Studies on Integrated Nutrient Management on Yield And Quality Characters of Elephant Foot Yam (*Amorphophallus paeonifolius* (Dennst.) Nicolsan) cv. Gajendra

ABSTRACT

The investigation was carried out to study the intergrated nutrient management practices on yield and quality characters 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 and conducted at farmer's field at Thirukkanur village, Villianur, Puducherry during the year 2020 with spacing 60 x 60 cm. Elephant foot yams corms were cut into 800 g for planting, after cutting corms were dipped in cow dung slurry and placed for drying. 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 (CBF 5 Kg ha^{-1}), organic manures of different combinations were applied as basal; where as recommended dose of fertilizer were also applied combined with organic manures. The observations were recorded at 190 days after planting. The results recorded maximum values for yield parameters *viz*., Culm girth (14.60 cm), Corm circumference (46.86 cm), Single Corm weight (48.21 Kg) $plant^{-1}$, Yield $plant^{-1}$ (2.42 Kg), Yield per plot (60.76 Kg), Total yield (40.15t ha^{-1}) whereas quality parameters such as Moisture content (79.64 %), Starch content (18.02 %), Crude protein(6.11 %), Calcium oxalate (12.18 mg g^{-1}), Total sugar content (2.62 mg g^{-1}) and β carotene (0.19µg g^{-1}). From the experiment, it was concluded that the integrated nutrient management *viz*., combination of vermicompost with 100 per cent RDF along with consortium biofertilizer were identified as the best treatment to increase quality and yield.

Keywords: [NPK; FYM; Vermicompost; CBF]

1. INTRODUCTION

Amorphophallus paeoniifolius is a tropical plant cultivated throught out Southeast Asia [17]. Due to potential and production capacity, it can be grown as cash crop and widely used as traditional vegetable by rural population as leaves are used as a vegetable by local tribes in India because they contain high concentration of vitamin A [12]. Corms are Corms are typically eaten by boiling, mashed or pounded and combined with other vegetables and used as secondary food during the period of scarcity of other vegetable. It is widely used in Ayurveda, Siddha and Unani and the tubers are also useful in treatment of piles. It has become crucial to diversify the current agriculture in order to fulfil the different human requirement due to the strain of an ever-increasing population and the rapid depletion of natural resources. Inorganic fertilizers are commonly believed to be an effective means to raise production in poor soils and thereby leading to stagnation. Also various reports shows use of inorganic fertilizers in the tropics had stagnated explained by low marketing and profitability [8].The recent hikes in prices of fertilizers have been compelling the Indian farmers to resort to imbalanced nutrition of crops and thus, leading to reduction in crop yields and also causing negative nutrient balance annually [19]. As an alternative way, to overcome the dependence on inorganic fertilizers, usage of organic waste integrated with chemicals and bio-fertilizers was recommended. Hence the field experiment was taken up to evaluate the effect of different organic and inorganic fertilizers on yield and quality.

2. MATERIAL AND METHODS

The present study was conducted at farmers field at Thirukkanur village, Villianur, Puducherry during the year 2020.

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 at 190 days after planting.Observations were recorded at different stages of the crop. Fifteen plants were tagged randomly in each plot of each treatment for recording the following observations.

TABLE 1. List of treatments used for the study

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 the effect of integrated nutrient management on yield and quality characters of Elephant foot yam (*Amorphophalus paeonifolius* (Dennst.) Nicolsan) cv. Gajendra.

The data result of the field experimental yield components has been presented in (Table 2&3) and (Fig. 1).

3.1 YIELD PARAMETERS AFFECTED BY INTEGRATED NUTRIENT MANAGEMENT PRACTICES

3.1.1 CULM GIRTH, CORM CIRCUMFERENCE, SINGLE CORM WEIGHT, CORM WEIGHT PLANT^{-1}, YIELD PLOT^{-1} AND TOTAL YIELD.

The yield attributes *viz*., Culm girth (cm), Corm circumference (cm), Single Corm weight $plant^{-1}$ (kg), Yield $plant^{-1}$ (kg), Yield $plot^{-1}$ (kg), Total yield (t ha^{-1}) were significantly affected by the application of various inorganic and organic inputs. From the results of the present study that maximum values for yield parameters were recorded in T_{11} [Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1})], followed by T_8

[Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1})] and the least values were recorded in T_{13} (control).

Corm yield is determined with the amount of dry materials translocated to the corms and the ability of the corm, to store assimilates as evidenced by the volume and diameter of the corms is regarded as a crucial determinant influencing eventual yield. Yield of elephant foot yam depends on photosynthetic capacity and duration of the crop.

The data on yield attributes revealed that, organic manures along with inorganic fertilizers at different levels exert a significant influence on corm yield and yield attributes. From the results it could be concluded that the 20% nutrient requirement could be substituted through organic source as vermicompost, FYM without any yield loss. As the application of vermicompost might have enhanced soil micro flora activity, besides supplementing nutrients Murthy et al. [6]. The combined application along with biofertilizers increased the availability of soil nitrogen and phosphorus. The corm yield was increased gradually with increase in fertility levels. Similar results were reported by Mukhopadhyay SK and Sen H [5]. Highest tuber yield in elephant foot yam for two seasons was recorded by Saraswathi et al. [13] and Saravaiya et al. [14] and reported that recommended dose of fertilizers through inorganic source was on par with the application of 75% of nutrients through inorganic source and 25 % of nutrients through organic sources. Sengupta et al. [15] has proved that vegetative growth viz., plant height, canopy spread had direct influence on yield. Furthermore, substantial positive relationship between plant height, dry matter output, and yield qualities and cassava tuber yield, which is consistent with the current study's findings [1].

TABLE. 2. EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD PARAMETERS OF ELEPHANT FOOT YAM cv. Gajendra.

Treatments	Culm girth (cm)	Corm circumference (cm)	Single Corm weight plant^{-1}(Kg)	Yield plant^{-1} (Kg)	Yied plot^{-1} (Kg)	Total yield (t ha^{-1})
T_1	11.13	40.38	29.07	1.36	39.02	24.21
T_2	13.49	44.72	43.84	2.12	54.81	36.51
T_3	12.36	42.59	36.26	1.75	46.90	30.20
T_4	11.54	41.06	30.72	1.45	41.00	25.58
T_5	13.85	45.42	45.84	2.22	56.78	38.18
T_6	12.74	43.29	38.40	1.85	48.86	31.98
T_7	11.96	41.78	32.86	1.56	42.96	27.37
T_8	14.23	46.14	47.23	2.32	58.76	39.75
T_9	13.11	44.00	40.08	1.95	50.84	33.38
T_{10}	12.00	41.89	34.56	1.65	44.93	28.78
T_{11}	14.60	46.86	48.21	2.42	60.76	40.15
T_{12}	13.46	44.68	41.83	2.03	52.83	34.84
T_{13}	9.47	37.52	25.63	1.27	37.06	21.34
S.Ed	0.17	0.34	1.17	0.03	0.98	-
CD (p=0.05)	0.34	0.68	2.35	0.07	1.95	-

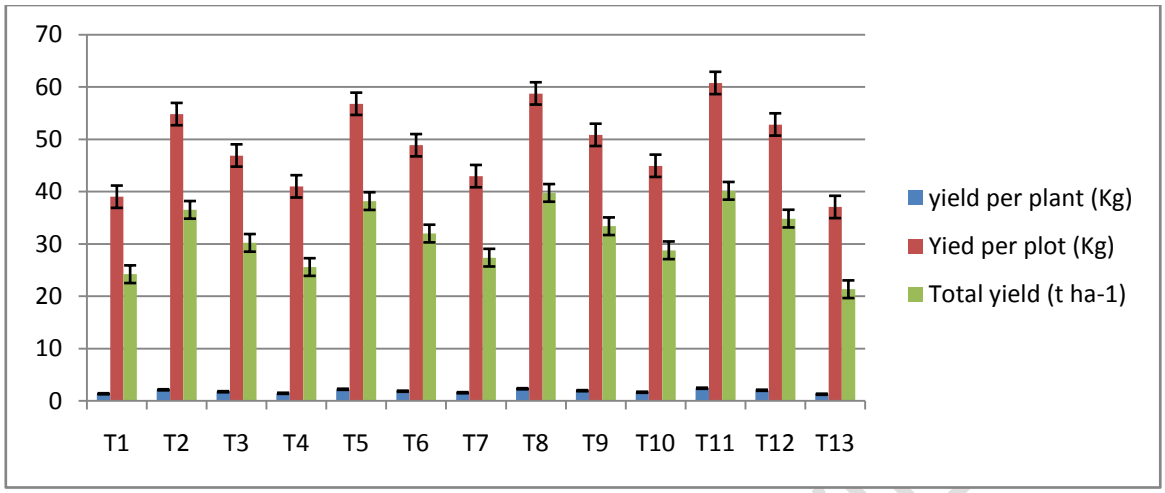

Fig. 1.Effect of integrated nutrient management on yield parameters of elephant foot yam cv. gajendra.

3.2 QUALITY PARAMETERS AFFECTED BY INTEGRATED NUTRIENT MANAGEMENT PRACTICES

3.2.1 MOISTURE, STARCH, TOTAL SUGAR CONTENT, CRUDE PROTEIN CALCIUM OXALATE AND BETA CAROTENE CONTENT

The data on quality attributes such as Moisture content (%), Starch content (%), Crude protein(%), Calcium oxalate (mg g^{-1}), Total sugar content (mg g^{-1}) and β carotene (µg g^{-1}) were significantly affected by the application of various inorganic and organic inputs. From the results of the present study shows that maximum values for quality parameters were recorded in T_{11} [Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1}) + CBF 5 Kg ha^{-1})], followed by T_8 [Vermicompost 5 t ha^{-1} + 100 % RDF (80:40:100 Kg NPK ha^{-1})] and the least values were recorded in T_{13} (control) (Table 3). These results were also reported by Jayathilake [3] and Shinde et al. [16] in onion.

The increased moisture content in corm might be as a result of maintenance of soil physical structure and thus resulted in better moisture retention in the underground storage organ which may have resulted in increased aeration, porosity and water holding capacity of soils.

The increase appears to be related to greater potash levels, which aided in creation and transfer of starch from the leaves to tubers [2] and might be due to its capacity in increasing parenchymatous cells which contains starch grains [6]. Whereas, the trend with respect to the protein content indicated that N application either in the form of inorganic fertilizers or organic manure plays a key role in enhancing the protein content of corms because nitrogen is a major constituent of protein.

Increased N resulted in higher amounts of crude protein in cassava tubers were reported by [10] which is similar with the findings of the above results.The protein content has significantly reduced in treatment receiving low levels of nitrogen, particularly in control. These results were similar with [6] where maximum starch and protein contents of the corms were observed at higher N and K doses in *Amorphophallus.* The integrated use of organic manures (vermicompost, FYM) favourably affected the crude protein content. The highest crude protein content might be due to the result of increased phosphorus supply in balanced proportion [9].

Higher nitrogen content through inorganic fertilizers resulted in the accumulation of more oxalates and the biochemical studies conducted in the present investigation clearly revealed the above fact. It can also be adjudged that this trait is more genotype specific and is least affected by growing environment Sengupta et al. [15].

The increased level of beta carotene due to combined use of organic manures might have resulted in enhancement in quality parameters of elephant foot yam. Nitrogen is most indispensable of all mineral nutrients for growth and development of plant. [5; 8] also supported the findings regarding beta carotene and calcium oxalate.

TABLE. 3. EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON QUALITY PARAMETERS OF ELEPHANT FOOT YAM cv. Gajendra.

Treatments	Moisture content (%)	Starch content (%)	Crude protein (%)	Calcium oxalate (mg g^{-1})	Total sugar content (mg g^{-1})	β carotene (µg g^{-1})
T_1	68.36	13.82	5.42	10.10	1.80	0.158
T_2	76.34	17.46	5.93	11.68	2.44	0.188
T_3	72.89	15.83	5.72	10.82	2.16	0.175
T_4	69.50	14.35	5.55	10.31	1.90	0.162
T_5	77.45	17.98	6.00	11.73	2.45	0.189
T_6	74.00	16.36	5.78	11.05	2.26	0.179
T_7	70.62	14.88	5.62	10.54	1.99	0.166
T_8	78.55	17.50	6.05	11.96	2.53	0.192
T_9	75.17	16.89	5.85	11.08	2.27	0.180
T_{10}	71.73	15.31	5.64	10.60	2.00	0.170
T_{11}	79.64	18.02	6.11	12.18	2.62	0.196
T_{12}	76.28	17.42	5.92	11.43	2.35	0.184
T_{13}	64.59	11.36	5.22	9.32	1.38	0.131
S.Ed	0.54	0.24	0.03	0.10	0.04	0.002
CD (p=0.05)	1.08	0.48	0.05	0.19	0.07	0.003

4. CONCLUSION

Based on the findings of the present investigation, it can be concluded that the application of 5 t ha^{-1} of vermicompost combined with 100% RDF (80:40:100 Kg NPK ha^{-1}) + 5 kg ha^{-1} of CBF (T_{11}) can be considered as best inorganic and organic combination to obtain maximum yield and quality characters whereas T_{13} (control) obtain minimum yield and quality of corms.

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ABBREVIATIONS

%	:	per cent
( )	:	Bracket parenthesis
@	:	At the rate of

[ ]	:	Square bracket
=	:	is equal to
CBF	:	Consortium Biofertilizers
C.D.	:	Critical difference
cm	:	Centimeter
cv.	:	Cultivar
Fig.	:	Figure
FYM	:	Farmyard manure
g	:	gram
ha^{-1}	:	per hectare
S.E.M. ±	:	Standard error of means
mg g-1	:	Milligram per gram
NPK	:	Nitrogen, Phosphorus and Potassium
Kg	:	Kilogram
No.	:	Number
$Plant^{-1}$	:	per plant
$Plot^{-1}$	:	per plot
RDF	:	Recommended dose of fertilizers
ha^{-1}	:	per hectare
t	:	tonne
viz.	:	Namely