**Review Article**

**Site-specific Nutrient Management in Elephant Foot Yam-A Review**

Biswanath Sahoo, M. Nedunchezhiyan, P. Acharyya, R. Munshi, D. Sahu, Madhuri Topo, Suchismita Tripathy, Kumari Sunita

1 Krishi Vigyan Kendra (OUAT), Ranital, Bhadrak, Odisha, India-756111
2 Regional Centre of ICAR-Central Tuber Crops Research Institute, Bhubaneswar, Odisha, India-751019
3 Department of Horticulture, University of Calcutta, Kolkata, West Bengal, India- 700019
4 Department of Plant Breeding and Genetics, OUAT, Bhubaneswar, Odisha, India-751003
5 Krishi Vigyan Kendra (OUAT), Jharsuguda, Odisha, India- 768202
6 Department of Agronomy, OUAT, Bhubaneswar-751003
7 Krishi Vigyan Kendra, West Champaran, Madhavpur-845454

*Corresponding author

**Abstract**

Rice is the major crop cultivated during kharif in eastern region of India, particularly in Odisha. Inconsistent and erratic behaviour of monsoon, high input costs and low market price at farm gate for rice is becoming unremunerative at times. Crop diversification with high potential crops seems to be a viable solution for the above situations. Elephant foot yam is an important food crop with a variety of alternative uses, has not been tried much in this region. With vast production potential and wide agro-climatic adaptability, if elephant foot yam can fit into the cropping systems of this region, it becomes most suitable answer to the bereaved farmers. However, elephant foot yam exhaust lot of nutrients from the soil owing to its high yield. Alfisols, most predominant in eastern region of India, particularly Odisha is deficient in major nutrients i.e., nitrogen (N), phosphorus (P) and potassium (K) along with minor nutrients especially magnesium (Mg), zinc (Zn), and boron (B). Hence, optimization of site specific nutrient requirement is to be worked out to harness the maximum yield without harming soil health. The work done on these aspects in elephant foot yam and other related tuber crops have been reviewed and discussed below.

**Keywords**

Manihot esculenta Crantz, Xanthosoma sagittifolium (L.) Schott.

**Introduction**

Rice is the major crop cultivated during kharif in eastern region of India, particularly in Odisha. Inconsistent and erratic behaviour of monsoon, high input costs and low market price at farm gate for rice is becoming unremunerative at times. Crop diversification with high potential crops seems to be a viable solution for the above situations. Tuber crops...
play in the multifaceted needs of more than 500 million people mostly in South and South East Asia, West Africa and the Pacific Ocean Islands contributing to their food, nutritional, social and economic security. The major tropical tuber crops include cassava (*Manihot esculenta* Crantz.), sweet potato (*Ipomoea batatas* (L.) Lam.), yams (*Dioscorea* spp.), aroids like elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson], taro (*Colocasia esculenta* (L.) Schott.) and tannia (*Xanthosoma sagittifolium* (L.) Schott.). Elephant foot yam is an important food crop with a variety of alternative uses, has not been tried much in this region. With vast production potential and wide agro-climatic adaptability, if elephant foot yam can fit into the cropping systems of this region, it becomes most suitable answer to the bereaved farmers. However, elephant foot yam exhaust lot of nutrients from the soil owing to its high yield. Alfisols, most predominant in eastern region of India, particularly Odisha is deficient in major nutrients i.e., nitrogen (N), phosphorus (P) and potassium (K) along with minor nutrients especially magnesium (Mg), zinc (Zn), and boron (B). Hence, optimization of site specific nutrient requirement is to be worked out to harness the maximum yield.

Soil health is imperative to obtain high yield and quality in tuber crops. Both the chemical and physical condition of the soil can be changed to benefit the tuber production in tropical tuber crops. Judicious application of fertilizers and manures plays a pivotal role in the production technology of tropical tuber crops. The manures used to supplement organic matter to the soil, so that through decay, it furnish more or less continuous supply of nutrients to the crops and improve the soil condition for better tuber bulking. They supply practically all the elements of fertility which crop require, though not in adequate proportion. The application of fertilizers restores or increases the amount of deficient nutrients. They are applied mainly to increase the supply of the essential nutrients, e.g., N, P and K. The nitrogenous fertilizer promotes the vegetative growth of the crop by imparting a healthy green colour to the leaves and it also controls the efficient utilization of P and K. The phosphatic fertilizer influences the vigour of plants and improves its quality. The role of K may be associated with starch synthesis leading to promotion of tuber growth and accelerated translocation of photosynthates from source to sink.

**Uptake**

The nutrient requirement of elephant foot yam is fairly high. In this context investigation carried out by Mohankumar *et al.*, (1984) revealed that the yield of 36 t ha\(^{-1}\) of elephant foot yam removed 121.9 kg N, 30.5 kg P and 176.4 kg K ha\(^{-1}\) from the soil. It was observed that the absorption of nutrients was high at the third month for N and sixth for P while K uptake was steady throughout the crop growth.

Under controlled conditions, the uptake of nutrients N, P and K studied under three different levels of N, P and K alone and along with FYM and the mean uptake of N, P and K were 26.89, 4.23 and 36.63 g m\(^{-2}\) respectively. A crop of elephant foot yam producing a tuber yield of 43 t ha\(^{-1}\) removed 124.8 kg N, 26.1 kg P and 222.4 kg K respectively (Kabeerathumma *et al.*, 1987).

Kabeerathumma *et al.*, (1987) studied the N, P and K utilization pattern of elephant foot yam during different growth stages of the crop and found a progressive increase in the uptake of the nutrients with increase in the age of the crop. The rate of uptake of N and P was found to be maximum between 3-5 months after planting (MAP). After 7 months after planting (MAP), no conspicuous increase in N and P uptake was noticed. Though K uptake was
maximum during 3-5 months after planting (MAP), it continued to increase with the age of the crop with the highest during the tuber bulking period.

Nair et al.,(1990) reported that elephant foot yam producing a corm yield of 43.0 t ha\(^{-1}\) removed 124.8 kg N, 26.1 kg P and 222.4 kg K ha\(^{-1}\) under rainfed, upland conditions in acid ultisol.

Pushpakumari and Sasidhar (1996) studied the uptake of N, P and K by elephant foot yam under shade and found that N and P uptake decreased with increasing shade intensities and K uptake was uniform at shade levels from 0-50%, but significantly higher at 75% shade.

Further studies on the N, P and K content of different plant parts at various growth stages revealed that the nutrient content changes with increase in age of the crop. The N and K content in the foliage of elephant foot yam were the highest after 5 MAP and thereafter it decreased with maturity. The N content of root, corm and pseudostem decreased towards maturity of the crop. Among the different plant portions, leaf was having higher amount of N (2-4%) and pseudostem had the highest K content (>4%).

The K content of corm was maximum during corm initiation which decreased towards bulking. The P content was maximum in leaves with maximum concentration during the early growth stage and further declined towards the maturity stage.

Verma et al., (1995) reported that the N and K contents were the highest in shoots and corms at 150 days after planting (DAP).

He further reported that concentration of N in shoots and corms decreased with growth stage and increased with N application rate.

**Response**

Mandal and Saraswat (1968) worked out the response of FYM and NPK fertilization on elephant foot yam and found that plots which received FYM 25 t ha\(^{-1}\) with NPK 80:80:120 kg ha\(^{-1}\) respectively gave the highest corm yield of 34.6 t ha\(^{-1}\) against 11.6 tha\(^{-1}\)recorded in manure control (no application of fertilizers) plot. Though yield response to potassium was noticed up to 120 kg K\(_2\)O ha\(^{-1}\), yield beyond 80 kg K\(_2\)O ha\(^{-1}\) was not significant. A dose of FYM 25 t ha\(^{-1}\) and NPK 40:40:80 kg ha\(^{-1}\) was however found to be economical for elephant foot yam.

Hrishi and Nair (1972) also shared similar observation and suggested 40 kg each of N and P and 80 kg K in combination with FYM 12 t for high yield of good quality corms of elephant foot yam in Kerala.

The trials conducted at Central Tuber Crops Research Institute (CTCRI), Trivandrum revealed that NPK combination of 100:80:120 kg ha\(^{-1}\) gave higher corm yield of 32.92 tha\(^{-1}\), though different levels of fertility (N:P:K 80:60:100, 80:80:120,100:60:100 and100:80:120 kg ha\(^{-1}\) showed no significant effect on the corm production of elephant foot yam. However, Mohankumar et al., (1984) viewed that the crop when given 25 t ha\(^{-1}\) of FYM along with 80, 60 and 100 kg ha\(^{-1}\) of N, P and K, respectively enhanced corm production. Under sandy loam soils of West Bengal, Mukhopadhyay and Sen (1986) studied the response of elephant foot yam to N and K nutrition ranging from 50 to 150 kg with uniform dosage of P\(_2\)O\(_5\) 60 kg ha\(^{-1}\). The results suggested that nitrogen influenced the growth and yield up to 150 kg ha\(^{-1}\) and potassium application beyond 50 kg ha\(^{-1}\)did not show any significant response on the corm yield, a maximum corm yield of 110.6 tha\(^{-1}\) was recorded under NPK dosage of 150:60:50 kg ha\(^{-1}\) in crop duration of six months.
Patel and Mehta (1987) also reported an increase in corm yield (31.81 to 36.73 t ha\(^{-1}\)) with the application of FYM 30 t ha\(^{-1}\). Besides, they recorded increased corm yield from 33.24 to 34.40 t ha\(^{-1}\) by increasing N rates from 0 to 100 and 150 kg ha\(^{-1}\), respectively.

Ghosh et al., (1988) reported that the presence of NPK fertilization, a linear response to FYM up to 25 t ha\(^{-1}\) has been observed under rainfed conditions in acid lateritic soils of Kerala.

In field experiment at West Bengal, Kundu et al., (1998) determined the effect of NPK fertilizer dose on plant biomass, corm yield and total yield and indicated that NPK 200:100:100 kg ha\(^{-1}\) was the optimum fertilizer dose for elephant foot yam.

Sen and Mukherjee (2002) investigated the effect of different levels and methods of application of N and K on corm production in elephant foot yam and application of the highest dose of N and K each @ 150 kg ha\(^{-1}\) in three splits produced the maximum corm yield of 54 t ha\(^{-1}\).

Sethi et al., (2002) studied the effect of different levels of NPK on the yield of elephant foot yam at different locations of Orissa for two seasons and found that application of NPK 125:50:125 kg ha\(^{-1}\) produced the highest yield of 35.29 t ha\(^{-1}\).

Chattopadhyay et al., (2006) found that the maximum plant height (89.5 cm), pseudo stem girth (19.2 cm), diameter of corm (21.3 cm), average weight of corm (2.2 kg) and yield (57.3 t ha\(^{-1}\)) were recorded with highest NPK level (175:125:175 kg ha\(^{-1}\)) but maximum canopy spread (123.1 cm) and breadth of corm (11.64 cm) were observed with NPK level (150:100:150 kg ha\(^{-1}\)).

Suja et al., (2015) standardized the organic production strategy as FYM @ 36 t/ha [cow dung + neem-cake mixture in (10:1) inoculated with Trichoderma harzianum], green manuring with cowpea to generate 20–25 t/ha green biomass in 45–60 days, neem cake @ 1 t/ha and ash @ 3 t/ha. Anjana Devi et al., (2015) found that by integrating nutrient use efficient biofertilizers, viz. N-fixers, P- and K-solubilizers, with NPK fertilizers, N, P and K can be saved to the tune of 25, 50–75 and 25% respectively. Navya et al., (2017) reported that the replacement of 50 % RDN with vermi-compost along with recommended...
dose of fertilizers and application of bio-fertilizers were very effective for improving vegetative, quality and yield characteristics. It has also been observed that integrated nutrient sources (mainly vermi-compost and FYM) and bio-fertilizers were effective in improving most majority of the growth parameters from 120 DAP which was reflected in producing higher corm weight and ultimately the highest yield. Further they stated that the integrated use of organic manures, bio-fertilizers and inorganic fertilizers is efficient than application of inorganic fertilizers alone with respect to growth, yield and quality of elephant foot yam.

References

Anjana Devi, Neetha I P, Soma John, Susan John, K, Jeeva, M L and Misra R S. 2015. Rock inhabiting potassium solubilizing bacteria from Kerala, India: Characterization and possibility of chemical K fertilizer substitution. *Journal of Basic Microbiology* 55(11): 1,326–1,335.

Chattopadhyay A, Hore J K, Bandopadhyay A and Ghosh D. 2006. Response of varying levels of NPK fertilization on elephant foot yam grown as inter crop in Arecanut plantation. *Agric. Sci. Digest.* 26 (1): 23 –26.

Ghosh S P, Ramanujam T, Jos J S, Moorthy S N and Nair R G. 1988. *Tuber Crops.* Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi, pp. 271.

Henpithaksa C. 1993. Effect of organic matter on growth and yield of elephant foot yam (Amorphophallus oncophyllus). *Kasetsart J. Nat. Sci.* 27: 255-260.

Hrishi N and Nair R G. 1972. Tuber crops in Indian economy. *Indian Fmg.* 22(6): 33-37.

Kabeerathamma S, Mohankumar B and Nair P G. 1987. Nutrient uptake and their utilization by Yams, aroides and coleus. Technical Bulletin Series no.10, CTCRI, Thrivanthapuram, Kerala, India, pp. 34.

Kundu, B.C., Ahamed, M.S., Hassan, M.K., Hossain, M.A. and Islam, M.S. 1998. Effect of NPK fertilizers on the performance of Olkachu (Amorphophallus campanulatus Blume). *J. Root Crops.* 24: 31-36.

Mandal, R.C. and Saraswat, V.N. 1968. Manural requirement of sweet yam in laterite soils of Kerala. *Indian Agriculturist.* 12 (1): 25-28.

Mohankumar B, Kabeeratham S and Nair P G. 1984. Soil fertility management of tuber crops. *Indian Fmg.* 33 (12): 35-37.

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.

Nair P G and Mohankumar C R. 1991. Dry matter accumulation and nutrient concentration in Amorphophallus campanulatus at different stages of growth as influenced by NPK nutrition. *J. Root Crops.* 17:158-160.

Nair P G, Mohankumar C R and Saraswathy P. 1990. National Symposium on Recent Advances in the Production and Utilization of Tropical Tuber Crops. Abstract. pp. 8-9.

Nair, P.G., Mohankumar, C.R. and Saraswathy, P. 1990. National Symposium on Recent Advances in the Production and Utilization of Tropical Tuber Crops. Abstract. pp. 8-9.

Navya K, Desai K D, Tandel Y N and Sheth S G.2017.Effect of integrated nutrient management on growth, yield and quality of elephant foot yam [Amorphophallus paeoniiifolius (Dennst.) Nicolson] *International Journal of Chemical Studies* 2017;
Pushpakumari R and Sashidhar V K. 1996. Dry matter production and uptake of nutrients by yams and aroids as influenced shade intensities. *Tropical Tuber Crops: Problems, Prospects and future strategies*. Science Publishers, Inc., Lebanon, USA. pp. 274-279.

Sethi K, Mohanty A, Naskar S K, Byju G and Mukherjee A. 2002. Effect of sett size, spacing and NPK fertilizer on yield of *Amorphophallus* in hilly areas of Orissa. *Orissa J. Hort.* 30: 72-75.

Verma P K, Sen H, Roychoudhury N and Panda P K. 1995. Growth, corm development and uptake of N and K as influenced by doses and methods of NK application in elephant foot yam (*Amorphophallus campanulatus* Blume). *J. Potato. Res.* 11: 68-74.

How to cite this article:

Biswanath Sahoo, M. Nedunchezhiyan, P. Acharyya, R. Munshi, D. Sahu, Madhuri Toppo, Suchismita Tripathy and Kumari Sunita 2019. Site-specific Nutrient Management in Elephant Foot Yam – A Review. *Int.J.Curr.Microbiol.App.Sci.* 8(09): 1591-1596.

doi: [https://doi.org/10.20546/ijcmas.2019.809.182](https://doi.org/10.20546/ijcmas.2019.809.182)