Original Research Article

Nutrient uptake and post harvest nutrient status of elephant foot yam influenced by integrated nutrient management under coastal condition

ABSTRACT

The investigation was carried out to study the intergrated nutrient management practices on nutrient uptake and economics of Elephant foot yam (*Amorphophallus paeonifolius* (Dennst.) Nicolsan) cv. Gajendra.The field experiment was laid out in randomized block design with thirteen treatments with three replications. Elephant foot yam corms were cut into 800 g for planting, and dipped in cow dung slurry and placed for drying. The treatments comprised of three levels of recommended dose of fertilizers *viz*., 75%, 100% and 150% along with organic inputs *viz*., FYM (20 t ha^{-1}),Vermicompost (5 t ha^{-1}), consortium bio fertilizer (5 Kg ha^{-1}) and organic manures of different combinations were applied as basal. The observations were recorded before and after harvesting. From the study it was observed that soil organic content was increased significantly due to the application of organic manures along with biofertilizers, whereas soil physical and chemical properties were unaffected. The economic analysis indicated that the T_5 resulted in the highest net income and B:C ratio..

Keywords: [Elephant foot yam, FYM, Vermicompost, B:C ratio]

1. INTRODUCTION

Elephant foot yam, often known as the "King of Tuber Crops" is a tropical under-ground tuber that is grown in Africa and Southeast Asia. Mostly cultivated commercially in Andhra Pradesh, Tamil Nadu, Gujarat, Maharashtra, West Bengal, Jharkhand, Kerala, Karnataka, Bihar, Uttar Pradesh, and Puducherry [3]. Tuber crops are well adapted to marginal environments, low input management, and drought in general. They bloom well when the annual rainfall is 1000-1500 mm. Tuber crops, particularly elephant foot yam, respond favorably to organic manures in general. Over a decade of research at the Central Tuber Crops Research Institute has shown that organic management improves production, quality, and soil qualities in tuber crops [7].The Green Revolution in India surely increased agricultural output. However, productivity decreased in many intensively cultivated regions where organic manures were partially or completely prohibited. The expansion of land usage with growing reliance on agrochemicals resulted in crop output stagnation in many cases, necessitating a shift to a alternative farming system approach with built-in aspects of farming-nature harmony [1]. Until 1980, it was widely assumed that inorganic fertilizers were a feasible technique of enhancing agricultural productivity in the humid tropics' low fertility soils. Various reports on the usage of inorganic fertilizers in the tropics had also stagnated, which was explained by low marketing and profitability [4]. As a result, maximizing the use of organic waste by combining it with chemical and bio-fertilizers in an integrated manner was discovered to be the preferable option. As a result, a field experiment was conducted to assess the effects of various organic and inorganic nutrient management strategies along with biofertilizers on nutrient uptake and B:C ratio of elephant foot yam.

2. MATERIAL AND METHODS

The study was conducted at farmers field at Thirukkanur village, Villianur, Puducherry during the year 2020-2022. Fifteen plants were tagged randomly in each net plot of each treatment for recording the following observations

2.1 Treatment Details

The treatments comprised of three levels of recommended dose of fertilizers (RDF - 80:40:100 Kg NPK ha^{-1}) *viz*., 75%, 100% and 150% along with organic inputs *viz*., FYM (20 t ha^{-1}), Vermicompost (5 t ha^{-1}) and (Consortium bio fertilizer 5 Kg ha^{-1}) (Table 1). Organic manures of different combinations were applied as basal. Observations were recorded before and after harvest of the crop. Fifteen plants were tagged randomly in each plot of each treatment for recording the following observations.

TABLE 1 :Treatment Details

Treatment	Treatment Details
T_1	FYM 20 t ha^{-1} + 75% RDF (60:30:75 Kg NPK ha^{-1})
T_2	FYM 20 t ha^{-1} + 100% RDF (80:40:100 Kg NPK ha^{-1})
T_3	FYM 20 t ha^{-1} + 125% RDF (100:50:125 Kg NPK ha^{-1})
T_4	FYM 20 t ha^{-1} + 75% RDF (60:30:75 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_5	FYM 20 t ha^{-1} + 100% RDF (80:40:100 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_6	FYM 20 t ha^{-1} + 125% RDF (100:50:125 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_7	Vermicompost 5 t ha^{-1} + 75 % RDF (60:30:75 Kg NPK ha^{-1})
T_8	Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1})
T_9	Vermicompost 5 t ha^{-1} + 125 % RDF (100:50:125 Kg NPK ha^{-1})
T_{10}	Vermicompost 5 t ha^{-1} + 75 % RDF (60:30:75 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_{11}	Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_{12}	Vermicompost 5 t ha^{-1} + 125 % RDF (100:50:125 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1}
T_{13}	Control

3. RESULTS AND DISCUSSION

The experiment was laid out during *kharif*, 2020at the farmer field at Thirukkanur village, Villianur, Puducherry to assess theeffect of integrated nutrient management on soil parametes of Elephant foot yam (*Amorphophaluspaeonifolius* (Dennst.) Nicolsan) cv. Gajendra.
The data result of the field experimental hasbeen presented in (Table 2&3).

3.1 SOIL PARAMETERS AND ECONOMICS AFFECTED BY INTEGRATED NUTRIENT MANAGEMENT PRACTICES

Table 2 shows the soil physical parameters, bulk density (BD) as well as the chemical properties, soil organic carbon, accessible N, P, and K levels available and after crop harvest as modified by different treatments. The soil organic carbon concentration was highest when 50% of the N was replaced with vermicompost, which recorded 0.64% organic carbon content and was comparable to T_{12}. Replacing 50% N with diverse organic nutrient sources increased the amount of organic carbon in the soil, resulting in a considerable increase in soil organic carbon content. The effect of bio-fertilizer application was found to be significant, with the highest organic carbon content of 0.64% found in the treatment with bio-fertilizer application, which may be due to well decomposition of organic manures by applied microbes, which may ultimately increase soil organic carbon content [7]. Similar results have been also reported in other crops under Indian conditions [2], [6].[3] discovered that manure treatment increased soil microbial bio-mass and carbon content. The enzymes found in organic manures may also directly boost soil enzymatic activity.

Better N, P, and K consumption was reported in treatments with integrated nutrition management or a higher level of vermicompost application. Control had the lowest nitrogen, phosphorus, and potassium intake. After two years of experiments, available P in the chemical plot was noticeably increased. This could be owing to the inclusion of synthetic fertilizers as well as FYM, which could limit P fixation. Bulk density was non-significant, but accessible N, P, and K were slightly higher in the treatments where 100% of the nitrogen was replaced with organic manures. [8] obtained similar results in elephant foot yam. When compared to the initial soil status, the amount of accessible N, P, and K contents is about equal to or slightly higher.

According to the findings, elephant foot yam efficiently utilized the extra nitrogen for vegetative growth while phosphorus and potassium for improved quality and corm production. The post-harvest soil nutrient status revealed that maximum soil N, P_2O_5 and K_2O_5 was available in T_{11}. Elephant foot yam response to P_2O_5 was observed up to 60 kg ha^{-1}[5]. This might be due to un-utilization of applied N and K in this treatment. Whereas in case of P_2O_5 was as result of excess application of P and lesser utilization of P by the crop.

The data presented in Table 3 revealed that the highest B:C ratio (4.46) was obtained in the treatment T_5 which was closely followed by the B:C ratio of 4.27, obtained in the treatment combination of T_{11}. The key explanation for this finding is the price differential between vermicompost and farm yard manure. The B: C ratio in all organic treatments can be increased if organic manures are created on the farm. One of the most significant aspects of organic farming is the natural fertility of each field/farm or region. As a result, effort should be taken to ensure that only a limited amount of nutrients exit the system, hence limiting "import" of nutrients. This can only be accomplished by recycling on-farm waste, which lowers input costs [10].

Table. 2. Effect of organic sources, recommended dose of fertilizers and biofertilizers on soil status of elephant foot yam.

Treatments	Bulk density (gcm^{-3})	Soil O.C. (%)	Nutrient uptake (Kg ha^{-1})			Post harvest soil nutrient status (Kg ha^{-1})		
			N	P	K	N	P_2O_5	K_2O
T_1	1.40	0.60	118.73	106.51	87.64	88.59	52.09	82.69
T_2	1.34	0.62	148.06	149.83	113.69	101.45	61.17	91.46
T_3	1.40	0.58	129.81	128.72	100.51	95.06	56.34	87.05
T_4	1.42	0.59	116.22	112.83	90.88	90.23	53.26	83.80
T_5	1.41	0.61	152.51	155.13	116.85	103.12	62.21	92.54

T_6	1.36	0.49	134.27	134.00	104.11	96.66	57.48	88.16
T_7	1.31	0.55	120.83	118.14	94.03	91.89	54.30	84.91
T_8	1.47	0.57	157.00	160.42	120.06	104.69	63.27	93.65
T_9	1.45	0.60	13.11	44.00	1670.40	98.31	59.02	89.02
T_{10}	1.60	0.54	12.00	41.89	1440.32	93.45	55.31	86.00
T_{11}	1.23	0.64	14.60	46.86	2009.17	106.31	64.29	94.83
T_{12}	1.11	0.63	13.46	44.68	1743.72	99.87	60.11	90.38
T_{13}	1.63	0.61	9.47	37.52	1068.26	85.28	50.17	79.51
CD (p=0.05)	NS	NS	0.34	0.68	2.35	1.53	0.98	1.03

Table. 3. Effect of integrated nutrient management on cost economics analysis in elephant foot yam

S.No		**Cost of cultivation (Rs ha^{-1})**	**Total yield (t ha^{-1})**	**Gross income (Rs ha^{-1})**	**Net income (Rs ha^{-1})**	**B:C ratio**
1	T_1	136257	24.21	484200	347943	1:2.55
2	T_2	138787	36.51	730200	591413	1:4.26
3	T_3	141781	30.20	604000	462219	1:3.26
4	T_4	137257	25.58	511600	374343	1:2.72
5	T_5	139787	38.18	763600	623813	1:4.46
6	T_6	142781	31.98	639600	496819	1:3.48
7	T_7	148757	27.37	547400	398643	1:2.68
8	T_8	151287	39.75	795000	643713	1:4.25
9	T_9	154281	33.38	667600	513319	1:3.33
10	T_{10}	149757	28.78	575600	425843	1:2.84
11	T_{11}	152287	40.15	803000	650713	1:4.27
12	T_{12}	155281	34.84	696800	541519	1:3.49

13	T_{13}	111475	21.34	426800	315325	1:2.83

List 1 :Cost of Experimental sources

Urea – 298/50 kg	FYM – 500/t	Labour cost – 200/day
SSP - 356/50 kg	Vermicompost – 5100/t	Seed cost – 20/kg
MOP – 565/50 kg	Irrigation charges – 50/hr	Bio fertilizers – 120/litre

4. CONCLUSION

The results of the study inferred that individual effect of integrated nutrient sources and bio-fertilizers had been effective in improving the soil fertility status. From the above enumeration, inference can be drawn that integrated nutrient management with vermicompost along with bio-fertilizers largely improves soil status in cultivation of elephant foot yam. T_5 recorded highest B:C ratio followed by T_{11}.

ABBREVIATIONS

%	:	per cent
( )	:	Bracket parenthesis
@	:	At the rate of
=	:	is equal to
CBF	:	Consortium Biofertilizers
C.D.	:	Critical difference
cm	:	Centimeter
cv.	:	Cultivar
FYM	:	Farmyard manure
g	:	gram
ha^{-1}	:	per hectare
NPK	:	Nitrogen, Phosphorus and Potassium
Kg	:	Kilogram
No.	:	Number
RDF	:	Recommended dose of fertilizers
ha^{-1}	:	per hectare
t	:	tonne
***VIZ*.**	**:**	**NAMELY**

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