

Effect of Different organic manures and their levels on nutrient status and soil microbial activity under *Rose-rose* (*Rosa bourboniana* Desportes) cultivation

Abstract

A field experiment was conducted to study the Effect-effect of Different-different Organic-organic Manures-manures and their levels on nutrient status and soil microbial activity in *Rose-rose* (*Rosa bourboniana* Desportes) in Deen Dyal Upadhyay Center of Excellence for Organic Farming, CCS Haryana Agricultural University, at Hisar during 2020-21. The experiment was conducted by using treatments comprised of 3 different types of organic manures viz., farm yard manures, vermicompost and poultry manure @ and 4 levels control, 4 kg/m², 5 kg/m² and 6 kg/m². The experiment were applied. It was carried out in the split plot design with three replications, comprising 12 treatments. Observation on various parameters of microbial activity of soil e.g. organic carbon, dehydrogenase activity and alkaline phosphatase activity, N, P & and K content present in leaves of rose leaves and available N, P & and K presented content in soil at the time of harvest were observed/recorded. Organic carbon in soil was observed maximum (0.93%) with the application of vermicompost while dehydrogenase and alkaline phosphatase activity was/were observed highest with the application of Farmyard-farmyard manure and poultry manure, respectively. Nitrogen (2.17%) and phosphorus (0.27%) content was found/were maximum in rose leaves at harvesting-harvest 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 observed in the nutrient status of soil with by the application of different organic manures. Hence, it could be/It is concluded that the treatment-combination/application of Poultry-poultry manures was found to have/had pronounced effect with respect to/on microbial activity and nutrient status in rose (*Rosa bourboniana* Desportes).

Keywords: *Rose*, organic carbon, microbial activity, dehydrogenase activity, alkaline-Alkaline phosphatase activity, Dehydrogenase activity, Microbial activity, Organic carbon, *Rose*

1. Introduction

One of the most important activities in organic agriculture is maintaining and enhancing the soil health respectively with 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-The important components for increasing-improving the soil fertility and health can/could be green manure, cover crops, living mulch (Crossland *et al.*, 2015). Different kind-types of organic matter can bring additional positive effects-effect on yield through amelioration of soil life/microflora, water retention, and humus content (van Opheusden *et al.*, 2012; Butcaru *et al.*, 2016).

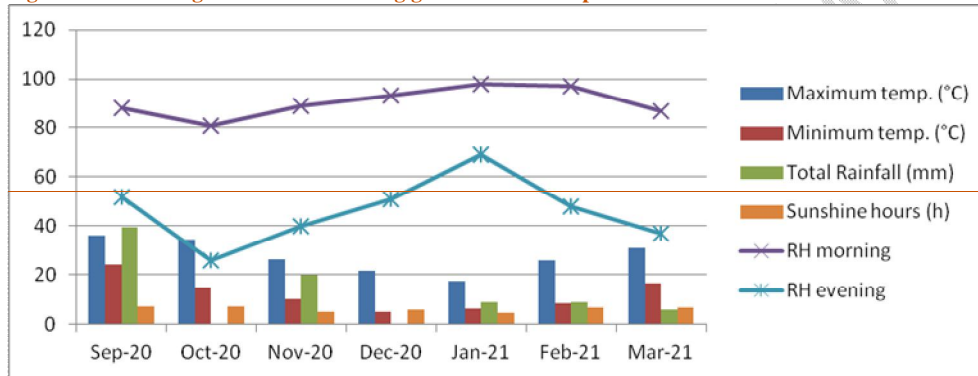
The present paper presents the results of An experiment was carried out to study effect of the different organic manures and their levels on microbiological activity and nutrient status (N, P and K) in the soil after using an alternative and innovative method for improving the soil activity by using

three different organic manures: farmyard manure, vermicompost and poultry manure at different levels i.e. control, 4 kg/m², 5 kg/m² and 6 kg/m² before the plantation of rose (*Rosa bourboniana* Desportes). The research analyses the effect of different organic manures and their levels on nutrient status and soil microbial activity in *Rose-rose* (*Rosa bourboniana* Desportes).

2. Material and Methods

The investigation entitled, "Effect of different organic manures on nutrient status and soil microbial activity in *Rose-rose* (*Rosa bourboniana* Desportes)" was carried out at Deen Dayal Upadhyay Centre of Excellence for Organic Farming, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana) located in the sub tropics at 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 *rose* plantation of *Rosa-bourboniana* Desportes during 2020-21.

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 the 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 in availability available of nitrogen (178.70 kg/ha), medium in phosphorus (23.80 kg/ha) and high in 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 phosphatase 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 combinations of *Rosa-bourboniana* Desportes. In the study we have used 3 different organic manures viz., Farm-farm yard manures, vermicompost and poultry manures at their different and 4 levels i.e. viz., control, 4 kg/m², 5 kg/m² and 6 kg/m². The total area used for each gross plot size was 4.05 m² and each plot having with 9 plants. The flood irrigation method was used for irrigating the field and irrigated when required. The experimental plots were irrigated by flood irrigation method as and when required.

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2.2 Soil and microbial activity analysis

For soil analysis, soil samples were taken from experimental plots after flower harvesting and dried at room temperature for 3 days and ground to pass a 30 mesh sieve. The analysis of available N, P and K were estimated by the standard procedures was done by distilling the 2-g soil with alkaline potassium permanganate solution and determining the ammonia liberated (Subbiah and Asija, 1956). Olsen's method of extraction with NaHCO₃ at pH 8.5 (Olsen *et al.*, 1954) and available K with flame photometer method (Jackson, 1973) was used. The organic carbon was analyzed estimated by Walkley's and Black wet digestion method (Walkley and Black, 1934). The and for Dehydrogenase activity estimated by method given by Casida *et al.*, (1964) and for alkaline phosphatase activity by 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 the observations recorded on different parameters of *Rosa bourboniana* Desportes were subjected to statistical 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 different treatments were assessed at 5% probability (P= 0.05)

3. Results and Discussion

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

Table 2 represents that organic carbon was significantly increased with the application of various organic manures. Maximum organic carbon (0.93 %) was observed with the application of vermicompost which and it was found significantly at par with the application of FYM (0.92 %) (Table 1). 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 recorded when organic manure was applied @ 6 kg/m² followed by area which was found significant with the application of organic manure @ 5 kg/m² area (0.94 %). Minimum organic carbon (0.82 %) was recorded in control. Interaction between organic manures and their levels was found non-significant. However, the maximum organic carbon (0.98 %) was observed when with vermicompost applied @ 6 kg/m² followed by application of FYM @ 6 kg/m² (0.97 %).

Table 1-2: Effect of organic manures and their levels on Organic carbon (%), Dehydrogenase activity (µg TPF/g/day) and Alkaline phosphatase activity (µg PNP/g/hr) in rose.

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Treatments	Organic carbon (%)					Dehydrogenase activity (µg TPF/g/day)					Alkaline phosphatase activity (µg PNP/g/hr)				
	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	174.20	150.45

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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			

The maximum dehydrogenase activity was observed ~~in~~ with FYM (61.82 µg TPF/g/day) followed by application of poultry manures (57.22 µg TPF/g/day) and minimum was recorded in vermicompost (51.93 µg TPF/g/day). Among the levels of organic manures maximum dehydrogenase activity (66.01 µg TPF/g/day) was recorded with the application of organic manure @ 6 kg/m² area and minimum (41.31 µg 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~~ increased significantly ~~increased~~ with the application of various organic manures and their levels. Maximum alkaline phosphatase activity (154.35 µg PNP/g/hr) was observed in poultry ~~manures~~ manure followed by application of vermicompost (147.68 µg PNP/g/hr) and minimum alkaline phosphatase activity was recorded in FYM (139.86 µg PNP/g/hr).

Among the levels of organic manures maximum alkaline phosphatase activity (164.01 µg PNP/g/hr) was recorded with the application of organic manure @ 6 kg/m² 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/m² (171.20 µg PNP/g/hr) which was found significantly higher than application of vermicompost @ 6 kg/m² (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/m².

The higher value of soil organic carbon content recorded with the application of vermicompost might be due to the ~~reason~~ fact 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. Dehydrogenase activity is the ~~indicator~~ 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 findings of Rathore *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-but~~ found significant for alkaline phosphatase activity. ~~However,The~~ 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 ~~Kgkg/m²~~. 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~~ significantly by the application of poultry manure which might be due to the ~~reason-factor~~ 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-The~~ increased dehydrogenase and phosphatase activity due to organic matter treatments also increased the nutrient availability (Table 2) in the present study, an indication-indicating of increased soil biological activity (Parham *et al.*, 2002). Ramesh *et al.* (2006) also reported the enhanced level of soil enzymatic activity; ~~thorough~~ addition of organic manures which 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 the 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 ~~&-and~~ Prasad, 2005). Gireesh (2009) also reported the direct relationship between photosynthetic pigment, ~~such as~~ chlorophyll content, and productivity of *Dunaliella salina*.

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Table 3.2. Effect of organic manures and their levels on N, P and K (%) content in leaves of rose

Treatments	Nitrogen content (%) in leaves					Phosphorus content (%) in leaves					Potassium content (%) in leaves				
	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/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	1.33
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/m² area and minimum nitrogen content (1.92 %) was recorded in control. Among the interactions, the highest amount of nitrogen content (2.35 %) was observed with the application of poultry manure @ 6 kg/m². 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, the maximum phosphorus content (0.27 %) in leaves was found when organic manure was applied @ 5 kg/m² and found statistically at par with the application of organic manure @ 5 kg/m² (0.26 %). Among the interactions, the highest amount of phosphorus content was observed with the application of poultry manure @ 6 kg/m² (0.29 %) ~~which and it~~ was found statistically at par with the application of poultry manure @ 5 kg/m² (0.28 %). Maximum ~~potash-potassium~~ content was observed with the application of vermicompost (1.41 %) followed by FYM (1.37 %). Minimum ~~potash-potassium~~ content (1.36 %) was observed with the application of poultry manure.

~~Potash-Potassium~~ content in leaves of rose increased with the increasing doses of organic manures up to ~~the level of~~ 6 kg/m². Maximum ~~potash-potassium~~ content (1.43 %) was recorded with the application of organic manure @ 6 kg/m² ~~area which and it~~ was found significantly higher ~~than as compared to~~ application of organic manure @ 5 kg/m² ~~area~~ (1.40 %). ~~However, The~~ minimum ~~potash-potassium~~ content (1.32 %) was recorded in control irrespective of various organic manures. Among the ~~Interaction-interactions the~~ highest amount of ~~potash-potassium~~ content was noticed with the application of vermicompost @ 6 kg/m² (1.47 %) ~~which and it~~ was found significantly higher with the application of vermicompost @ 5 kg/m² (1.43 %) followed by farm yard manure @ 6 kg/m² (1.42 %). All the levels of organic manures differed significantly ~~from with~~ 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 ~~that the~~ 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 3).

Table 4:3. Effect of organic manures and their levels on ~~Available-available~~ N, P and K (kg/ha) in soil at the time of harvest

Treatments	Available Nitrogen nitrogen(kg/ha) in soil					Available Phosphorus phosphorus(kg/ha) in soil					Available potassium(kg/ha) in soil			
	Control	4	5	6	Mean	Control	4	5	6	Mean	Control	4	5	6
Organic manures (M)														
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
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
Poultry Manure 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

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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, The minimum available nitrogen in soil at harvest was recorded in FYM (178.82 kg/ha). The Maximum highest available nitrogen (184.87 kg/ha) among the different levels of organic manures was found when organic manure applied @ 6 kg/m². that was recorded significantly higher with the level @ 5 kg/m² (183.25 kg/ha). M The minimum available nitrogen (174.84 kg/ha) was recorded in control. The M maximum available nitrogen (189.00 kg/ha) was recorded when poultry manure was applied @ 6 kg/m² in case of among the different interactions between the organic manures and their levels.

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 recorded when organic manure was applied @ 6 kg/m² followed by application of organic manure @ 5 kg/m² (27.82 kg/ha). The M minimum available phosphorus (21.85 kg/ha) in soil at harvest was recorded in control. In all Among the levels of different organic manures, maximum available phosphorus (31.40 kg/ha) was recorded with poultry manure applied @ 6 kg/m². Maximum available potassium (408.47 kg/ha) was observed with the application of vermicompost, which and it was found significantly higher than to 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, the maximum available potassium (419.61 kg/ha) was recorded with the application of organic manure @ 6 kg/m² of area which and it was found significantly higher than the application of organic manure @ 5 kg/m² of area (415.30 kg/ha). The M minimum available potassium (364.75 kg/ha) was recorded in control.

The application of organic 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 manures enhanced the available N, P and K status of in the soil, because as 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 & and K in soil while available N in soil while found non-significant. This could be due to an increase in microorganism population of microorganism and the formation of organic acids after decomposition of organic manures, resulting in better availability soil nutrients 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 of Kaur *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 improved~~ microbial activity of the soil and ~~increasing increased~~ the nutrient status as compared to ~~controls control~~ and with the initial phases. ~~The a~~ Application of vermicompost ~~along~~ could be considered as the best treatment for ~~the improved performance in increasing the~~ nutrient ~~content~~ and microbial activity ~~attributes of in~~ soil in ~~Rose rose (Rosa bourboniana Desportes) under open field condition.~~

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