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Influence of fertiliser and organic manures on the yield attributes and yield of cassava (*Manihot esculenta* Crantz.)

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ABSTRACT
Field experiments were conducted to find out the effect of poultry manure on yield attributes and yield of cassava at Veterinary College and Research Institute Farm, Namakkal during 2001 and 2002. The popular hybrid of cassava H 226 was tried as test crop. Two fertiliser levels viz., 100 per cent recommended NPK (60:60:150 kg/ha^{-1}) and 75 per cent recommended NPK (45:45:112.5 kg/ha^{-1}) were assigned to main plots. Six organic manurial treatments viz., FYM (25 t/ha^{-1}), Poultry manure (10 t/ha^{-1}), composted poultry manure (10 t/ha^{-1}), FYM (12.5 t/ha^{-1}) + poultry manure (5 t/ha^{-1}), FYM (12.5 t/ha^{-1}) + composted poultry manure (5 t/ha^{-1}) along with control (no organic manure) were assigned to sub plots. The results indicated that 100 per cent recommended NPK had better yield parameters than 75 per cent recommended NPK. All the yield parameters such as number of tubers, tuber length, and tuber girth and ultimately the tuber yield were positively influenced by the application of organic manures especially composted poultry manure.

Key words : Organic manure, Poultry manure, Compost, Cassava, Yield attributes.

INTRODUCTION

Among cassava growing countries, India ranks twelfth in area, but it is the seventh largest producer of cassava with a production capacity of 5.4 million tonnes from an area of 0.24 million hectares. However, India tops in productivity with 22.1 t/ha^{-1} which is the highest for any country in the world (Chadha and Nayar, 1994).

Application of organic manures has various advantages like increasing soil physical properties, water holding capacity, organic carbon content apart from supplying good quality of nutrients. Poultry manure is rich organic manure since solid and liquid excreta are excreted together resulting in no urine loss. In fresh poultry excreta uric acid or urate is the most abundant nitrogen compound (40-70 per cent of total N) while urea and ammonium are present in small amounts (Krogdahl and Dahlsgard, 1981). The nutritional value of unprocessed poultry manure deteriorates rapidly. Hence, the immediate processing of poultry manure to prevent its rapid decomposition and save its nutrient properties is, thus essential.

Composting or the biological degradation of poultry manure produces a material with several advantages with respect to handling by reducing volume, mass of dry matter, odours, fly attraction and weed seed viability (Sweeten, 1980). Composting poultry manure under anaerobic conditions helps for greater recovery of final product and negligible loss of nutrients particularly nitrogen (Kirchmann and Witter, 1989).

Even though poultry manure contains more amount of nutrients than other manures, the research work on poultry manure is less, since poultry population is concentrated only in certain areas and hence the manure availability also. Moreover poultry manure containing more nutrients, if applied to cassava, may even help to reduce the application of inorganic fertilizers. With these ideas in view, the present study was formulated.

MATERIALS AND METHODS

Field experiments were conducted to find out the effect of fertiliser levels and organic manures on the quality of cassava tubers at Veterinary College and Research Institute Farm, Namakkal during 2001and 2002. The popular hybrid of cassava, H 226 was tried as test crop. Two fertiliser levels viz., 100 per cent recommended NPK (60:60:150 kg/ha^{-1}) and 75 per cent recommended NPK (45:45:112.5 kg/ha^{-1}) were assigned to main plots. Six organic manurial treatments viz., FYM (25 t/ha^{-1}), Poultry manure (10 t/ha^{-1}), composted poultry manure (10 t/ha^{-1}), FYM (12.5 t/ha^{-1}) + poultry manure (5 t/ha^{-1}), FYM (12.5 t/ha^{-1}) + composted poultry manure (5 t/ha^{-1}) along with control (no organic manure) were assigned to sub plots. The treatments were fitted in split plot design replicated thrice.

Disease free setts of 20 cm length were prepared and planted at a spacing of 90 x 90 cm. Manures were applied as per treatments and thoroughly incorporated at the time of forming beds and channels.

The entire dose of phosphorus, 50 per cent of recommended dose of nitrogen and 50 per cent of potassium were applied basally at the time of planting and the remaining 50 per cent of the recommended dose of nitrogen and potassium were top dressed in two equal splits at third and fifth month, respectively, as per the treatments. After initial and life irrigation on third day, subsequent irrigations were given to the experimental field at an interval of ten days. Three hand weeding on 30th, 60th and 90th day after planting and an earthing up at 120 DAP was given commonly for all the plots.

Composting of poultry manure was initiated using poultry manure and chopped sorghum straw. The bits of sorghum straw were mixed with poultry manure at the rate of 1:10 and packed in dug pits and closed with mud plaster. To maintain optimum moisture, water was sprinkled before it is being packed and left under anaerobic conditions for 75 days as suggested by Sims *et al.* (1992) for composting

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poultry manure and poultry carcasses. The chemical analysis of the manures is furnished in Table 1.

Table 1 : Chemical analysis of FYM and poultry manure

Particulars	FYM	Poultry manure	Composted poultry manure
N content (%)	0.55	2.20	1.92
P content (%)	0.48	1.41	1.35
K content (%)	0.90	1.52	1.55
p H (1:2 soil water extract)	7.60	6.40	7.10
C: N ratio	20.8	11.8	16.9

The number of storage tubers of five plants was counted and the mean was expressed in number per plant. The length of storage tubers of five plants was measured and the mean was expressed in cm. The maximum girth of cassava tubers was measured for ten tubers at random and expressed in cm.

RESULTS AND DISCUSSION

Number of tubers plant^{-1}

Among the fertilizer levels, 100 per cent NPK registered significantly higher number of tubers (Table 2). This might be due to the higher uptake of all nutrients, which in turn might have led to the better growth of tuber forming roots. Nair (1982) reported an increase in tuber number due to increased dosage of N. Nair and Sadanandan (1987) got significant increase in tuber numbers per plant up to 200 kg K_2O/ha^{-1}, while Jimenez (1990) reported an increase in root numbers with high K rates.

With regard to organic manures, higher tuber numbers recorded in all the treatments than no organic manure control might be due to the increased availability and the resultant uptake of higher nutrients due to organic manures, which could have reflected in the formation of tubers. Production of more number of tubers might be due to adequate supply of assimilates at the productive stages leading to increased tubers. This might be due to the development and increased vegetative structures because of continuous supply of nutrients. Agasimani and Hosmani (1989) reported increase in yield parameters due to the application of organic manures in groundnut.

Tuber length

The tuber length also contributes to the yield increase in cassava.

Regarding fertilizer levels, higher tuber length recorded in 100 per cent fertilizer level might be due to the higher uptake of nutrients (Table 2). Nair (1982) reported an increase in tuber numbers and mean tuber weight due to increased dosage of N.

Among the organic manures, composted poultry manure either alone or with FYM registered higher tuber length. The favourable conditions created in the soil due to

Table 2 : Effect of fertilizer levels and organic manures on the yield attributes and yield of cassava

Treatment	2001				2002			
	No. of tubers plant^{-1}	Tuber length (cm)	Tuber girth (cm)	Tuber yield (t ha^{-1})	No. of tubers plant^{-1}	Tuber length (cm)	Tuber girth (cm)	Tuber yield (t ha^{-1})
100 % NPK	6.39	27.81	16.55	31.91	6.33	27.07	16.46	32.58
75 % NPK	6.34	27.36	16.22	30.78	6.29	26.95	16.31	31.19
SE_d	0.01	0.01	0.11	0.33	0.02	0.19	0.12	0.33
CD (P=0.05)	0.02	0.02	0.25	0.73	0.04	NS	NS	0.75
Control	5.21	24.35	13.63	21.83	5.13	23.59	13.93	22.03
FYM (25 t ha^{-1}),	6.44	27.18	16.25	31.63	6.46	26.55	16.33	32.35
Poultry manure (10 t ha^{-1}),	6.44	27.87	16.21	32.16	6.49	27.44	16.46	32.48
Composted poultry manure (10 t ha^{-1})	6.75	29.22	17.73	34.67	6.64	28.46	17.53	35.44
FYM (12.5 t ha^{-1}) + poultry manure (5 t ha^{-1}	6.61	27.86	17.02	33.62	6.55	27.73	16.84	34.10
FYM (12.5 t ha^{-1}) + composted poultry manure (5 t ha^{-1})	6.74	29.13	17.45	34.15	6.60	28.27	17.24	34.92
SE_d	0.09	0.38	0.22	0.03	0.27	0.37	0.22	0.03
CD (P=0.05)	0.17	0.75	0.44	0.07	0.54	0.73	0.45	0.07

increased nutrient availability and the resultant uptake owing to high nutrient content of the manures might have complemented the tuber length, which corroborated with the findings of Ayyasamy (1994).

Tuber girth

Tuber girth in cassava is of considerable significance due to its close relation to the ultimate yield. Among the fertilizer levels, 100 % NPK registered higher tuber girth than 75 % NPK (Table 2). This might be due to higher uptake of N and K by 100 % NPK. Nair (1982) observed increase in tuber weight due to increase in dosages of N. Similarly, Nair and Aiyer (1985) recorded greater tuber size at 150 kg K_2O/ha^{-1}.

With regard to organic manures, higher tuber girth was recorded in composted poultry manure either alone or with FYM. Increased availability of nutrients and the increased uptake especially P and K might have increased the tuber girth. Ayyasamy (1994) reported similar effect due to the application of coir waste at 10 t/ha^{-1}.

Tuber yield

Fertilizer levels and organic manures influenced the tuber yield of cassava. In cassava cultivation, the fresh tuber is the ultimate product that decides the benefit. Any practice that improves the yield would enhance returns and this is well known. In this study, various treatments imposed had their own influence on the tuber yield with varying magnitudes.

Regarding fertilizer levels, 100 per cent NPK recorded higher yield than 75 per cent NPK (Table 2-3). The reduction in fertilizer dose might have caused a depression in the growth parameters in the early stage as evidenced in this study, which in turn might/have reflected in the ultimate yield. Saraswat and Chettiar (1976) obtained yield increase due to higher N up to 150 kg/ha^{-1}. Ramanujam and Indira (1987). Reported increased yield of cassava due to application of K up to 200 kg K_2O/ha^{-1} On comparing the data on yield due to the organic manures, it was clearly evident that all the treatments that received organic manures recorded higher tuber yield than no organic manure control suggesting the importance of organic manures. Higher tuber yield due to organic manures could be attributed to favourable changes in soil, which might have resulted in loose and friable soil condition and enabled better tuber formation. Moreover, positive influence of these treatments might be due to slow and steady availability of nutrients throughout the crop growth period from organic manures. Pillai *et al*. (1987) reported the beneficial effect of FYM at 12.5 t/ha^{-1} in enhancing the yield of cassava tuber.

Adequate biomass production, better nutrient uptake and improvement in yield parameters might have resulted in higher tuber yield consequent to application of composted poultry manure either alone or in combination with FYM followed by poultry manure in conjunction with FYM. Enrichment of soil N and P in available form by the addition of composted poultry manure might be responsible for good performance by CPM besides their higher NPK content compared to FYM. Jayanthi (1995) reported similar result of higher yield of rice due to composted and recycled poultry manure. Increased castor seed yields due to the application of 10 t/ha^{-1} of poultry manure was reported by Ugbaja (1996) and increased egg plant yields up to 15 t/ha^{-1} of poultry manure was reported by Opara and Asiegbu (1996). Ponsica *et al***.** (1983) observed a higher efficiency of poultry manure than cattle manure in increasing the yield of maize. Even though poultry manure had higher N than composted poultry manure, it did not record higher yield over composted poultry manure. The immediate mineralisation of N after application, at the stage, the plant/had not even sprouted and the resultant loss of N by ammonia volatilisation might be the reason for the relatively lesser yield recorded under poultry manure. In the present investigation, in part I incubation studies, the available N of the soil incubated with poultry manure increased markedly on 15th day and

Table 3 : Effect of fertilizer levels and organic manures on the tuber yield ($t\ ha^{-1}$) of cassava

Treatment	2001			2002		
	100 % NPK	75 % NPK	Mean	100 % NPK	75 % NPK	Mean
Control	22.48	21.17	21.83	22.74	21.33	22.03
FYM (25 $t\ ha^{-1}$),	32.22	31.05	31.63	32.98	31.72	32.35
Poultry manure (10 $t\ ha^{-1}$),	32.52	31.79	32.16	33.16	31.80	32.48
Composted poultry manure (10 $t\ ha^{-1}$)	35.23	34.12	34.67	36.21	34.66	35.44
FYM (12.5 $t\ ha^{-1}$) + poultry manure (5 $t\ ha^{-1}$)	34.28	32.97	33.62	34.77	33.42	34.10
FYM (12.5 $t\ ha^{-1}$) + composted poultry manure (5 $t\ ha^{-1}$)	34.72	33.57	34.15	35.62	34.22	34.92
Mean	31.91	30.78		32.58	31.19	
	SE_d	CD (P=0.05)		SE_d	CD (P=0.05)	
F	0.32	0.72		0.33	0.73	
M	0.03	0.07		0.03	0.07	
F x M	0.33	0.73		0.33	0.74	

reduced suddenly on 30th day and slowly thereafter. Wolf *et al***.** (1988) reported that 37 per cent of N in poultry manure was volatilised in 11 days after application, which might reduce the availability of N for plant uptake and this is concomitant to this result. Another ostensible reason might be the narrower C: N ratio of poultry manure. Low C: N ratio might/have favoured aerobic fermentation in the field resulting in loss of Co_2 and ammonia, thus reducing the nutrients especially N for plant uptake. Similar result was also reported by Simpson (1986). Regarding fertilizer levels and organic manure interaction, the treatment combination 100 % NPK along with composted poultry manure registered the highest yield. The immediate supply of nutrients due to the addition of inorganic fertilizers and the slow and continuous supply of nutrients due to the addition of composted poultry manure either alone or with FYM might be the reason for increased yields in the treatments mentioned. It is noteworthy that composted poultry manure with 75 per cent NPK registered higher yields than the combination of 100 per cent NPK in conjunction with FYM 25 t/ha^{-1}, or poultry manure 10 t/ha^{-1}, indicating the potentiality of CPM to supply nutrients, even if inorganic fertilizers were reduced by 25 per cent, owing to its higher content of NPK than other organic manures. Savithri *et al*. (1991) reported similar finding in sorghum.

The results indicated that 100 per cent recommended NPK (60:60:150 kg/ha^{-1}) had better yield parameters than 75 per cent (45:45:112.5 kg/ha^{-1}) recommended NPK. All the yield parameters such as number of tubers, tuber length, and tuber girth and ultimately the tuber yield were positively influenced by the application of organic manures especially composted poultry manure. The study suggested that the inorganic fertilizer could be reduced by 25 % if applied along with composted poultry manure

REFERENCES

Agasimani, C.A. and Hosmani, M.M. (1989). Response of groundnut crop to farmyard manure, nitrogen and phosphorus in rice fallows in coastal sandy soils. *J. Oilseeds Res.,* **6 :** 360-363.

Ayyasamy, M. (1994). Irrigation scheduling for cassava comrade cropping system. Ph.D. Thesis. Tamil Nadu Agric. Univ., Coimbatore, India.

Chadha, K.L. and Nayar, G.G. (1994). History of Tuber Crops Research in India. **In**: Advances in Horticulture 8: 1-16 **Eds**. K.L.Chadha and G.G.Nayar. Malhotra Publishing House, New Delhi, India.

Jayanthi, C. (1995). Sustainable component linkage and resource recycling to lowland integrated farming systems. Ph.D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India.

Jimenez, C. J.A. (1990). Potassium fertilization on land continuously planted to Tapioca. *Abstracts on cassava*. Vol XVII No.1 1991 pp.4.

Kirchmann, H. and Witter, E. (1989). Ammonia volatilisation during aerobic and anaerobic manure decomposition. *Plant Soil,* **115:** 35-41.

Krogdahl, A., and Dahlsgard, B. (1981). Estimation of nitrogen digestibility in poultry. Content and distribution of major urinary nitrogen compounds in excreta. *Poultry Sci.,* **60**: 2480-2485.

Nair, V.M. (1982). Potash nutrition of Tapioca (*Manihot esculenta* Crantz.) Ph.D. Thesis, Kerala Agricultural University, Trichur, India.

Nair, P.G. and Aiyer, R.S. (1985). Effect of potassium nutrition on cassava. I. Growth, yield components and yield. *J. Root Crops,* **11 (1 & 2):** 23-28.

Nair, V.M. and Sadanandan, N. (1987). Response of cassava to nitrogen and potassium in red loam soil. **In**: Proc. Nat. Symp. on production and utilization of Tropical tuber crops. CTCRI, Trivandrum. Pp. 89-92.

Opara, N.C. and Asiegbu, J.E. (1996). Nutrient content of poultry manures and the optimum rate for Eggplant fruit yield in a weathered tropical alfisol. *Biol. Agric. Hort.,* **13 :** 341-350.

Pillai, N.G. B. Mohankumar, Nair, P.G. , Kabeerathumma, S. and Mohankumar, C.R. (1987). Effect of continuous application of manures and fertilizers on the yield and quality of cassava in laterite soil. **In**: Proc. Nat. Symp. on production and utilization of Tropical tuber crops, CTCRI, Trivandrum, India. Pp.109-114.

Ponsica, E.P., Eralala, R.G. and Quirol, B.F. (1983). Effects of animal manure application on the growth and yield of Corn. *Annals of Tropic. Res.,* **5**: 110-116.

Ramanujam, T. and Indira, P. (1987). Effect of potassium on growth, dry matter production, yield and quality of cassava. **In**: Proc. Nat. Symp. on production and utilization of Tropical tuber crops. CTCRI, Trivandrum. Pp.119-122.

Saraswat, V.N. and Chettiar, T.S. (1976). Effect of organic and inorganic sources of nitrogen on cassava (*Manihot esculenta* Crantz.) *Indian Agriculturist,* **20(1):** 23-26.

Savithri, P., Subbiah, S., Malarvili, P. and Gopalsamy , A. (1991). Effect of coir pith based poultry litter on yield and nutrient uptake by sorghum cowpea cropping system. **In**: Proc. Seminar on utilization of coirpith in agriculture. Nov. 20th 1991. TNAU, Coimbatore.

Sims, T.T., Murphy, D.W. and Handweker, T.S. (1992). Composting of poultry wastes: Implications for dead poultry disposal and manure management. *J. Sustainable Agric.,* **2(4):** 67-82.

Simpson, K. (1986). Fertilizers and manures. Pub. Longman Group Limited, Longman house, England.

Sweeten, J.M. (1980). Waste treatment: State-of-the-art. Livestock waste: A Renewable resource. **In**: Proc. 4th Int. Symp. on Livestock Wastes. ASAE, St. Joseph, MI: 334-338.

Ugbaja, R.A.E. (1996). Growth and Responses of Castor Oil Plant to Sources and Rates of Organic manures in Ferralitic soils. *Biol. Agric. Hort.,* **13 :** 291-299.

Wolf, D.C., Gilmour, J.T. and Gale, P.M. (1988). Estimating potential ground and surface water pollution from land application of poultry litter -II. Publication No. 137, Arkansas Water Resources Research Center, Fayetteville, A. R.

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