The Bioscan 10(3): 1255-1257, 2015 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

PRODUCTIVITY POTENTIAL OF ELEPHANT FOOT YAM (*AMORPHOPHALLUS PAEONIIFOLIUS* (DENNST.) NICOLSON) IN ALFISOLS AS INFLUENCED BY FERTILITY LEVELS

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KEYWORDS
Elephant foot yam
Nutrient levels
Corm bulking rate
Corm yield

Received on :
10.05.2015

Accepted on :
18.08.2015

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ABSTRACT
The field experiment was carried out for consecutive two years during 2011-12 and 2012-13 to study the effect of fertility management practices on elephant foot yam which revealed that application of FYM 25 t/ha alone or N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha resulted in tall and wider spread plants. Application of N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha resulted in higher corm diameter (25.55 cm), corm yield/plant (2159 g/plant) and corm yield/ha (37.6 t/ha). The yield attributes and yield with the application of N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha were on par with the application of FYM 25 t/ha. Higher corm bulking rate at early stage (8.32-9.11 g/day) followed by higher corm bulking efficiency (437.50%) led to higher corm yield with the application of N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha. Hence, the fertilizer level N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha may be recommended for farmers growing elephant foot yam under irrigated alfisols.

INTRODUCTION

Elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson) is one among the root and tuber crops, belongs to Araceae family and grown widely in the tropics and sub-tropics. Presently, the status of elephant foot yam is elevated from a small scale subsistence crop to a large scale commercial crop due to its wide range of uses such as for culinary purpose, pickle making and is a good remedy for patients suffering from piles, asthma, dysentery and abdominal pain (Mishra *et al.*, 2002). The corms are usually eaten boiled, mashed or sometimes pounded, frequently mixed with other staples, such as sour vegetables. Even the stem and flowers are used as food (Raghu *et al.*, 1999). It also contains vitamins, minerals, and energy (Bradbury and Holloway, 1988; Chowdhury and Hussain, 1979; Parkinson, 1984) and has medicinal and therapeutic value (Chattopadhyay and Nath, 2007).

The elephant foot yam is one important among the aroids and responds well to application of manures and fertilizers. Under sandy loam soils of West Bengal, Mukhopadhyay and Sen (1986) reported that elephant foot yam responded to N and K 150 kg/ha and P_2O_5 60 kg/ha. External application of major nutrients is essential for higher growth and yield of elephant foot yam in alfisols. Alfisols are low in organic matter content. Patel and Mehta (1987) reported an increase in corm yield with the application of FYM 30 t/ha along with fertilizer nitrogen. Thus, the application of organic manures enhances the fertilizer use efficiency. Keeping the above in view, in alfisols an investigation was carried out to find the effect of varied inorganic and organic fertilizers on productivity potential of elephant foot yam.

MATERIALS AND METHODS

The field experiment was carried out for consecutive two years during 2011-12 and 2012-13 at Regional Centre of Central Tuber crops Research Institute (20° 14'53.25'' N and 85°47'25.85''E and 33m above mean sea level), Dumduma, Bhubaneswar, Odisha, India. Texturally the soil was sandy loam with neutral soil reaction (p^H 6.7). The soil type of experimental site was alfisols and falls under the family on Typic Rhodustalfs. The experiment was laid out in randomized block design (RBD) with three replications. The experiment was comprised of eight treatments viz. T_1-Control, T_2-60-60-60 N-P_2O_5-K_2O kg/ha, T_3 - 80-60-80 N-P_2O_5-K_2O kg/ha, T_4 - 100-60-100 N-P_2O_5-K_2O kg/ha, T_5 - FYM 10 t/ha +60-60-60 N-P_2O_5-K_2O kg/ha, T_6 – FYM@ 10 t/ha +80-60-80 N-P_2O_5-K_2O kg/ha, T_7 - FYM 10 t/ha + 100-60-100 N-P_2O_5-K_2O kg/ha, T_8– FYM 25 t/ha. The variety Gajendra was planted at the spacing of 75 cm on the ridges formed at the spacing of a 75 cm. The fertilizers and manures were applied as per treatments. Single super phosphate was applied as a basal dose during the final ploughing and 1/3rd of N and K were applied as basal dose where as rest of N and K were applied in two equal splits at one and two months after planting. The other package of practices as standardized by Central Tuber Crop Research

Institute (CTCRI), Thiruvanthapuram (ICAR) was followed (Mohankumar and Kabeerathumma, 1994). The mean maximum and minimum temperatures ranged between 29.4-38.3^{0}C and 15.4-26.6^{0}C, respectively and mean maximum and minimum relative humidity varied in between 61.5-90.7%. The average annual rainfall was between 1274 mm and maximum precipitation was recorded during June to September over both the experimental year.

The corm bulking rate (CBR) was calculated by the following method:

$$\text{CBR (g plant}^{-1}) = \frac{W_2 - W_1}{t_1 - t_2}$$

Where, W_2 and W_1 are the final and initial weight in gram (g) per plant at time t_1 and t_2 respectively.

The corm bulking efficiency (CBE) was computed by the following method

$$\text{CBE (\%)} = \frac{C_O - C_S}{S_C} \times 100$$

Where C_0 and C_s are the corm weight at the time of observation and weight of seed corm (C_s) planted, respectively. The data were statistically analyzed by following the method of Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth attributes

The mean result of the two years investigation on the effect of different fertility levels on days to sprouting has been presented in Table 1. It was evident from the Table 1 that faster 50% sprouting of elephant foot yam cv. Gajendra was attained in treatment T_4 and T_5. However, treatment T_7 resulted in faster 100% sprouting closely followed by T_8. This might be due to addition of farm yard manure (FYM) in these treatments that resulted in retaining higher moisture and induced physiological process for sprouting of tubers. The data corroborates with the findings of Singh *et al.* 2013.

Plant height and spread increased with the advancement of age upto 5 MAP and then the plant showed symptom of senescence (yellowing) (Fig. 1). Hence, the data on plant height and spread were presented upto 5 MAP (Table 1). At 5 MAP, the treatments T_8 and T_7 registered taller plants, wider canopy spread and higher pseudostem diameter. Growth hormones present in the FYM in the above treatment might have helped the plants for rapid cell multiplication. Similar results of increase in plant height for higher levels of inorganic fertilizers (N, P and K) in taro have been realized by Bhuyan and Quasem (1983), Purewal and Dargan (1957), Hossain and Rashid (1982) and Rahman and Rashid (1983).

Yield

The effect of differential fertility levels on the yield attributes of elephant foot yam is depicted in Table 2. The pooled mean data for two years of investigation revealed that the treatment T_7 resulted in highest corm diameter and corm yield per plant. The CBR and CBE indicated that up to 3 MAP, the treatment T_7 recorded higher corm bulking rate followed by T_8. A similar trend of CBR and CBE were also noticed in 3-5 MAP and 5-8 MAP (Table 2).

The corm yield as influenced by different fertility management as given in Table 2 revealed that all the fertility levels except T_2 significantly increased the corm yield. The application of

Table 1: Effect of fertility levels on sprouting of elephant foot yam (pooled mean of 2 years)

Treatments	Days to sprouting (50%)	Days to sprouting (100%)	Pseudostem height at 5 MAP (cm)	Canopy spread at 5 MAP (cm)	Pseudo stem diameter at 5 MAP (cm)
T_1	35.4	58.8	88.3	86.2	10.9
T_2	34.6	57.0	90.4	88.3	11.2
T_3	33.4	57.0	92.9	92.0	11.6
T_4	32.8	57.1	95.1	92.1	12.7
T_5	32.8	56.1	100.9	96.6	12.9
T_6	35.2	55.3	103.7	99.6	13.1
T_7	34.6	53.7	107.2	102.0	13.9
T_8	35.7	53.8	110.5	106.4	13.6
SEm ±	0.46	0.71	3.33	2.77	0.27
CD (5%)	1.3	2.1	9.7	8.1	0.8

Table 2: Effect of fertility levels on yield attributes and yield of elephant foot yam (Pooled mean of 2 years)

Treatments	Corm diameter (cm)	Corm yield (gplant^{-1})	CBR(g day^{-1})			CBE(%)			Corm yield (t ha^{-1})
			0-3 MAP	3-5 MAP	5-8 MAP	0-3 MAP	3-5 MAP	5-8 MAP	
T_1	19.55	1045	3.56	4.96	5.58	9.00	54.50	161.25	18.3
T_2	20.60	1390	4.83	5.94	6.23	20.88	98.12	247.50	24.3
T_3	21.60	1555	5.15	6.89	7.11	26.37	129.75	288.75	27.2
T_4	23.00	1695	5.85	7.51	7.94	31.75	141.12	323.75	29.6
T_5	23.40	1845	6.58	7.89	8.75	48.12	166.50	361.25	32.3
T_6	24.50	2020	7.81	8.47	8.98	75.75	202.88	405.00	35.4
T_7	25.55	2150	8.32	9.11	9.49	87.25	224.00	437.50	37.6
T_8	24.65	2060	7.95	8.98	9.00	78.87	212.38	415.00	36.1
SEm ±	0.651	42	0.102	0.171	0.171	1.782	4.829	10.988	0.71
CD (5%)	1.90	124	0.29	0.50	0.50	5.20	14.10	32.08	2.1

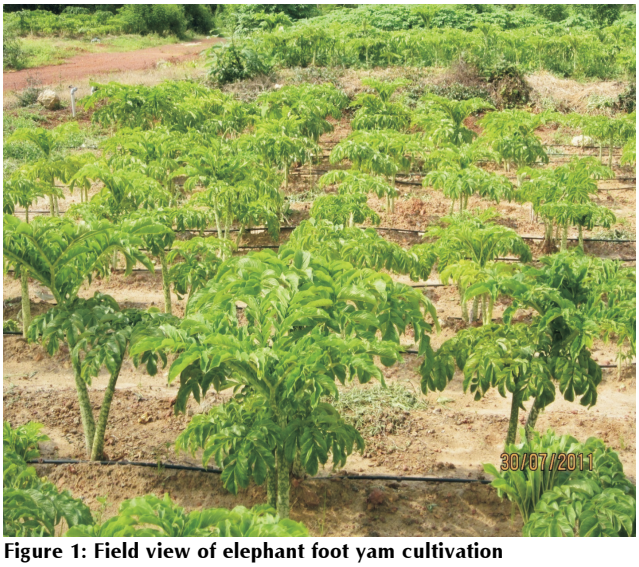

Figure 1: Field view of elephant foot yam cultivation

higher dose of inorganic fertilizers recorded higher corm yield. The application of inorganic fertilizers + FYM 10 t/ha recorded higher corm yield than application of only inorganic fertilizer. Patel and Mehta (1987) also reported similar results and reported FYM is essential for increasing fertilizer use efficiency in elephant foot yam. The application of FYM 10 t/ha + N-P_2O_5-K_2O 100-60-100 kg/ha resulted in significantly higher corm yield (37.6 t/ha). The corm yield with the application of FYM 10 t/ha + N-P_2O_5-K_2O 100-60-100 kg/ha was 105% higher over the control treatment. The higher yield in this treatment was due to higher growth (Table 1) and yield attributes (Table 2). Similar findings were also reported by Nedunchezhiyan (2014). The sole application of FYM 25 t/ha produced 36.1 t/ha which was at par with that of T_7. This might be due to higher amount of nutrients contributed from the FYM 25 t/ha apart from growth promoting substances. Chattopadhyay *et al.* (2008) also reported similar findings in elephant foot yam. The treatments comprising of only N-P_2O_5-K_2O fertilizers (T_3 and T_4) also recorded significantly more yield over control. However, the corm yield did not changed appreciably at lower doses of N-P_2O_5-K_2O i.e. 60-60-60 kg/ha (T_2). This indicates that elephant foot yam requires high amount of nutrients and responds to external application of organic and inorganic fertilizers.

It can be concluded from the study that elephant foot yam requires higher amount of N, P and K nutrients. The yield is proportional to the unit of nutrients applied. Further, application of FYM increased the growth and corm yield of elephant foot yam due to supplement of nutrients and growth hormones apart from improving soil organic matter. But FYM alone application is not feasible because it requires huge quantity to substitute inorganic fertilizer. The availability of huge quantity of FYM is a major constraint. Hence, integrated application of N-P_2O_5-K_2O 100-60-100 kg/ha + FYM 10 t/ha may be recommended for higher corm productivity under alfisols under irrigated conditions.

REFERENCES

Bhuyan, M. A. J. and Quasem, M. A. 1983. Effect of nitrogen on the yield of mukhi-kachu (*Colocasia esculenta*). *Bangladesh J. Agril. Research*. **8(1):** 65-67.

Bradbury, J. H. and Holloway, W. D. 1988. Chemistry of tropical root crops: significance for nutrition and agriculture in the Pacific. In *Australian Centre for International Agricultural Research* Canberra, Australia.

Chattopadhyay, A. and Nath, R. 2007. Medicinal importance of some well known and unexploited roots and tubers. *Agriculture update. Hind. Agri-Hort. Soc.* **2:** 80-82.

Chattopadhyay, A., Mukhopadhyay, S. K. and Nath, R. 2008. Short duration vegetables as intercrops in elephant foot yam in the gangetic alluvium of West Bengal: analysis of growth, yield and economics. *J. Root Crops*. **34(1):** 10-14.

Chowdhury, B. and Hussain, M. 1979. Chemical composition of the edible parts of aroids grown in Bangladesh. *Indian J. Agric. Sci.* **49:** 110–115.

Hossain, M. M. and Rashid, M. M. 1982. Effect of different levels of nitrogen on the yield of mukhi- kachu (*Colocasia esculenta*).*Bangladesh Hort.* **10(1):** 23-26.

Misra, R. S., Nedunchezhiyan, M., Shivalingaswamy, T. M. and Edison S. 2002. Mass multiplication techniques for producing quality planting of *Amorphophallus paeoniifolius* (Dennst.) Nicolson (Araceae). *Aroideana*. **25:** 78-87.

Mohankumar, B. and Kabeerathumma, S. 1994. Agro and nutritional requirements of aroids and minor tubers. In: Advances in Horticulture. 8. Tuber crops. Chadha, K.L. and Nair G.G (Eds), Malhotra publishing house, New Delhi, pp. 271-292.

Mukhopadhyay, S. K. and Sen, H. 1986. Effect of nitrogen and potassium on yield and quality of elephant foot yam (*Amorphophallus campanulatus* Blume). *J. Root Crops*. **12(2):** 103-106.

Nedunchezhiyan, M. 2014. Production potential of intercropping spices in elephant foot yam (*Amorphophallus paeoniifolius*). *Indian J. Agron.* **59(4):** 596-601.

Panse, V. G. and Sukhatme, P. V. 1967. Statistical Methods for Agricultural Workers, *I.C.A.R,* New Delhi, India.

Parkinson, S. 1984. The contribution of aroids in the nutrition of people in the South Pacific. In: *Edible aroids*, Edited by: Chandra, S. Oxford: Clarendon Press. pp. 215-224.

Purewal, S. S and Dargan, K. S. 1957. Effect of spacing on development and yield of arum *(Colocasia esculenta*). *Indian J. Agric. Sci.* **27:** 151-162.

Patel, B. M. and Mehta, H. M. 1987. Effect of farm yard manure, spacing and nitrogen application on chemical constituents of elephant foot yam (*Amorphophallus campanulatus*). *Gujarat Agric. Univ. Res. J.* **13(1):** 46-47.

Raghu, A., Deepa V. C and Sundaran, K. 1999. A study on soorana (*Amorphophallus paeoniifolius*). The king of the Tubers (In:) Tropical Tuber Crops in Food Security and Nutrition. *Oxford and IBH Publishing Co. Pvt. Ltd.* New Delhi. pp. 10-14.

Rahman, M. A. and Rashid, M. M. 1983. Effect of nitrogen application and desuckering on the yield of Pani-kachu *(Colocasia esculenta*). *Bangladesh Hort.* **11(2):** 9-13.

Singh, R., Bhusan, S., Kumar, S. and Shanker, R. 2013. Yield assessment of elephant foot yam grown under multilayer vegetable cropping system. *The Bioscan*. **8(4):** 1237-1239.