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Effect of tuber size & weight on yield and quality of greater yam (*Dioscorea alata* L.) under southern Rajasthan conditions

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Abstract
The present investigation entitled "Effect of Tuber size & weight on Yield and quality of greater yam (*Dioscorea alata* L.) Under Southern Rajasthan Conditions" was conducted during June 2017 to March 2018 at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur. The experiment were comprising with different weight of tubers (25g, 50g, 75g, 100g, 125g, 150g, 175g, 200g, 225g and 250g) and three replications. The vegetative growth parameters were significantly influenced by different weight of tubers. Minimum days to sprouting (14.40 days), maximum speed of emergence (81.50%), no. of leaves per vine after four months (96.00), vine length after four months (183.76cm), girth of vines after four months (6.06 cm), leaf area (8181.76 cm^2) were recorded in highest weight of tuber (250g). Maximum sprouting percentage (100%) was found in treatment T1 (25g) and T4 (100g). The maximum survival percentage (90.00%) was found in treatment T9 (225g). The minimum days to harvesting from sowing (215 days) was observed in treatment T10 (250g). The maximum number of tubers per vine (3.33), tuber length (18.18 cm), tuber diameter (9.99 cm), tuber yield per vine (1.97 kg) and yield (24.36 t/ha) were recorded highest in treatment T_8 (200g). The maximum gross return (□ 730800ha^{-1}), net return (□545141 ha^{-1}) with BC Ratio (2.90) were observed under treatment T8 (200g).

Keywords: Minisett, tuber weight, growth and yield

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 contains anthocyanin pigment in its bright lavender colour tuber which can be extracted as food colourant (Jose *et al*., 2015) [11]. It is a very nutritive vegetable and contains starch (27.88 g), 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.

The main constraints in cultivation of greater yam are lack of availability of healthy planting materials and low multiplication ratio i.e.1:6, therefore, released varieties take a long time to reach to the farmer. The traditional method of producing of yams involves cutting a yam into small pieces called setts. Each sett weighs 300-350g depending on location and tradition. The sets are then planted and in one hectare area about 18-20 qt. sets are required. This means large quantities of greater yam are required for propagation purpose and marketable tubers are reserved for planting. 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).

The minisett technique is a unique technique and fulfills the need. It was developed by National Root Crops Research Institute (NRCRI), Nigeria. The minisett technique involves cutting a yam tuber into small size pieces and planting them. The purpose of Minisett technique is not to produce large tuber but to produce large number of healthy planting seed yams. The minisett technique is profitable due to lower materials cost and higher yield (Eyitayo *et al.*, 2010). It enhance the multiplication ratio (1:24) to large extent. Buds are spread all over the periderm (body surface) of yam tuber. Hence any portion of yam tuber having is capability to sprouting and producing a new plant (George *et al.*, 2004**).** 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.

Material and Methods
An experiment entitled "Standardization of minisett technique in greater yam

(*Dioscorea alata* L.) Under Southern Rajasthan Conditions." was conducted at Horticulture farm, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur which is situated at South Eastern part of Rajasthan. This region falls under agro-climatic Zone IV a *i.e.* "South-humid Southern Plain and Aravalli Hills" of Rajasthan at altitude of 582.17 meter above mean sea level, 24°35' latitude and 74°42' E longitude. This region has a typical sub-tropical climate, characterized by mild winters and summers. The average rainfall of this tract ranges from 592.5 mm to 620 mm per year. More than 90 per cent of rainfall is received during mid-June to September with scanty showers during winter months. The experiment was laid out with Randomized Block Design with ten treatments and three replications. In minisett technique, mother 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 from each treatment were sown in pots filled with moist growing media containing75% soil + 25% FYM. The pots watered regularly. The experimental field was ploughed once with a mould board plough in the beginning followed by cross 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. The layout of experiment was made as per treatments and replications. 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 days 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.

Result and Discussion

Effect of tuber weight on phonological traits

Days to sprouting

A perusal of data indicated that different weight of tubers were significantly affected the minimum time taken for day to sprouting (14.40 days) was recorded in treatment T_{10} (250g) due to larger tubers have larger surface area to retain water, this contributed to it to sprout faster compare to smaller tuber (Onwueme *et al.,* 1984).

Sprouting percentage

The data revealed that the sprouting percentage was significantly influenced by various tuber weights. The maximum sprouting percentage (100%) were recorded in treatment T_2 (50 g) and T_4 (100 g), whereas, the minimum sprouting percentage (86.67%) were recorded in treatment T1 (25g), T6 (150g). Aswathy *et al*., (2017) [2] reported that the increasing trend of sprouting with increasing weight of planting material in Kasturi turmeric.

Survival percentage

The data revealed that the survival percentage was significantly influenced by different weight of tubers. The maximum survival percentage (90.00) was recorded in treatment T_9 (225g) and minimum survival percentage (40.00) was recorded in T5 (125g).

Speed of emergence (%)

The data revealed that the speed of emergence (%) was significantly influenced by various tuber weights. The maximum speed of emergence (81.50%) was found in treatment T10 (250g) and minimum speed of emergence (60.50%) was recorded in T4 (100g).

Number of leaves after four months

An examination of data revealed that the number of leaves was significantly influenced by various tuber weights. The maximum number of leaves (96.00) was recorded in treatment T10 (250g) and minimum number of leaves (51.00) was recorded in T1 (25g).

Girth of vines after four months

An examination of data revealed that the girth of vines was significantly influenced by various tuber weights. The maximum girth of vines (6.06 cm) was recorded in treatment T10 (250g) and minimum girth of vines (4.03cm) was recorded in T1 (25g).

Length of vines after four months

An examination of data revealed that the length of vines was significantly influenced by various tuber weights. The maximum length of vines (183.73cm) was recorded in treatment T10 (250g) and minimum length of vines (99.09cm) was recorded in T1 (25g).

Leaf area (cm^2) after four months

An examination of data revealed that the leaf area (cm^2) was significantly influenced by various tuber weights. The maximum leaf area (8181.76cm^2) was recorded in treatment T10 (250g) and minimum leaf area (2900.89cm^2) was recorded in T1 (25g). Aswathy *et al.*, 2017 [2] reported that the maximum node bits produced more leaf area, roots and root length in Kasturi turmeric.

The present finding also supported with Onwueme (1972) [15], Asadu *et al.*, (1987) [1] and Cyansa- Ameyaw *et al.* (1999), Okonmah *et al*. (2009), Ch'ng *et al*. (2017) are reported that larger sets are quickly established and more vigorous as compared to small weight of seed yam and promote vegetative growth parameters such as number of leaves, length of vines and basal portion of greater yam.

Table 1: Effect of tuber weight on days to sprouting, sprouting percentage, survival percentage and speed of emergence (%) in greater yam

Treatments	Days to sprouting	Sprouting percentage	Survival percentage	Speed of emergence (%)
T_1	22.83	86.70	73.33	61.67
T2	23.90	100.00	66.66	62.86
T3	20.70	96.67	76.66	70.17
T4	16.60	100.00	50.00	60.50
T5	16.10	93.33	40.00	63.83
T6	19.37	86.70	86.66	72.53
T7	17.50	90.00	73.33	75.23
T8	17.00	90.00	86.66	73.70
T9	17.33	93.33	90.00	75.14
T10	14.40	86.70	66.66	81.50
SEm±	0.60	2.59	1.81	1.84
CD (0.05)	1.78	7.69	5.39	5.47
CV (%)	9.7	8.4	7.7	7.9

Table 2: Effect of tuber weight on number of leaves, girth of vines, length of vines after 4 months and leaf area (cm2)

Treatments	Number of leaves per vine	Girth of vines(cm)	Length of vines (cm)	Leaf area (cm^2)
T_1	51.00	4.03	99.09	2900.89
T2	52.57	4.71	100.70	2960.68
T3	52.97	5.12	104.40	3491.62
T4	53.00	4.21	126.13	3593.58
T5	54.27	4.46	107.82	3631.32
T6	59.67	5.02	146.47	4454.17
T7	53.53	5.85	144.13	3566.77
T8	92.67	5.49	178.87	7281.39
T9	65.47	5.25	176.27	5143.12
T10	96.00	6.06	183.73	8181.76
SEm±	1.31	0.13	3.88	134.500
CD (0.05)	3.86	0.36	11.52	399.620
CV (%)	6.2	7.7	8.5	8.9

Effect of tuber weight on yield attributes

Number of tuber per vine

An examination of data revealed that the number of tuber per vine was significantly influenced by various tuber weights. The maximum number of tuber per vine (3.33) was recorded in treatment T8 (200g) and minimum number of tuber per vine (1.37) was recorded in T1 (25g).

Tuber length per vine (cm)

An examination of data revealed that the length of tuber per vine was significantly influenced by various tuber weights. The maximum length of tuber per vine (18.18 cm) was recorded in treatment T8 (200g) and minimum length of tuber per vine (12.74 cm) was recorded in T1 (25g).

Table 3: Effect of tuber size on days to harvesting from sowing, number of tubers per vine, tuber length (cm) and tuber diameter (cm)

Treatments	Days to harvesting	Tubers per vine	Tuber length (cm)	Tuber Diameter (cm)
T_1	227.00	1.37	12.74	4.95
T2	228.67	1.77	12.92	5.20
T3	226.00	1.90	14.30	5.42
T4	226.00	2.07	14.56	5.79
T5	226.00	2.17	14.08	6.13
T6	224.00	2.63	16.41	7.54
T7	224.00	2.63	16.83	7.64
T8	222.00	3.33	18.18	9.99
T9	215.00	3.27	17.53	8.50
T10	215.00	3.10	17.47	7.78
SEm±	0.67	0.10	0.41	0.32
CD (0.05)	NS	0.31	1.22	0.94
CV (%)	0.90	12.8	7.9	13.8

Tuber diameter per vine (cm)

An examination of data revealed that the diameter of tuber per vine was significantly influenced by various tuber weights. The maximum diameter of tuber per vine (9.99cm) was recorded in treatment T8 (200g) and minimum diameter of tuber per vine (4.95cm) was recorded in T1 (25g).

Tuber yield (kg) per vine

An examination of data revealed that the tuber yield (kg) per vine was significantly influenced by various tuber weights. The maximum tuber yield per vine (1.97 kg) was recorded in treatment T8 (200g) and minimum tuber yield per vine (0.86 kg) was recorded in T1 (25g).

Tuber yield (t/ha)

An examination of data revealed that the tuber yield (t/ ha) was significantly influenced by various tuber weights. The maximum tuber yield per vine (24.36t/ha) was recorded in treatment T8 (200g) and minimum tuber yield per vine (10.61 t/ha) was recorded in T1 (25g).

The above results are in conformity with the findings of Onwueme, (1972) [15], Nwoke *et al*. (1974) [18], Obigbesan, (1980) [13], ferguson *et al*., (1984) [9], Kayode *et al.,* (1984) [12], Okonmah *et al*. (2009) in greater yam.

Table 4: Effect of tuber size on tuber yield (kg) per vine, tuber yield (t) per hectare

Treatments	Tuber yield (kg) per vine	Tuber yield (t/ha)
T_1	0.86	10.61
T2	0.87	10.76
T3	0.89	11.02
T4	1.11	13.67
T5	1.27	15.69
T6	1.42	17.55
T7	1.43	17.59
T8	1.97	24.36
T9	1.94	23.93
T10	1.94	23.99
SEm±	0.024	0.294
CD (0.05)	0.071	0.872
CV (%)	5.2	5.2

Economics Feasibility

The maximum gross return (` 730800 $ha^{-1}$), net return (` 545141 ha^{-1}) and BC Ratio (2.90) were observed under treatment T8 (200g), whereas, minimum gross return (` 318300 $ha^{-1}$) was recorded in treatment T1 (25g). The minimum net returns (` 183434.7 ha^{-1}) was recorded in treatment T2 (50g), while lowest B: C Ratio (1.25) was recorded in treatment T3 (75g). The results are in agreement with the findings of Chinaka *et al.* (1983) [3], Oyolu, (1983) [17], Eyitayo *et al.* (2010) [8], those worked on greater yam.

Table 5: Economic feasibility of different treatments of greater yam

Treatments	General cost (Rs /ha)	Gross returns (Rs/ha)	Net returns (Rs /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 vegetative growth characteristics like days to sprouting, speed of emergence (%), no. of leaves per vine, length of vines (cm), girth of vines (cm), leaf area (cm^2) and yield attributes like days to harvesting from sowing and quality attributes like dry matter percentage were recorded superior in highest weight of tuber (250g). The tuber yield per vine (kg), tuber yield (t/ha), tuber length (cm), tuber diameter (cm), number of tubers per vine were recorded superior in 200g weight of tuber. The sprouting percentage was recorded best in 50g, 100g weight of tuber and survival percentage found superior in 225g weight of tuber. The economics concerned, maximum gross return, net return and BC ratio was recorded for treatment T8 (200g). However, the cost of

planting material are less (Rs 7715.5/ha) in small weight of tubers T1 (25g) compared to (Rs 77158.75/ha) large weight of tubers T10 (250g).

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