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Effect of Nutrient Management on the Productivity of Minisett Raised Elephant Foot Yam [*Amorphophallus paeoniifolius* (Dennst.) Nicholson] Intercropped in Banana

Elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicholson] is a popular tuberous vegetable in Kerala. The high production efficiency, carbohydrate and nutrient content of the tubers make it important as food cum nutritional security crop. Conversion of rice fields to raised beds for banana cultivation is a common practice in the lowlands of the state. Maximising productivity calls for intercropping in the available lands and among tuber crops, the suitability of elephant foot yam as inter crop in banana has been widely established (Nayar and Nair,1992; Jata et al., 2009). The concept of using small sized corms in elephant foot yam as planting material (George et al., 2004) is gaining momentum and in this background an attempt was made to evaluate the effect of different doses of NPK and their split application on the growth and yield of elephant foot yam raised by minisett technique as intercrop in banana in lowlands.

The field experiment was conducted in farmer's field in Thalavur panchayat of Kollam district during May 2015 to January 2016 by the Farming Systems Research Station, Sadanadapuram under Kerala Agricultural University. The site experiences a warm humid tropical climate and soil of the experimental site was strongly acidic (4.71), medium in organic carbon (0.72%), high in available P and K (291.98 and 241.22 kg ha^{-1} respectively). Banana (*Nendran*) suckers were planted at a spacing of 2 m x 2 m. Cut corm pieces (150 g size) of elephant foot yam, variety Sree Padma, were planted in the interspaces of banana at a spacing of 60 cm x 60 cm, one month after planting the suckers. The inter row spacing between six banana plants formed one experimental plot. The gross plot size was 8 m^2 accommodating 18 elephant foot yam plants. The experiment was laid out in RBD with three replications and the treatments were fixed on the basis of the present recommendation of NPK @ 100:50:150 kg ha^{-1} (KAU, 2011) (Table 1).

Table 1. Treatment details of the experiment

Treatment	NPK doses and splits
T_1	NPK @ 100:50:150 kg ha^{-1} in two splits at one month interval (45 and 75 DAP)
T_2	NPK @100:50:150 kg ha^{-1} in two splits at two months interval (45 and 105 DAP)
T_3	NPK @120:60:180 kg ha^{-1} in two splits at one month interval (45 and 75 DAP)
T_4	NPK @120:60:180 kg ha^{-1} in two splits at two months interval (45 and 105 DAP)
T_5	NPK @80: 40: 120 kg ha^{-1} in two splits at one month interval (45 and 75 DAP)
T_6	NPK @80: 40: 120 kg ha^{-1} in two splits at two months interval (45 and 105 DAP)
T_7	NPK @100:50:150 kg ha^{-1} in two splits at one month interval (45 and 75 DAP) using organic manures

A uniform dosage of farmyard manure was applied @ 2 kg pit^{-1} for elephant foot yam just before planting. The recommended dose of nutrients T_1 to T_6 were applied using chemical fertilisers (urea - 46% N, Rajphos- 20 % P_2O_5, muriate of potash- 60% K_2O) and the organic sources in T_7 were poultry manure (1.2% N, 0.7% P_2O_5 and 0.4% K_2O), vermicompost (1.2% N, 0.5% P_2O_5 and 0.6% K_2O), and ash (5.0% K_2O). Nutrient applications were done in elephant foot yam as per the treatments fixed and in banana, as per recommendation (KAU, 2011). Farm yard manure was applied @ 10 kg pit^{-1} and NPK @ 190: 115: 300 g plant^{-1} in six splits at monthly intervals from 1MAP. Other cultural operations were adopted as per the package of recommendations for both crops and observations on yield and yield attributes were recorded. Elephant foot yam crop was harvested during December 2015 and banana in January - February 2016. Soil samples were collected after the completion of

the field experiment and analysed for nutrient contents as per standard analytical procedures. The data were subjected to statistical analysis to assess the influence of the nutrient doses on the yield of elephant foot yam.

The results of the field experiment are presented in Table 2. Perusal of the data revealed that corm yields (27.22 t ha^{-1}) were significantly high in T_5 (NPK @ 80 : 40 : 120 kg ha^{-1} at one month interval) on par with the organically raised crops (T_7 - 25.97 t ha^{-1}) The corm circumference and corm weights were significantly superior in T_5, whereas the corm height did not show significant variations but was higher in T_5, the per plant yields being 1.51 and 1.43 kg plant $^{-1}$ respectively.

Table 2. Influence of nutrient doses and scheduling on yield of minisett raised elephant foot yam

Treat-ments	Corm weight (kg)	Corm height (cm)	Corm circum-ference (cm)	Yield (t ha^{-1})
T_1	1.13	7.31	42.44	19.97
T_2	0.95	5.90	45.67	21.45
T_3	1.29	4.80	44.50	18.59
T_4	1.06	5.93	41.00	22.79
T_5	1.51	6.93	55.72	27.22
T_6	1.23	4.92	38.44	24.26
T_7	1.43	6.73	44.45	25.97
CD (0.05)	0.161	-	8.288	2.179

It is interpreted that the nutrient requirement of the crop was satisfied with the lower dose of 80 : 40 : 120 kg NPK ha^{-1} and remained on par with the 100 percent organic nutrition. In general, yams and aroids are reported to yield in proportion to the size of the planting material used and, larger sized corms always yielded higher than smaller sized corms in elephant foot yam (Sankaran et al., 2011). The conventional size of corms used for planting range between 750-1000g (KAU, 2011) and the average yield reported in sole cropping was 4.35 kg $plant^{-1}$ (Girijadevi et al., 2013). This justifies the response shown to the nutrient dose of 80 : 40 : 120 kg NPK ha^{-1} and the lower dose proved sufficient for the minisett raised crop to produce corms of average weights, 1.51 kg. In organic manure application, although a higher dose of NPK was given, it is assumed that the 100 per cent release of nutrients from the sources would not have taken place immediately as normally observed in chemical fertilizer applications, but, the improvement in soil health with organic matter addition would have favoured bulking and corm weights statistically similar to T_5. Suja, et al., (2012) had earlier reported significantly higher yields in elephant foot yam with organic farming practices and had attributed this to the overall improvement in the soil physico- chemical and biological properties under the influence of organic manures. The split application at one month interval was found to be better compared to the application at two months interval. It is presumed that an adequate supply of nutrients in the early stages was important for the establishment and development of a good root system and canopy for proper absorption of nutrients and photosynthesis, which ultimately decided the yield of the crop. A similar observation on the effect of N application being more pronounced in the early growth stages of elephant foot yam than in the later periods was reported by Ravi et al. (2011).

Bunch weights in banana ranged from 8.25 to 9.50 kg in the plants that formed the boundary of the intercropped plots. There was no significant variation in the banana yields compared to the sole crop (9.10 kg) as these were managed uniformly as per package of practices recommendations. Joseph (1992) had recorded that when intercropped with tuber crops, the reduction in bunch yields of banana was least in the combination with elephant foot yam.

The variations in soil pH, organic carbon, available P and K with the different nutrient management practices were not significant (Table 3).

Table. 3. Effect of nutrient management practices on soil chemical properties

Treat-ment	Soil pH	Organic C(%)	Available P (kg ha^{-1})	Available K (kg ha^{-1})
T_1	4.80	0.85	288.83	273.89
T_2	4.75	0.83	372.63	270.56
T_3	4.77	0.97	303.21	247.55
T_4	4.71	1.05	296.27	247.54
T_5	4.80	1.02	269.54	240.67
T_6	4.74	0.99	251.25	239.40
T_7	4.72	1.00	315.99	241.01
CD(0.05)	-	-	-	-

Based on the study it can be concluded that the nutrient package of farmyard manure @ 2 kg pit^{-1} and NPK @

80: 40: 120 kg ha^{-1} in two splits at one month interval (45 and 75 DAP) was best for minisett raised elephant foot yam intercropped in banana grown in lowlands. Thus, the KAU recommendation of NPK @ 100:50:150 kg ha^{-1} could be reduced by 20 per cent. The ICAR-CTCRI recommendation for minisett raised elephant foot yam (George et al., 2004) NPK @ 100: 50:100 kg ha^{-1}also could be reduced to NPK @ 80: 40: 120 kg ha^{-1} when intercropped in banana.

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