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Determination of yield, dry matter and economic feasibility of greater yam (*Dioscorea alata*) through minisett technique

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Abstract
In yam plantations, farmers required to set aside 33% of their harvest as planting materials. To solve this problem, minisett technique was practiced to produce large number of healthy seed yams. The experiment was conducted at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture (MPUA&T) Udaipur, to determine the yield, dry matter and economic feasibility of greater yam (*Dioscorea alata* L.) through minisett technique. The experiment was laid out in Randomized Block Design and three replications. The experimental result revealed that the yield and economic feasibility of greater yam were significantly (p= 0.05) affected by minisett technique while No. of days to harvesting and Dry matter content (%) do not show any significant effect by minisett technique. Yield attributes characteristics *viz.* days to harvesting from sowing and tuber yield (t/ha) were influenced by different tuber weight. The minimum days to harvesting from sowing (215 days) and yield (24.36 t/ha) were recorded in treatment T_8 (200g). Data of economic feasibility was significant influenced by tuber weight. The maximum gross return, net return and BC Ratio (2.94) were observed in treatment T8 (200g).

Keywords: *Dioscorea alata*, minisett, tuber yield, dry matter, economic feasibilty

Introduction

Greater yam (*Dioscorea alata* L.) belongs to the family Dioscoreaceae and it has chromosome number (2n=2x=20 & 2n=4x=40). It belongs to genus Dioscorea which contains about 600 species (Coursey, 1967). It is the third global agro-economic product after cassava and sweet potato (Harijono T.E., 2013). It is a very nutritive vegetable and contains starch (27.88 g), energy (108 kcal), vitamin A (138 µg) protein (1.53 g) and fibre (0.65-1.40%) per 100 g of edible part. It is widely used for making vegetable, chips, puri and fried vegetable for canning, dehydration and flour manufacture.

Traditionally, water yams are propagated vegetatively by means of tuber. Whole tuber called "seed" yam from l00 g to 1500 g are used as planting materials. Alternatively, larger tubers are often cut into approximately 200 g pieces and used to establish the new crops (Onwueme, 1978; Okoli *et al.* 1982) [13, 9]. The main constraints in cultivation of greater yam are lack of availability of healthy planting materials and low multiplication ratio i.e.1:6. The sets are planted in one hectare area required about 18-20 qt. setts. Since the tuber for which the crop is grown is equally needed as planting material, it becomes difficult to get enough material for planting since this constitute a competitive use for the tuber. The cost of planting materials is over 33 percent of the total outlay for yam production, so there is a need to improve the rate of yam multiplication (Okoli and Akorada, 1995) [10]. The National Root Crop Research Institute in Nigeria developed a system termed the "minisett" technique which aims at overcoming the seed yam problem. A "minisett" is defined as set less than one quarter of the minimum size (l00 g) of yam sett often planted (Okoli *et al.* 1982) [9]. The technique involves cutting the selected "mother seed" yam into pieces 20 g to 25 g each, treating them in a fungicides or insecticides suspension and sprouting them in nursery beds or polyethylene bags. After three to four weeks, the sprouted minisetts are transplanted into the main fields (Vernier, 1999) [16].

The minisett technique is profitable due to lower materials cost and higher yield (Eyitayo *et al.*, 2010) [3]. It enhance the multiplication ratio (1:24) to large extent. Hence any portion of yam tuber having is capability to sprouting and producing a new plant (George *et al.*, 2004) [4]. It is an effective and viable technology which is quite farmer friendly and farmers oriented. This technique presents a rapid and cheap multiplication method for greater yam and produced healthy greater yams. It also offers a chance to reduce the production cost of greater yam. Therefore, in this study “Determination of yield and dry matter and economic feasibility of greater yam (*Dioscorea alata*) through minisett technique” were investigated.

Material and Methods

The experiment was conducted at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture (MPUA&T) Udaipur, to determine the yield, dry matter and economic feasibility of greater yam (*Dioscorea alata* L.) through minisett technique. The experiment was laid out in Randomized Block Design and three replications. The experimental area situated at South Eastern part of Rajasthan. This region has a typical sub-tropical climate. This area received a heaviest rainfall during mid June to September and has a mind winters and summers.

For sample preparation, seed yam of 500-1000g that have broken dormancy are cut into pieces weighed of 25g, 50g, 75g, 100g, 125g, 150g, 175g, 200g, 225g, 250g with the help of sharp knife and tubers were treated with fungicide (12% carbendazim + 63% mencozeb)**.** The tubers of each treatment were sown in pots filled with moist growing media containing 75% soil + 25% FYM. The pots watered regularly. The experimental field was ploughed once with a mould board plough in the beginning followed by harrowing with disc cultivator and finally by planking to prepare the field to fine tilth. Basal application of well rotten FYM @ 3 tons ha^{-1} was incorporated in experimental area before transplanting. Yam seedlings were ready for transplanting 2 months after sowing of tubers. Seedling were planted at 7.5 cm depth keeping 90 x 90 cm spacing and covered with soil. Irrigation may be given at weekly intervals in the initial stage and afterwards at about 10 day interval. Bamboo poles were used as staking material to support the trailing vines. Initially the vines were tied with the coir string. The crop was harvesting manually 8 months after planting. The crop was harvested at full physiological maturity stage. A light irrigation 2-3 days before harvesting was required. Vines were removed first and then tubers were dug out manually with proper care. Cleaning was done to remove adhered roots and soil particles.

In this experiment, the observation collected were No. days harvesting, tuber yield (t/ha), dry matter content (%) and also asses the economic feasibility of greater yam through minisett technique. The experimental data were subjected to statistical analysis of variance and test of significance through the procedure appropriate to the Randomized Block Design as described by Panse and Sukhatme (1989) [15] and means differences determined at 5% level of significance. The cost of cultivation was worked out by taking all consideration of expenditure incurred on the basis of existing market rate of input. Grass income was calculated by multiplying per hectare yield of tuber under various treatments with prevailing of tuber in the local market near Udaipur. Cost of cultivation was subtracted from gross income to obtain net profit and the benefit cost ratio was computed by adopting following formula.

$$\text{B:C ratio} = \frac{\text{Net return (` ha}^{-1}\text{)}}{\text{Total cost of cultivation (` ha}^{-1}\text{)}}$$

Result and Discussion

The data illustrated (Table 1) revealed that the tuber yield (t/ha) was significantly influenced by various tuber weight. The maximum tuber yield (24.36t/ha) was recorded in treatment T8 (200g) followed by 23.99 t^{-1} and 23.93t^{-1} in treatment T10 (250g) and T9 (225g) respectively and minimum tuber yield (10.61 t/ha) was recorded in T1 (25g). While, the days to harvesting from sowing and dry matter content (%) were not significantly influenced by various tuber weight. The minimum days to harvesting (215.00 days) were recorded in treatment T9 (225g) and T10 (250g) and maximum days to harvesting (228.67 days) was recorded in treatment T2 (50g). The maximum dry matter (22.56%) was recorded in treatment T10 (250g) and minimum dry matter (19.87%) was recorded in treatment T1 (25g). Large setts will contain a greater quantity of dry matter and nutrients than smallsetts and it has been shown by Ferguson *et al*. (1980).

The tuber yield increased with increasing sett size and effect was confined to middle setts only, particularly at the wide spacing. Similarly, larger size tuber helps in development of new cells in meristematic tissue and regulates carbohydrate metabolism & also helps in formation of chlorophyll and absorption of other nutrients in soil and resulted more accumulation in sink. The above results are in conformity with the findings of Onwueme, (1972) [12], Nwoke *et al*. (1973) [7], Obigbesan, (1980) [8], Kayode, (1984) [6] and Okonmah and Akparobi, (2009) [11] in greater yam.

Table 1: Effect of minisetts on number of days to harvesting, tuber yield (t/ha) and dry matter content (%) in greater yam.

Treatments	Days to harvesting	Tuber yield (t/ha)	Dry matter %
T_1	227.00	10.61	19.87
T2	228.67	10.76	20.91
T3	226.00	11.02	20.10
T4	226.00	13.67	20.10
T5	226.00	15.69	21.60
T6	224.00	17.55	22.70
T7	224.00	17.59	21.40
T8	222.00	24.36	22.47
T9	215.00	23.93	21.57
T10	215.00	23.99	22.56
SEm±	0.67	0.29	0.49
CD (P=0.05)	NS	0.9	NS
CV (%)	0.90	5.2	6.8

Table 2 shows the results that the gross return from sale of greater yam was calculated on an average price of 30 per kg. The maximum gross return (₹730800 ha^{-1}) was obtained under T_8 (200g), while minimum gross returns (₹318300 ha^{-1}) was obtained in treatment T1 (25g). The treatments maximum net returns (₹545141 ha^{-1}) was obtained under T_8 (200g), while minimum net returns (₹183434.7 ha^{-1}) was obtained in treatment T2 (50g). Maximum B:C (2.94) was recorded in T_8 (200g) closely followed by treatment T_9 (2.71) and T10 (2.58). The minimum B: C Ratio (1.25) was recorded in treatment T3 (75 g). The results are in agreement with the findings of Chinaka *et al.* (1983) [1], Oyolu, (1983) [14], Eyitayo *et al.* (2010) [3], those worked on greater yam.

Table 2: Economic feasibility of different treatments of greater yam

Treatments	General cost (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	BC Ratio
T_1	131650	318300	186650	1.41
T2	139365	322800	183435	1.31
T3	147139	330600	183461	1.25
T4	154797	410100	255303	1.65
T5	162512	470700	308188	1.90
T6	170205	526500	356295	2.09
T7	177984	527700	349716	1.96
T8	185659	730800	545141	2.94
T9	193444	717900	524456	2.71
T10	201093	719700	518607	2.58

Conclusion

The following silent findings are drawn on the basis of investigation. The yield attributes like days to harvesting from sowing and quality attributes like dry matter percentage, tuber yield (t/ha) were recorded higher in large weight of tuber *i.e*., 200g, 225g, and 250g weight tuber. The economics is concerned, maximum gross return, net return and BC ratio was recorded for treatment T8 (200g). However, the cost of planting material are less (₹7715.5 ha^{-1}) in small weight of tubers T1 (25g) compared to (₹77158.75 ha^{-1}) large weight of tubers T10 (250g). The cost and 33 per cent of planting material was saved by the tuber weight (200g) was found better than traditionally grown tuber weight (300g).

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