



P-ISSN: 2349-8528

E-ISSN: 2321-4902

[www.chemijournal.com](http://www.chemijournal.com)

IJCS 2020; 8(3): 1772-1775

© 2020 IJCS

Received: 22-03-2020

Accepted: 24-04-2020

**NV Mhaskar**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India**AT Jadye**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India**KV Malshe**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India**SB Bhagat**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India**AV Dahiphale**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India**Corresponding Author:****NV Mhaskar**Regional Agricultural Research  
Station, Karjat, Raigad,  
Maharashtra, India

## International Journal of Chemical Studies

# Evaluation lesser yam (*Dioscorea esculenta* L.) tuber yield and economics under different crop geometry in lateritic soils of Konkan

NV Mhaskar, AT Jadye, KV Malshe, SB Bhagat and AV Dahiphale

DOI: <https://doi.org/10.22271/chemi.2020.v8.i3x.9455>

### Abstract

Different species of yam are grown around the world especially in tropical region of Africa and Asia. Lesser yam (*Dioscorea esculenta* L.) is one of the important yam species cultivated in Konkan region of Maharashtra. Field experiments were conducted at Central Experiment Station, Wakawali, Dapoli (M.S.) for three years from 2011-12 to 2013-14 to investigate the effect of different crop geometry on productivity and profitability of lesser yam. The treatment consisted of 6 crop geometry viz., S<sub>1</sub> - 90 x 90 cm, S<sub>2</sub> - 90 x 60 cm, S<sub>3</sub> - 90 x 30 cm, S<sub>4</sub> - 60 x 60 cm, S<sub>5</sub> - 60 x 45 cm and S<sub>6</sub> - 60 x 30 cm. The release variety "Konkan Kanchan" was used in this experiment. A uniform tuber size 100-150 g was planted on ridges and furrow method on ridges at per different spacing treatment. The recommended NPK @ 80 : 60 : 80 Kg. ha<sup>-1</sup> was uniformly applied to all the spacing treatments. The pooled mean of three year indicated that the highest total tuber yield 31.29 t ha<sup>-1</sup> was recorded by the spacing 60 x 30 cm, which was substantially and significantly superior over rest of the spacing. The wider spacing 90 x 90 cm reported maximum tuber yield per plant (1.106 kg) and average tuber weight (121.71 g). The economics of different spacing treatment was revealed that the spacing 90 x 30 cm realized the highest net returns of Rs. 3,66,619/- ha<sup>-1</sup> and C:B ratio of 1: 2.21 in lesser yam.

**Keywords:** Lesser yam, crop geometry, tuber yield, partitioning, economics

### Introduction

Tropical tuber crops, including cassava, sweet potato, yams (greater yam, white yam and lesser yam), and aroids (elephant foot yam, taro and tannia) form the most important staple for over one billion people in the developing world. Tuber crops are the third most important food crops of man after cereals and grain legumes. It is estimated that tuber crops provide about 6% of the world's dietary energy, apart from being good sources of β - carotene, anti-oxidants, dietary fibre and minerals (Suja and Nesunchezhiyan, 2018) [14]. Yam plants are members of genus *Dioscorea*. The world distribution of *Dioscorea* is about 850 species, out of which about 50 species are found in India (Anon., 1952) [1] but only greater yam, lesser yam, aerial yam and white yam are important cultivated species (George and Sunitha, 2018) [6]. Lesser yam (*Dioscorea esculenta* L.) is the most important commercially cultivated species cultivated throughout the tropics but its production is mainly in South Eastern Asia. The tuber is the main economically utilized part of the lesser yam. The tubers are small and characteristically born in clusters by each plant, unlike most other yams. Each plant produces 5 to 20 tubers. Each tuber is almost cylindrical, with rounded ends (Onwueme, 1978) [10].

It is an important tuber crop cultivated in Konkan region of Maharashtra during *Kharif* season in well-drained soil or on sloppy land. This yam is known as Kangar or Kate kanke in vulnerable language in Konkan region. It is rich in carbohydrates and other nutritional compounds (Mhaskar *et al.*, 2015) [9]. There are various factors that influence the tuber yield and its size in lesser yam. Among them adoption of suitable crop geometry have been played an important role. Since, this crop is considered as a minor tuber crops in Konkan region, there is scarcity of information on the agro-techniques for lesser yam production.

The productivity influenced by different agro techniques. Among agronomic practices crop geometry influences the growth and yield of crop. The level of plant population should be such that maximum solar radiation is intercepted. Farmers in this region cultivated this crop in backyards or on marginal land without any standard spacing. Most of the tribal and marginal

farmers adopted their own packages in this region. So they are gaining low yield. Study on crop geometry has to be standardized to get higher production and productivity. In this context, the present experiment was conducted to work out the crop geometry of lesser yam for higher production and productivity under *Konkan* region of Maharashtra.

### Materials and methods

A field experiment was conducted at Central Experiment Station, Wakawali, Dapoli, Maharashtra for three consecutive years during 2011-12 to 2013-14. The site of experimental site was lateritic in nature having acidic soil reaction (5.5). The soil of the experimental field was sandy clay loam in texture and rated as low for available N (188.16 Kg ha<sup>-1</sup>), available P (9.52 Kg ha<sup>-1</sup>) and available K (297.54 kg ha<sup>-1</sup>). The climate of the region is characterized by warm and humid with mean annual rainfall of 3500 mm. The experiment was laid out in randomized block design (RBD) with four replications. The plot size was 3.6 m x 1.8 m. The experiment consisted of 6 crop geometry treatments consisting S<sub>1</sub> - 90 x 90 cm (12345 plants ha<sup>-1</sup>), S<sub>2</sub> - 90 x 60 cm (18518 plants ha<sup>-1</sup>), S<sub>3</sub> - 90 x 30 cm (37037 plants ha<sup>-1</sup>), S<sub>4</sub> - 60 x 60 cm (27777 plants ha<sup>-1</sup>), S<sub>5</sub> - 60 x 45 cm (37037 plants ha<sup>-1</sup>) and S<sub>6</sub> - 60 x 30 cm (55555 plants ha<sup>-1</sup>). Variety "*Konkan Kanchan*" released by AICRP on Tuber Crops, Dapoli Centre (M.S.) was used in this experiment (George *et al.*, 2012)<sup>[6]</sup>.

The tuber size 100-150 g was planted in pits reformed into ridges and furrow method on ridges at per different spacing treatment. Well decomposed FYM @ 10 t ha<sup>-1</sup> was applied. The recommended NPK @ 80: 60: 80 Kg. ha<sup>-1</sup> was uniformly applied to all the spacing treatments. Full dose of Phosphorus and half dose of nitrogen and potassium was applied as basal at the time of planting. The remaining half dose of nitrogen and potassium were applied at 60 days after planting. Fertilizer type, rate, its application, seed tuber size, seed rate, variety were similar in each spacing treatment in all the years under study. The other recommended package of practices was duly followed same to all the treatments.

The yield attributes and yield were recorded at the time of harvest. The economics was computed on the basis of prevailing market rates of produce and agro inputs. The data collected were subjected to analysis of variance appropriately to the design. Comparison of treatment means for significance

at 5% was done using the critical difference (C.D.) as suggested by Gomez and Gomez (1984)<sup>[7]</sup>.

### Result and discussion

#### Yield attributes and Tuber yield

It is clear from the table 1 that the yield attributes *viz.*, tuber yield per plant, average tuber weight and dry weight of vine were statistically significant. However, the length and girth of tuber did not differ significantly due to different spacing treatment. These results are on par with the findings of Onwueme (1978)<sup>[10]</sup>. The wider spacing 90 x 90 cm reported maximum tuber yield per plant (1.106 kg) and average tuber weight (121.71 g) which was significantly superior over rest of the treatment. The same yield attributes was reported lowest by close spacing 60 x 30 cm. The full yield potential of individual plant is achieved when sown at wider spacing. When sown densely, competition among plants is more for growth factors resulting in reduction in size and yield of the plant. Yield per plant is decreased gradually as plant population per unit area is increased (Reddy and Reddy, 2003)<sup>[13]</sup>. George (2000)<sup>[5]</sup> reported that closer spacing reduces the average weight of tubers in yam. As regards the dry vine yield per ha, the highest plant density of 60 x 30 cm produced significantly the highest dry vine yield of 2.48 t ha<sup>-1</sup>. Reddy and Reddy, (2003)<sup>[13]</sup> pointed out that dry matter production per unit land area increased with increase in plant population. The average length of tuber ranges from 13.16 cm to 14.13 cm while average girth was 12.35 cm to 13.04 cm.

The pooled mean of three consecutive years (2011-12 to 2013-14) indicated that the highest tuber yield 31.29 t ha<sup>-1</sup> was recorded by the close spacing treatment 60 x 30 cm, which was substantially and significantly superior over rest of the spacing (Table 1). This might be due to highest plant density per unit area. The lowest tuber yield of 13.66 t ha<sup>-1</sup> was recorded by 90 x 90 cm. CTCRI (1992) reported similar results in African yam and observed that closer spacing recording the highest yield while wider spacing gave significantly lower yield. The results are in conformity to those given by George (1991)<sup>[4]</sup>. The increase in tuber yield over 60 x 60 cm spacing by 60 x 30 cm, 60 x 45 cm, 90 x 30 cm, 90 x 60 cm and 90 x 90 cm spacing treatments to the tune of 43.98%, 17.19%, 27.60%, -6.43% and -35.51%, respectively.

**Table 1:** Effect of spacing on yield attributes and tuber yield of lesser yam (pooled Mean)

Tr. No.	Spacing (cm)	Yield attributes					Tuber yield (t ha <sup>-1</sup> )	
		Tuber yield per plant (kg)	Average tuber weight (g)	Length of tuber (cm)	Girth of tuber (cm)	Dry weight of vine (t ha <sup>-1</sup> )	Pooled mean	% increase over 60 x 60 cm spacing
T <sub>1</sub>	90 x 90	1.106	121.71	13.75	13.04	0.88	13.66	- 35.51%
T <sub>2</sub>	90 x 60	1.056	113.02	13.89	12.86	1.01	19.55	- 6.43%
T <sub>3</sub>	90 x 30	0.734	98.19	14.13	12.76	1.20	27.17	27.60%
T <sub>4</sub>	60 x 60	0.772	99.68	13.16	12.88	1.36	21.43	--
T <sub>5</sub>	60 x 45	0.672	93.12	13.78	12.54	1.32	24.87	17.19%
T <sub>6</sub>	60 x 30	0.563	80.16	13.83	12.35	2.48	31.29	43.98%
	S.E. m ±	0.014	1.71	0.11	0.08	0.03	0.43	
	C.D.@ 5%	0.043	5.31	NS	NS	0.11	1.35	

#### Number of tubers per plant

It is observed from the data presented in Table 2 that all the partitioning and total number of tubers per plant was statistically significant except very small (< 50g) category. In case of bold and medium size, the number of tubers per plant recorded the highest by spacing 90 x 60 cm, which was significantly superior over the rest of the spacing treatments. However, the wider spacing 90 x 90 cm reported the highest

number of tubers per plant in the small and very small size. The spacing 90 x 60 cm and 90 x 90 cm recorded the significantly the highest total number of tuber per plant of 9.38 and 9.16, respectively over rest of spacing. However, both spacing treatments were at par. The number of tubers per plant may be reflected by means of competition of different resources.

**Table 2:** Effect of spacing on average number of tubers per plant (pooled Mean)<sup>7</sup>

Tr. No.	Spacing (cm)	Number of Tubers plant <sup>-1</sup>				
		Bold (> 200gm)	Medium (100 – 200 gm)	Small (50 - 100gm)	Very Small (< 50gm)	Total
T <sub>1</sub>	90 x 90	1.51	2.26	2.85	2.54	9.16
T <sub>2</sub>	90 x 60	1.70	2.72	2.56	2.39	9.38
T <sub>3</sub>	90 x 30	0.97	2.11	2.23	2.17	7.47
T <sub>4</sub>	60 x 60	0.91	2.03	2.42	2.39	7.75
T <sub>5</sub>	60 x 45	0.90	1.65	2.30	2.33	7.18
T <sub>6</sub>	60 x 30	0.57	1.76	2.30	2.42	7.05
	S.E. m ±	0.05	0.08	0.06	0.10	0.10
	C.D.@ 5%	0.16	0.23	0.18	NS	0.32

**Number of tubers per ha**

The results regarding the number of tubers per hectare for the average of three years revealed that the close spacing of 60 x 30 cm recorded the maximum number of tubers per hectare with respect to all partitioning and total number except bold size (Table 3). Geroge (2000)<sup>[5]</sup> observed that closer spacing was increased the number of tubers per unit area. The 90 x 30

cm spacing reported the significantly highest bold size number of tuber per hectare (35,864) over remaining plant densities except 60 x 45 cm. The former and later spacing treatments was not significant. Increasing the number of tubers per hectare in close spacing might be due to more number of plant populations. This is supported by Holliday (1960)<sup>[8]</sup>.

**Table 3:** Effect of spacing on average number of tubers per hectare (pooled Mean)

Tr. No.	Spacing (cm)	Number of Tubers ha <sup>-1</sup>				
		Bold (> 200gm)	Medium (100 – 200 gm)	Small (50 - 100gm)	Very Small (< 50gm)	Total
T <sub>1</sub>	90 x 90	18608	27951	35182	31369	113110
T <sub>2</sub>	90 x 60	31560	50457	47371	44329	173716
T <sub>3</sub>	90 x 30	35864	78082	82437	80287	276669
T <sub>4</sub>	60 x 60	25184	56470	67312	66412	215377
T <sub>5</sub>	60 x 45	33264	61249	85002	86473	265989
T <sub>6</sub>	60 x 30	31601	97636	127800	134444	391481
	S.E. m ±	1210.94	2395.90	2282.93	2934.19	4318.16
	C.D.@ 5%	3767.55	7454.28	7102.81	9129.06	13434.97

**Economics**

It is seen from the data presented in Table 4 that, the highest pooled marketable tuber yield was recorded by closer spacing of 60 x 30 cm (28.22 t ha<sup>-1</sup>) followed by 90 x 30 cm (25.01 t ha<sup>-1</sup>). The economics of different spacing treatment was

evaluated at cost C level and revealed that the spacing 90 x 30 cm realized the highest net returns of Rs. 3,66,619/- ha<sup>-1</sup> followed by the spacing of 60 x 30 (Rs. 3,38,590/-). However, the C:B ratio of 1: 2.21 was highest in spacing of 90 x 60 cm in lesser yam.

**Table 4:** Effect of spacing on economics of lesser yam

Tr. No.	Spacing	Marketable Yield (t ha <sup>-1</sup> )	Gross Income (Rs ha <sup>-1</sup> )	Cost of Cultivation (Rs ha <sup>-1</sup> )	Net Return (Rs ha <sup>-1</sup> )	C: B ratio
T <sub>1</sub>	90 x 90	12.64	379061/-	186331/-	1,92,731/-	2.03
T <sub>2</sub>	90 x 60	18.34	550343/-	248526/-	3,01,817/-	2.21
T <sub>3</sub>	90 x 30	25.01	750326/-	383707/-	3,66,619/-	1.96
T <sub>4</sub>	60 x 60	19.60	588107/-	302578/-	2,85,528/-	1.94
T <sub>5</sub>	60 x 45	22.97	689210/-	373521/-	3,15,689/-	1.85
T <sub>6</sub>	60 x 30	28.22	846499/-	507909/-	3,38,590/-	1.67

**Conclusion**

It is concluded from the three years pooled tuber yield data that the total tuber yield (31.29 t ha<sup>-1</sup>) as well as marketable tuber yield (28.22 t ha<sup>-1</sup>) in lesser yam was significantly the highest by adopting closer crop geometry of 60 x 30 cm followed by 90 x 30 cm. The economics of different spacing treatment was revealed that the crop geometry of 90 x 30 cm realized the highest net returns of Rs. 3,66,619/- ha<sup>-1</sup>. However, the C:B ratio of 1: 2.21 was highest in plant density of 90 x 60 cm. Planting of lesser yam at spacing of 90 x 30 cm for gaining higher net returns ha<sup>-1</sup> is recommended.

**References**

1. Anonymous. The wealth of India, Vol. 3, CSIR, New Delhi, 1952.
2. CTCRI. Annual Report, Central Tuber Crops Research Institute (CTCRI), Triruvananthpuram, 1972.

3. George J, Sunitha S. Tropical tuber crop – potential and prospects. Westville Publishing House, New Delhi. 2018.
4. George J. Annual Report. Central Tuber Crops Research Institute, 1991, 52-53.
5. George J. Cultural and manorial requirements of yams and aroids. Production technology of tuber crops. Published by CRCRI, Thiruvananthpuram, 2000.
6. George J, Suresh Kumar P, Unnikrishnan M. Description of recommended/ release varieties under AICRP on Tuber Crops. Published by CRCRI, Thiruvananthpuram, 2012.
7. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley and Sons Ltd. New York, 1984.
8. Holliday R. Population and crop yield. Field Crop Abst. 1960; 13:159-167.

9. Mhaskar NV, Chavan SA, Mahadkar UV, Haldankar PM. Konkanatil Kandpik. Published by Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, 2015, 1-3.
10. Onwueme IC. The tropical tuber crops, yams, cassava, sweet potato, cocoyams. John Wiley and Sons Ltd., Chichester, New York, 1978.
11. Palaniswami MS, Shirly RA. Regional specific technologies for tropical root and tuber crops in India. Published by CRCRI, Thiruvananthapuram, 2006.
12. Ravindran CS, George J. Agro techniques of tuber crops. Silver Jubilee Commemoration Volume 1963-'88. Published by CRCRI, Thiruvananthapuram, 1989.
13. Reddy TY, Reddy GHS. Principles of Agronomy. Kalyani Publishers: 193-203.
14. Suja G, Nedunchezhiyan M. Crop Diversification with Tropical Tuber crops for Food and Livelihood Security. Journal of Root Crops. 2018; 44(1):3-11.