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Effect of corm sett size on whole seed corm production of elephant foot yam (*Amorphophallus paeoniifolius* Dennst.) in the *Gangetic* plains of West Bengal

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ABSTRACT

The elephant foot yam (Amorphophallus paeoniifolius Dennst.) is one of the most popular tropical tuber crops grown particularly in eastern India. Considering the importance of the crop a study was undertaken to standardize optimum seed corm sett size suitable for whole seed corm production of elephant foot yam in Gangetic alluvial zone of West Bengal. Five sett sizes viz. S_1: 100g; S_2: 200g; S_3: 300g; S_4: 400g and S_5: 500g were considered as different treatments and were planted at a distance of 50 cm both ways. Among the treatments, the maximum height of primary pseudostem (75.5cm), basal girth (9.93cm) of primary pseudostem, corm weight (1196.25g) and seed corm yield (478.50q ha^{-1}) was recorded with 500 g sett size of corm. But the maximum seed: corm ratio (4.53) and cost: benefit ratio (1.84) was obtained with the smallest sett size (100g). For whole seed corm production of 500-600g size, planting of 100 to 200g mini-corm sett was found suitable and economically beneficial in the Gangetic plains of West Bengal.

***Keywords* :** Corm production, corm sett size, corm yield, elephant foot yam

The elephant foot yam (*Amorphophallus paeoniifolius* Dennst.) is one of the most popular tropical tuber crops grown particularly in eastern India. Popularity of this tuber as vegetable is increasing day by day in tropical and subtropical regions due to its higher productivity, non irritant taste and very high economic return within a short period of time (Mukhopadhyay and Sen, 1999; Dutta *et al*., 2003; Nath *et al*., 2007). The crop has gained tremendous prospects in Gangetic alluvial zone of West Bengal and could play an important role in food and nutritional security owing to its high nutritional (Bradbury and Holloway, 1988; Chattopadhyay *et al*., 2010) and therapeutic (Chattopadhyay and Nath, 2007) values. Since the crop is propagated through vegetative means, the rate of increase in the area coverage is very low, though there is profuse demand for seed corm among the farming community of the State. More than 40 per cent demand of seed corms of this State are being fulfilled by Andhra Pradesh alone. Importing seed corm from distant places caused huge transportation cost and bruising damage of the corm which results much increase in cost of seed corm every year. There is no public or private agency available in the country to supply bulk quantity good quality whole seed corm with optimum size (500-600g) at reasonable price (Nath *et al*., 2007). The major advantages for using whole seed corm are cent percent sprouting and nearly 40 per cent more yield than cut seed corm of equal size (Nath *et al*., 2007). Since the cropping intensity of the Gangetic plains is so high (nearly 300%), no farmer of this zone is interested to book their field for at least 8-9 months to produce seed corm of this crop. In this situation, the crisis of seed corm during planting is of common occurrence in this zone. Under these circumstances, standardization of protocols for production of quality seed corm at Government organizations like Agricultural University, KVKs, State Agricultural/Horticultural farms *etc*. is essential to meet high demand of planting materials in the Gangetic plains of West Bengal. Mini-sett (cutting of big sized corm into small setts) technology is the key factor that decisively affects the seed corm production of elephant foot yam as envisaged from previous studies (Nath *et al*., 2007; Ravi *et al*., 2011; Salam *et al*.,2016). Therefore, the present study aimed at optimization of seed corm size in order to obtain whole seed corm of suitable size through mini corm setts at the Gangetic plains of West Bengal.

MATERIALS AND METHODS

The present study was carried out at the Farm of Krishi Vigyan Kendra Murshidabad, West Bengal University of Animal and Fishery Sciences, Milebasa, Murshidabad, West Bengal, India located at 24º16′10″N latitude and 88º17′15′′E longitude for the two consecutive years (2015 and 2016). The disease free

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Table 1: Effect of seed corm weight on growth characters and seed corm yield of elephant foot yam

Treatments	Height of pseudostem (cm)	Basal girth of pseudostem (cm)	Corm weight at harvest (g)	Seed : harvested corm ratio	Seed corm yield (q ha^{-1})
S_1 (100 g)	61.80	6.37	452.50	4.53	181.00
S_2 (200 g)	64.60	7.73	611.25	3.06	244.50
S_3 (300 g)	66.95	8.35	805.00	2.68	322.00
S_4 (400 g)	71.45	8.87	1023.75	2.56	409.50
S_5 (500 g)	75.50	9.53	1196.25	2.39	478.50
SEm (±)	**0.91**	**0.13**	**38.51**	**-**	**21.30**
LSD (0.05)	**2.81**	**0.41**	**118.69**	**-**	**65.66**

Table 2: Economics of seed corm production of elephant foot yam

Treatments	Seed corm required (q ha^{-1})	Seed cost ₹ 3000 q^{-1}	Labour wages + other inputs cost (₹)	Interest on working capital** (₹)	Total cost of cultivation (₹)	Gross income (₹)***	Net income (₹)	Income per rupee investment
S_1 (100 g)	40.00*	1,20,000	70,000	5,938	1,90,593	5,43,000	3,52,407	1.84
S_2 (200 g)	80.00	2,40,000	70,000	9,688	3,19,688	7,33,500	4,13,812	1.29
S_3 (300 g)	120.00	3,60,000	70,000	13,438	4,43,438	9,66,000	5,22,562	1.17
S_4 (400 g)	160.00	4,80,000	70,000	17,188	5,67,188	12,28,500	6,61,312	1.16
S_5 (500 g)	200.00	6,00,000	70,000	20,938	6,90,938	14,35,500	7,44,562	1.07

*Note: * Considering 40,000 plants accommodated per hectare; ** Considering interest on working capital for ½ life of total crop duration (8 months) @ 12.5 % per year; ***Considering farm gate price of elephant foot yam seed corm @ ‘ 3000 q^{-1}*

healthy seed corms (cv. Gajendra) collected from BCKV, Mohanpur, West Bengal were cut into five sett sizes *viz*. S_1 (100g), S_2 (200g); S_3 (300g), S_4 (400g) and S_5 (500g) and were considered as treatments following Randomized Block Design with four replications. Seed corms were planted at 50 × 50 cm spacing in both ways in the month of March each year. The experimental soils were non-saline (EC 0.30 dS m^{-1}), sandy-loam in texture, neutral in reaction (pH 6.7), low in organic carbon (4.5 g kg^{-1}), available N (142 kg ha^{-1}), high in available P (50 kg ha^{-1}) and medium in available K contents (135 kg ha^{-1}). The crop was incorporated with recommended dose of fertilizers (100:50:100 kg ha^{-1}) and irrigated at regular interval and weed control and plant protection measures were followed following the recommendation of Sen and Roychoudhury, 1993). The crop was harvest at 8 month stage for utilizing as seed corm in the following year. The observations were recorded on height of primary pseudostem (cm), basal girth (cm) of primary pseudostem at 120 days after planting, average corm weight (g) at harvest, ratio of seed corm: harvested corm, and seed corm yield (q ha^{-1}). The economics were worked out considering the existing price of inputs, hired labour wages, interest on working capital for ½ life of total crop duration (8 months) @ 12.5 per cent per year (as per the Commission for Agricultural Costs and Prices, Ministry of Agriculture and Farmers Welfare, Government of India), and the existing farm gate price of whole seed corm for vegetable cultivation. The data collected from different characters were analyzed by the method of analysis of variance given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant The data presented in table 1 revealed that height of the primary pseudostem varied significantly among different sett sizes, the maximum (75.5 cm) being with the largest corm size (S5, -500g size) and the minimum (61.8 cm) when used the smallest sett. Thus the height of the primary pseudostem in Gangetic plains of West Bengal showed an increasing trend in length with increase in seed corm weight. Similar observation was reported by Ashokan *et al.* (1984); Nath *et al.* (2007) and Salam *et al.* (2016). The basal girth of primary pseudostem also exhibited similar trend as that of height of the pseudostem. The basal girth was recorded maximum (9.53 cm) when used the largest corm size (500g size) and the minimum (6.37 cm) in smallest corm size. Initially large size corms had more storage of food materials and water content which might promote early sprouting, and such plants showed a tendency of superior plant vigour than plants produce from small corm sett (Dev, 2012).

The average corm weight was also found to increase with the increase in seed corm weight from 100 g to 500g. The treatment S_5 (500g corm weight) produced the largest harvestable corm of 1196.25g as compared to S_1 (100g corm weight) which produced only 452.50g corm. The increase in corm weight with increased size of seed corms was also reported by Mondal and Sen (2004) from West Bengal; Sethi *et al*. (2002) from hill area of Orissa; Bairagi and Singh (2014) from Uttar Pradesh and Salam *et al*. (2016) from inter crop under coconut orchard. This might be due to the fact that large size corm had more food reserve and water content and such plants from these corms could withstand more adverse conditions by way of less mortality leading to better plant growth characteristics than plants resulting from small corm. Usually seed corm of 500-600g size is more economically beneficial than planting large corm size (more than 1000g) for commercial vegetable cultivation (Nath *et al*., 2007). It was found that planting of 100g and 200g sett were found to produce optimum seed corm sizes of 452.50 g and 611.25g, respectively (Table 1). Such observation corroborates the earlier study of Nath *et al*. (2007) at the Laterite belt of West Bengal.

The ratio of seed corm size to harvestable corm size was worked out and it was observed that 100g seed corm (S_1) could able to produce 4.53 times bigger corm while the largest seed corm (500g) produced only 2.39 times bigger harvestable corm. This observation indicates that the reproducibility of corm decreased with increase in seed corm weight. Greater plant competition and mutual shading might have resulted in reduction in the rate of seed corm multiplication under comparatively closer planting density (50 cm in both ways) with bigger corm setts. The results from Gangetic plains of West Bengal is in confirm with the observations of earlier workers (Alam and Narzary, 1997; Sankaran *et al*., 2011).

Seed corm yield was found to be the maximum (478.50 q ha^{-1}) when used 500g corm sett as planting material and decreased significantly with decrease in seed corm weight, and recorded to be the minimum (181.00 q ha^{-1}) when 100g corm sett was utilized (Table 1). This was happened due to the fact that the weight of harvestable corm increased with increase in seed corm weight from 100g to 500g resulting an increasing trend of seed corm yield. Greater corm size was attributed to better crop growth as a consequence of more food reserve at the initial stage, and higher translocation of photosynthates from source to sink, resulting in higher corm yield. This is in conformity with the observations from different growing condition by Sethi *et al*. (2002) and Sankaran *et al*. (2011).

The economic analysis was computed on the basis of existing prices of inputs, corm yield prevailing at the time of this study and presented in table 2. It revealed that the cost of seed corm production was highly influenced by seed corm size. Although the maximum estimated net return (₹ 7,44,562/-) was obtained with largest seed corm (500g) but the income per rupee investment increased with decrease in seed corm weight, and it was recorded highest (1.78) when used 100g weight of seed corm followed by 200g sett size . This was mainly due to involvement of minimum initial seed cost (₹ 1, 20,000/-) for the crop cultivation.

From the present study, it can be concluded that higher multiplication rate of seed corm could be obtained by using mini-sett tubers. A mini-sett tuber weighing between 100g and 200g is sufficient enough to produce optimum size of whole seed corm which is economically beneficial for commercial cultivation of elephant foot yam as vegetable in the Gangetic plains of West Bengal.

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