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Influence of Composted Coir Pith, Farmyard Manure and Panchagavya Application to Capsicum on Soil Chemical Properties

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Abstract **– A field experiment was conducted to study the soil chemical properties as influenced by application of farmyard manure, composted coir pith and panchagavya to capsicum at Agricultural Research Station, Arsikere, Karnataka. Significant differences were observed in soil organic carbon content, available N, P_2O_5 and K_2O with different sources, levels of organic manures and panchagavya application. Among the sources, higher organic carbon content (0.53 %), available N (290.04 kg ha^{-1}) and available P_2O_5 (9.39 kg ha^{-1}) were recorded with FYM compared to composted coir pith (CCP) application (0.48 %, 275.52 and 8.96 kg ha^{-1} respectively). Whereas higher available K_2O (259.0 kg ha^{-1}) was recorded with CCP compared to FYM application (246.56 kg ha^{-1}). Among fertility levels, FYM at 200 per cent N equivalent recorded maximum available P_2O_5 9.72 kg ha^{-1}, while, CCP at 150 per cent recorded higher available K_2O (266.11 kg ha^{-1}). Application of FYM with 3 per cent panchagavya spray recorded soil pH of 6.65, available N (293.11 kg ha^{-1}), and available K_2O (251.44 kg ha^{-1}) and application of FYM with 6 per cent panchagavya spray recorded maximum organic carbon 0.55 per cent, available P_2O_5 9.62 kg ha^{-1}.Application of , CCP with 6 per cent panchagavya spray recorded soil pH of 6.36, organic carbon 0.48 per cent, available P_2O_5 (9.14 kg ha^{-1}), available K_2O (264.44 kg ha^{-1}) and available N (276.78 kg ha^{-1}) was recorded with application of CCP with 3 per cent panchagavya spray.**

Keywords **– Farm Yard Manure, Composted Coir Pith, Panchagavya, Capsicum, N Equivalent.**

I. Introduction

Organic farming is gaining gradual momentum across the world. Growing awareness of health and environmental issues in agriculture has demanded production of organic food which is emerging as an attractive source of rural income generation. While trends of rising consumer demand for organics are becoming discernible, sustainability in production of crops has become the prime concern in organic agriculture. Adoption of organic farming among the farming community has started gaining momentum in all crops including capsicum. Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment. Organic production systems are based on specific standards precisely formulated for food production and aim at achieving agro ecosystems, which are socially and economically sustainable. It is based on minimizing the use of external inputs through use of on-farm resources efficiently compared to industrial agriculture. Thus the use of synthetic fertilizers and pesticides is avoided (Ramesh et al.).

Capsicum being an exhaustive crop needs heavy application of fertilizers to put forth good growth and higher yields. As this crop requires and respond well to high quantity of fertilizers, farmers are forced to apply large volume to the soil. Use of high amount of inorganic inputs have an adverse effect on soil health and environment, expensive, unsafe, not much affordable by small and marginal farmers (Rekha and Gopal Krishnan, 2001). It is necessary to reduce the dependence on chemical inputs by adopting alternative source of plant nutrients is imperative and one such alternative is use of judicious combination of organic manures and liquid organic manure like panchagavya. The cost of fertilizers can be reduced by using liquid manures as they can be prepared on-farm by farmers themselves. The current global scenario firmly emphasizes the need to adopt eco friendly agricultural practices for sustainable food production. Hence, organic farming is an opt solution that too for the crop like capsicum which fetches high value for organic products (Parvatha Reddy, 2008).

and marginal farmers (Rekha and Gopal Krishnan, 2001). This could be overcome by the use of judicious combination of organic manures and liquid organic manures like Panchagavya. The cost of fertilizers can be reduced by using liquid manures as they can be prepared on-farm by farmers themselves. The current global scenario firmly emphasizes the need to adopt eco friendly agricultural practices for sustainable food production. Hence, organic farming is an opt solution that too for the crop like capsicum which fetches high value for organic products (Parvatha Reddy, 2008).

II. Materials and Methods

A field experiment was conducted at Agricultural Research Station, Arsikere, University of Agricultural Sciences, Bengaluru, Karnataka. The experiment was laid out on spit plot design with three replications. There were 18 treatment combinations consisting of three factors *viz.*, Nitrogen sources (2 levels) - farm yard manure (FYM - S_1) and composted coir pith (CCP - S_2), fertility (3 levels) - 100 % (F_1), 150 % (F_2) and 200 % (F_3) and panchagavya (3 levels) – without panchagavya spray (P_0), 3 per cent (P_1) and 6 per cent panchagavya (P_2). Soil was red sandy loam and neutral to slight acidic in reaction with a pH of 6.42 having EC of 0.14 dSm^{-2}, organic carbon (0.40 %) and available nitrogen (241.50 kg ha^{-1}), P_2O_5 (20.06 kg ha^{-1}) and potassium (231.00 kg ha^{-1}) content. Sources of N, P_2O_5 and K_2O used were farm yard manure (FYM) and composted coir pith (CCP) respectively. Nitrogen equivalent basis of well decomposed farm yard manure (FYM) and composted coir pith (CCP) were applied to each plot 3 weeks before transplanting of capsicum seedlings and incorporated into the soil. The capsicum Indra hybrid seedlings of 30 days old were transplanted in the main field.

Preparation of panchagavya: Panchagavya was prepared by following Coimbatore method, wherein 7 kg fresh cow dung and 1 kg ghee were mixed well and incubated in a plastic drum for 2 days and it was mixed daily once. On third day, 10 litres cow urine and 10 litres water were added and mixed thoroughly and incubated for fermentation for 13 days. Then, 3 litres milk, 2 litres curd, 3 litres tender coconut water, 3 kg jaggary and 12 ripened cavendish banana were added and contents were incubated for 6 days and the mixture was stirred thoroughly thrice a day. Plastic drum was kept in shade and it was covered with wet jute bag. After 21 days of fermentation mixture was filtered through a cotton cloth and was used for seedlings root dipping. Panchagavya was sprayed on 25, 50, 75 and 100 days after transplanting (DAT).

All agronomic operations were performed as per the package of practice and irrigations were provided whenever necessary to overcome the soil moisture stress. Nitrogen content of soil at harvesting was estimated by Alkaline potassium permanganate method (Subbaiah and Asija, 1956). Available phosphorus content was estimated by Bray's No.1 extract Chlorostannous reduced molybdo-phosphoric blue colour method (Muhr et al.. 1965) and potassium was estimated by Flame photometric method, respectively (Jackson, 1973) and expressed in percentage. Data was stastistically analysed by Fisher's method of analysis of variance (ANOVA) and critical difference (CD) values were calculated the F-test was significant at 5 percent level.

III. Results and Discussion

Soil pH and EC did not vary due to sources, fertility levels and panchagavya application whereas, organic carbon content of the soil varied significantly due to CCP, FYM and panchagavya application (Table 1). It has increased from 0.40 per cent before planting to 0.53 per cent with FYM and 0.48 per cent in CCP. The improved status of organic carbon might be due to the higher OC content in FYM (15 to 16 percent) and in CCP (24 to 25 percent) directly added additional organic carbon to the soil after decomposition (Krishan Chandra 2005 and Zubair, *et al*.(2012).. Kumar (2004) have also reported the significant effect of FYM on the build-up of soil organic carbon. This is also in conformity with Mandal and Mandal (1994) who have also reported increase in organic carbon level with application of organic sources of nutrient such as FYM, compost, green manure application. Selviranganathan and Augustine Selvaseelan (1997) who have also reported increase in organic carbon with increased levels of FYM, CCP and green leaf manures etc., on permanent manurial trials.

NPK: Significantly higher nitrogen content of 290.04 kg ha^{-1} and 275.52 kg ha^{-1} was recorded with FYM and CCP application (Table 2). Nagarajan (1990), Ravichandra (1988) and Rajanna (1988), who have reported coir pith is having higher lignin content of 30 to 37.12 per cent and cellulose about 29 per cent with wider C:N ratio and they are highly resistant for decomposition. High N content in the organic material favours net mineralization and N concentration less than 1.7 to 2 per cent generally causes net immobilization (Constantinides and Fownes, 1994). Melillo *et al.,* (1982) found that plant materials contain high concentration of lignin, there was little mineralization inspite of high N concentration in the plant tissue. Similarly, Pathak and Sarkar, (1994) reported significant negative relationship between N mineralization and lignin content. This clearly indicates the lower availability of nutrients with CCP application. Similarly, application of FYM with 3 per cent panchagavya has increased the available N content in the soil (286.22 to 293.11 kg ha^{-1}). This is attributed to the mineralization and release of higher N from organic matter to the soil labile pool due to high enzymatic activities in soils might have increased transformation of nutrients to available form. This is also further supported by Singh, *et al.* (1990), Devakumar *et al.* (2008), Gopinath, *et al.* (2009) and Vidyavathi, *et al.* (2012). FYM itself contains reasonable amounts of various nutrient including N,P,K, etc., which are released into the soil upon decomposition and then these nutrients are absorbed by the plants (Chander, 2004).

Available P_2O_5 varied significantly with sources (9.39 kg ha^{-1} to 8.96 kg ha^{-1}), fertility levels (9.16 kg ha^{-1} to 9.72 kg ha^{-1}) and panchagavya application (9.06 kg ha^{-1} to 9.62 kg ha^{-1}) which may be due to the release of organic acids during microbial decomposition of organic matter have helped in solubility of native phosphorus. The complex organic anion chelates Al^{3+}, Fe^{3+} and Ca^{2+} and decrease the phosphate precipitating power of these cations and there by increases the availability of phosphorus (Reddy, *et al*., 2011, Kondapa, *et al*., 2009). The increase in available-P with FYM incorporation may be solubilization of phosphate by the action of organic acids produced during the decomposition of FYM (Singh and Subbiah, 1969), formation of protective coating on sesquioxides which reduce P-fixation (Singh and Lal 1976) and complex formation of humic and fulvic acid, thereby replacing phosphate ions by sesquioxides (Bhardwaj and Patil 1982).

Significantly, higher soil potassium was recorded with sources (246.56 kg ha^{-1} to 259.00 kg ha^{-1}), fertility levels (241.78 kg ha^{-1} to 250.56 kg ha^{-1}) and panchagavya (242.00 kg ha^{-1} to 251.44 kg ha^{-1}) application. However, the potassium content was high in CCP applied plots than FYM. This might be due to higher potassium content in CCP than FYM, the solubilization action of certain organic acids produced during decomposition and its greater capacity to hold potassium in available form in soil and also due to interaction of organic matter with clay Gopinath, *et al.* (2009), Kondapa, *et al.* (2009) and Vidyavathi, *et al*. (2012).

IV. Conclusion

Application of FYM significantly improved soil available N, P_2O_5 and organic carbon while composted coir pith increased the available K_2O. Applying 200 per cent N equivalent FYM improved the soil chemical properties.

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Table 1: Effect of different sources and levels of organic manures and panchagavya on soil pH, electrical conductivity and organic carbon content after harvesting of capsicum

Treatments	Soil pH			EC (dSm^{-2})			OC (%)		
	Sources of Organic Manure (S)								
	FYM S_1	CCP S_2	Mean	FYM S_1	CCP S_2	Mean	FYM S_1	CCP S_2	Mean
Fertility Levels (F)									
F_1 100 %	6.64	6.54	**6.59**	0.15	0.15	**0.15**	0.51	0.50	**0.50**
F_2 150 %	6.70	6.46	**6.58**	0.16	0.14	**0.15**	0.54	0.46	**0.50**
F_3 200 %	6.65	6.47	**6.56**	0.15	0.14	**0.15**	0.55	0.48	**0.51**
Mean	**6.66**	**6.49**		**0.15**	**0.15**		**0.53**	**0.48**	
	S.EM±	**C.D.**		**S.EM±**	**C.D.**		**S.EM±**	**C.D.**	

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Sources (s)	0.030	NS		0.004	NS		0.001	0.004	
Fertility levels (F)	0.049	NS		0.004	NS		0.006	NS	
S x F	0.069	NS		0.006	NS		0.008	0.026	
Panchagavya spray (P)									
P_0 0%	6.72	6.60	**6.66**	0.14	0.14	**0.14**	0.51	0.48	**0.49**
P_1 3%	6.65	6.50	**6.57**	0.15	0.15	**0.15**	0.54	0.48	**0.51**
P_2 6%	6.63	6.36	**6.49**	0.16	0.15	**0.15**	0.55	0.48	**0.52**
Mean	**6.66**	**6.49**		**0.15**	**0.15**		**0.53**	**0.48**	
	S.EM±	C.D.		S.EM±	C.D.		S.EM±	C.D.	
Panchagavya spray (p)	0.030	0.089		0.003	NS		0.005	0.015	
S x P	0.043	NS		0.005	NS		0.007	0.021	
				Fertility Levels (F)					
Panchagavya spray (p)	F_1	F_2	F_3	F_1	F_2	F_3	F_1	F_2	F_3
P_0 0%	6.60	6.74	6.64	0.14	0.14	0.14	0.51	0.48	0.48
P_1 3%	6.66	6.50	6.57	0.16	0.15	0.15	0.51	0.50	0.52
P_2 6%	6.52	6.50	6.46	0.15	0.16	0.15	0.49	0.51	0.54
	S.EM±	C.D		S.EM±	C.D		S.EM±	C.D	
F x P	0.053	NS		0.006	NS		0.009	0.026	

DAT = Days after transplanting — F_1, F_2 & F_3 = N equivalents
FYM = Farm yard manure — C.D. at 5 % level
CCP = Composted coir pith — NS = Non significant

Table 2: Effect of different sources and levels of organic manures and panchagavya on available nitrogen, phosphorus and potassium content after harvesting of capsicum

Treatments	Available N (kg ha^{-1})			Available p_2O_5(kg ha^{-1})			Available K_2O(kg ha^{-1}))		
	Sources of organic manure (S)								
	FYM S_1	CCP S_2	Mean	FYM S_1	CCP S_2	Mean	FYM S_1	CCP S_2	Mean
Fertility Levels (F)									
F_1 100 %	287.00	276.22	**281.61**	9.16	8.70	**8.93**	241.78	254.22	**248.00**
F_2 150 %	290.78	275.44	**283.11**	9.29	8.99	**9.14**	247.33	66.11	**256.72**
F_3 200 %	292.33	274.89	**283.61**	9.72	9.20	**9.46**	250.56	256.67	**253.61**
Mean	**290.04**	**275.52**		**9.39**	**8.96**		**246.56**	**259.0**	
	S.EM±	C.D.		S.EM±	C.D.		S.EM±	C.D.	
Sources (s)	0.79	4.80		0.06	0.36		1.89	11.48	
Fertility levels (F)	1.37	NS		0.12	0.38		1.10	3.58	
S x F	1.94	NS		0.17	NS		1.55	5.06	
Panchagavya spray (P)									
P_0 0%	286.22	273.44	279.83	9.06	8.83	8.94	242.00	254.22	**248.11**
P_1 3%	293.11	276.78	284.94	9.49	8.91	9.20	251.44	258.33	**254.89**
P_2 6%	290.78	276.33	283.56	9.62	9.14	9.38	246.22	264.44	**255.33**
Mean	**290.04**	**275.52**		**9.39**	**8.96**		**246.56**	**259.00**	
	S.EM±	C.D.		S.EM±	C.D.		S.EM±	C.D.	
Panchagavya spray (p)	1.02	2.97		0.10	0.30		1.29	3.76	
S x P	1.44	NS		0.15	NS		1.82	5.31	
				Fertility levels (F)					
Panchagavya spray (p)	F_1	F_2	F_3	F_1	F_2	F_3	F_1	F_2	F_3
P_0 0%	278.50	279.67	281.33	8.88	8.80	9.15	239.83	254.50	250.00
P_1 3%	281.00	287.33	286.50	8.83	9.38	9.38	251.00	258.33	255.33
P_2 6%	285.33	282.33	283.00	9.07	9.23	9.84	253.17	257.33	255.50
	S.EM±	C.D		S.EM±	C.D		S.EM±	C.D	
F x P	1.76	NS		0.18	NS		2.23	NS	

DAT = Days after transplanting — F_1, F_2 & F_3 = N equivalents
FYM = Farm yard manure — C.D. at 5 % level
CCP = Composted coir pith — NS = Non significant