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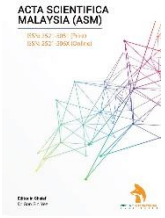

RESEARCH ARTICLE

EFFECT OF TUBER SIZE AND NUTRIENT SOURCE ON THE YIELD OF YAM *(DIOSCOREA SP.)*

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ABSTRACT

A field experiment was conducted at a private forest at Kalyanpur, Chitwan from March to January of 2018/2019 to evaluate the effect of different tuber size and nutrient source on the yield of yam (Dioscorea spp.). The experiment was laid out in a factorial Randomized Complete Block Design (factorial RCBD) with two factors i.e. tuber size viz small tuber size (<50 gm.) and large tuber size (100-150 gm.) and nutrient source viz farm yard manure, chicken manure and forest soil, replicated four times. The use of large size tubers has a significant effect on the yield of yam, higher yield (3.05 kg.) with large tuber size. Similarly, the interaction between tuber size and nutrient source was also significant on the yield. The highest yield (3.23 kg.) was made from the large size tuber (T1) and farm yard manure (M1) followed by the large size tuber (T1) and chicken manure (M2). The smallest yield (2.25 kg.) was from the interaction of small tuber size (T2) and farm yard manure (M2). Therefore, the use of a large size tuber (100-150 gm.) with farm yard manure as the nutrient source can be recommended to increase the yield of yam.

KEYWORDS

Dioscorea spp., tuber size, nutrient source, farm yard manure

1. INTRODUCTION

Dioscorea genus, commonly known as Yam, belongs to the family Dioscoreaceae of order Dioscoreales that has more than 650 species worldwide (Shu, 2000). They are annual, terrestrial and herbaceous climbers that produce underground tubers. 13 of these species are cited to be distributed in the tropical, subtropical and temperate climate of three development regions; eastern, central and western in Nepal from 150-3100 masl (Hara et al., 1978; Press et al., 2000). Among them, D. alata and D. esculenta are the only cultivated species in Nepal. Yam has religious significance in Nepal. They play an integral part of our celebration of our festival known as Maghe Sankranti that is commemorated on the first day of the Nepali month Magh (mid-January). People consume the tuber in boiled and fried form (Joshi et al., 2007). Despite its religious significance, yam holds high in comparison to other root crops in terms of nutritional superiority containing essential dietary elements making it favorites among dieticians (Bhandari et al., 2003).

The nutritional composition of yam comprises starch (27.88 g), vitamin A (138 µg) protein (1.53 g) and fibre (0.65-1.40%) per 100 g of edible part (Meena et al., 2018). In Nepal, yams are concentrated on rural areas, serving as staple as well as vegetable in the daily diet. D. deltoidea, D. prazeri are some of the species found in Nepal with medicinal significance, some are used as washing materials in brewing, wine and fodder. However, Dioscorea hispida is poisonous (Sharma and Bastakoti, 2009). A researcher reports the main reason behind the neglect of this highly nutritious and multifaceted crop is associated with planting and harvesting (Kaini and Bhairab, 2020). The cultural, religious and medicinal importance and ever-increasing demand, there is need for an increase in production. Yam cultivation in Nepal is often done with the tubers of last year's harvest and on the forest soil. The yield of yam is greatly affected by the size of the planting material used (Envi, 1972).

2. MATERIALS AND METHODS

2.1 Experimental Details

A field experiment was conducted at a private forest at Kalyanpur, Chitwan from March to January of 2018/2019. Geographically, it is located at 27^{0}64' N latitude and 84^{0}37' E longitude with an elevation of 193 meters above sea level. The area is characterized by subtropical climate with uni-modal rainfall patterns with peak rainfall during the month of June/July.

2.2 Experimental Design

The experiment was carried out to find out the effect of different sizes of tuber used to grow yam and the appropriate media to grow yam. As two different factors affecting the yield were examined, factorial RCBD designs with four replications were used to examine the effects of both the factors.

Factor 1: Different sizes of bulbil as main factor

T1= large size (100-150 gm.)
T2= small size (<50 gm.)

Factor 2: Different source of nutrient used

M1= farm yard manure
M2= chicken manure
M3= control

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Yam was grown in a sack and each sack represents a sample and with four samples represents a single plot. Each plot was replicated four times and replicates were randomly placed along the tree trunk in the small private forest.

2.3 Plant Material

Local phenotype of the yam was collected from the locality which was used by the local farmers to cultivate yam. Yam tubers were collected during the crop cutting season and were planted once the tuber started sprouting naturally. The tuber was classified as a small tuber (<50 gm) and large tuber (100-150 gm), the most commonly used size of tuber. Artificial sprouting wasn't induced using chemicals. These tubers were treated with fungicide 63% Mancozeb+ 12% Carbendazim W.P. (commercially known as SAFF) prior planting.

2.4 Agronomic Practices

The agronomic practice for the research of yam cultivation was in accordance with the local farmers' method. The method entails growing yam in a jute bag that helps in ease in harvesting. 144 jute bags with the capacity of 50 kg were bought and about 40 kg of soil was used per jute bag. We have different substrate based on the nutrient source most commonly used by local farmers to grow yam; so, the jute bags were prepared by:

1. mixing even ratio of soil and the farm yard manure,
2. two third of soil and one third of chicken manure and,
3. only forest soil

After each substrate was prepared in the jute bag, each jute bag is placed along the tree trunk to facilitate the training of the yam. The jute bag was left to rest until the harvest. Periodic weeding was done and the climbing vine was trained into the tree. Manual harvesting was done at the end of the crop period in the first week of January. The yam was weighed in using weighing balance to measure its yield and the length and the diameter at the point of junction between stem and root was measured using measuring scale and vernier caliper respectively. The collected data was processed by MS Excel and the analysis of variance (ANOVA) was performed using R-studio. Multiple comparisons among the means were tested using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

3. Results

Table 1: Effect of tuber size on the diameter, length and yield of Yam (*Dioscorea sp.)* in Kalyanpur, Chitwan, Nepal, 2018/19.

Treatments	Yam Diameter (cm)	Yam length (cm)	Yam Yield (kg)
Large Size (T1 = 100-150 gm)	1.95	35.36	**3.05**[a]
Small Size (T2 <50 gm)	1.39	27.84	2.52[b]
CV %	78.78	33.80	10.89
LSD (0.05)	1.12	9.12	0.25
F test	NS	NS	***

Note: Means followed by a common letter superscript within a column are non-significantly different whereas the means followed by different letter superscripts within a column are significantly different based on Duncan's Multiple Range Test (DMRT) at P=0.05; NS: Non-Significant; CV: Coefficient of Variation; *, ** and *** are significant at P=0.05, P=0.02 and P<0.001 respectively.

Table 2: Effect of nutrient source on the diameter, length and yield of Yam (***scientific name***) in Kalyanpur, Chitwan, Nepal, 2018/19.

Treatments	Yam Diameter (cm)	Yam length (cm)	Yam Yield (kg)
Farm Yard Manure (M1)	2.54	32.86	2.74
Chicken Manure (M2)	1.20	30.49	2.80
Forest Soil (M3)	1.26	31.45	2.82
CV %	71.35	37.17	15.69
LSD (0.05)	1.25	12.34	0.45
F test	NS	NS	NS

Note: Means followed by a common letter superscript within a column are non-significantly different whereas the means followed by different letter superscripts within a column are significantly different based on Duncan's Multiple Range Test (DMRT) at P=0.05; NS: Non-Significant; CV: Coefficient of Variation; *, ** and *** are significant at P=0.05, P=0.02 and P<0.001 respectively.

Table 3: Effect of interaction of tuber size and nutrient source on the diameter, length and yield of Yam (*Dioscorea sp.)* in Kalyanpur, Chitwan, Nepal, 2018/19

Treatments	Yam Diameter (cm)	Yam length (cm)	Yam Yield (kg)
T1*M1	3.26	32.70	**3.23**[a]
T1*M2	1.27	35.14	3.02[ab]
T1*M3	1.31	38.25	2.90[abc]
T2*M1	1.83	33.03	2.25[d]
T2*M2	1.13	25.84	2.27[cd]
T2*M3	1.20	24.66	2.73[b]
CV %	71.52	36.00	9.54
LSD (0.05)	1.80	17.15	0.40
F test	NS	NS	*

Note: Means followed by a common letter superscript within a column are non-significantly different whereas the means followed by different letter superscripts within a column are significantly different based on Duncan's Multiple Range Test (DMRT) at P=0.05; NS: Non-Significant; CV: Coefficient of Variation; *, ** and *** are significant at P=0.05, P=0.02 and P<0.001 respectively.

4. Discussions

The effect of tuber size on the length and diameter of yam was found non-significant (Table 1) neither has any significant difference for nutrient source. Additionally, even the interaction of tuber size and nutrient source was found to have no significant difference on the length and diameter (Table 1). From the same table 1; the effect of tuber size was found highly significant on the yield of yam (P<0.001). Greater yield (3.05 kg) was harvested from the treatment with large tuber (T1) and lower yield (2.52 kg) was from small tuber (T2). Our observation of higher yield from large size tubers was consistent with the findings (Meena et al., 2018). This increase in yield of yam with the use of larger tuber size may be due to the large amount of carbohydrate available subsequently inducing faster emergence due to better development of sprouts with food supply from the mother tuber. Thus, with early emergence, Large tuber size supported longer and excellent vegetative growth, responding better to inputs and thus led to increased yield.

Many researchers also reported similar conclusions in potato, a root crop as well (Iratani et al., 1972; Pandey and Ghai, 1975; Kushwah et al., 1989). Similarly, the same table shows non-significant difference in the yield with the difference in the source of nutrients. While there was a difference in significance in the yield for the interaction of tuber size and nutrient source (P=0.05). The highest yield (3.23 kg) was obtained from the interaction of large tuber (T1) and farm yard manure (M1) followed by the interaction of large tuber size (T1) and chicken manure (M2) but on the downside lowest yield (2.25 kg) was harvested from the small tuber (T2) and farm yard manure (M1) interaction. The interaction of large size

tubers with all the nutrient sources is statistically similar. Other researchers reported the nutrient uptake increased significantly in potato particularly N, P and K by the application of FYM (Grewal and Trehan, 1979; Sahota et al., 1983). This increased in nutrient uptake, yam being a root crop as well with the large size tuber may have yielded the higher production from the interaction.

5. Conclusion

The size of the tuber seed for yam plantation has a direct impact on its yield and with the right interaction of nutrient source and tuber size significant increase in yield can be achieved. The highest yield was harvested from the large tuber size (100-150 gm.) and with the farm yard manure as the nutrient source. Thus, this combination can be recommended among the existing system partaken by farmers to improve the production in yam cultivation.

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