was found significantly higher than application of organic manure @ 5 kg/m^2 area (1.40 %). However, minimum potash content (1.32 %) was recorded in control irrespective of various organic manures. Among the Interaction highest amount of potash content was noticed with the application of vermicompost @ 6 kg/m^2 (1.47 %) which was found significantly higher with the application of vermicompost @ 5 kg/m^2 (1.43 %) followed by farm yard manure @ 6 kg/m^2 (1.42 %). All the levels of organic manure differ significantly from each other at 5 % level of significance.

3.3 Available N, P and K (kg/ha) in soil

It is evident from the data shown in the Table 4 that available nitrogen in soil at the time of flower harvest was found maximum with the application of poultry manure (183.46 kg/ha) followed by vermicompost application (180.44 kg/ha).

Table 4: Effect of organic manures and their levels on Available N, P and K (kg/ha) in soil at the time of harvest

	Available Nitrogen(kg/ha) in soil					Available Phosphorus(kg/ha) in soil					Available potassium(kg/ha) in soil				
Treatments	**Levels of Organic Manures (kg/m^2)**														
Organic manures (M)	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**	**Control**	**4**	**5**	**6**	**Mean**
FYM	174.68	178.60	180.90	181.08	**178.82**	21.83	24.95	25.90	26.68	**24.84**	363.71	412.00	418.30	421.10	**403.78**
Vermicompost	174.25	180.15	182.83	184.52	**180.44**	21.85	26.55	27.50	28.45	**26.09**	364.79	421.50	422.12	425.50	**408.47**
Poultry Manure	175.58	183.22	186.03	189.00	**183.46**	21.87	27.90	30.05	31.40	**27.80**	365.75	398.75	405.50	412.25	**395.56**
Mean	**174.84**	**180.66**	**183.25**	**184.87**		**21.85**	**26.47**	**27.82**	**28.84**		**364.75**	**410.75**	**415.30**	**419.61**	
C.D. (P= 0.05)	Organic manures (M) = NS					Organic manures (M) = 0.41					Organic manures (M) = 0.91				
	Level of organic manures (L) = 1.08					Organic manures levels (L) = 0.82					Organic manures levels (L) = 1.17				
	Factor (L) at same level of M = NS					Factor (L) at same level of M = 1.45					Factor (L) at same level of M = 2.12				
	Factor (M) at same level of L = NS					Factor (M) at same level of L = 1.29					Factor (M) at same level of L = 0.28				

However, minimum available nitrogen in soil at harvest was recorded in FYM (178.82 kg/ha).Maximum available nitrogen (184.87 kg/ha) among the different levels of organic manures was found when organic manure applied @ 6 kg/m^2 that was recorded significantly higher with the level @ 5 kg/m^2 (183.25 kg/ha). Minimum available nitrogen (174.84 kg/ha) was recorded in control. Maximum available nitrogen (189.00 kg/ha) was recorded when poultry manure applied @ 6 kg/m^{2}in case of interaction between the organic manures and their levels.

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The maximum available phosphorus (27.80 kg/ha) in soil was observed with application of poultry manure followed by vermicompost application (26.09 kg/ha) and minimum was recorded with the application of FYM (24.84 kg/ha).The maximum available phosphorus (28.84 kg/ha) in soil was found when organic manure was applied @ 6 kg/m^2 followed by application of organic manure @ 5 kg/m^2 (27.82 kg/ha).Minimum available phosphorus (21.85 kg/ha) in soil at harvest was recorded in control.In all the levels of different organic manures, maximum available phosphorus (31.40 kg/ha) was recorded with poultry manure applied @ 6 kg/m^2. Maximum available potassium (408.47 kg/ha) was observed with the application of vermicompost, which was found significantly higher than FYM (403.78 kg/ha). Minimum available potassium was observed with the application of poultry manure (395.56 kg/ha). Among the different levels of organic manures maximum available potassium (419.61 kg/ha) was recorded with the application of organic manure @ 6 kg/m^2 of area which was found significantly higher than application of organic manure @ 5 kg/m^2 of area (415.30 kg/ha). Minimum available potassium (364.75 kg/ha) was recorded in control.

The application oforganic manures increased the N, P and K content in plant and soil as compared to control.This may be due to the release of N from poultry manure which was easily accessible to plants. Due to solubilizing action of organic acid released from vermicompost maximum K content was observed with the application of vermicompost.Organic manure enhanced the available N, P and K status of the soil, because these sources improved soil organic matter status, which improved soil physical and biological activities and hence increased the availability of plant nutrients. The results are in accordance with the results of Meena*et al.* (2015) and Bandyopadhyay*et al.* (2010).Interaction was found significant in influencing the N, P and K content in plant and for available P & K in soil while available N in soil while found non-significant. This could be due to an increase in microorganism population and the formation of organic acids after decomposition of organic manures, resulting in better availability soil nutrient and easier plant uptake or it could be due to the highest N and P content in applied poultry manure and the highest K content in vermicompost. Results are in close conformity with the findings ofKaur *et al.* (2005) and Khaliq and Abbasi (2015).

4. Conclusion

Positive results through the use of different organic manures applied to rose were obtained regarding stimulating microbial activity of the soil and increasing the nutrient status as compared to controls and with the initial phases. The application of vermicompost along could be consideredas the best treatment for the improved performance in nutrient and microbial activity attributes of soil in Rose (*Rosa bourboniana*Desportes) under open field condition.

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