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Effect of Different Spacing on Growth and Yield of Sweet Potato

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ABSTRACT

The present experiment is carried out at Agriculture research Station, Sonapur –Gadchiroli during the year 2019-20 with six different spacing (60 × 30, 60 × 45, 90 × 30, 90 × 45, 120 cm × 30 cm and 120 cm x 45 cm) in Randomized block design with four replication, with the objective to determining the effect of plant spacing on the growth and yield of sweet potato. The results revealed that, maximum growth was recorded *viz.*, vine length (149.10 cm), and number of branches per vine (7.80) was recorded maximum in wider spacing 120 cm x 45cm however, the intermodal length of vine was found to be non significant. The maximum yield per vine was obtained in the wider spacing 120 cm x 45 cm (405.48 g). However, calculating the yield data per plot and per ha got different results. The maximum tuber yield per plot (13.09 kg) and per ha (13.47 t) was recorded with the spacing of 60 cm x 30 cm which was statistically at par with the spacing 90 cm x30 cm and 120 cm x 30 cm. Increasing plant density from 2 plants m^{-2} (120 cm x 45 cm) to higher level of 6 plants m^{-2} (60 cm x 30 cm) increased the production of total tuber yield from 13.47 t ha^{-1}. In conclusion, the results of the study revealed that the highest plant density of 6.00 plants m^{-2} (60 cm x 30 cm) despite decreasing the yield per plant, resulted in the production of the highest tuber yields ha^{-1}

Keywords

Sweet potato, Spacing, Tuber, Yield

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Introduction

Among the tuber crops of the world, sweet potato [*Ipomaea batatas* (L.)] ranks third in importance after Iris potato and cassava (Ikeorgu, 2003) belongs to the family Convolvulaceae, It is a warm-season crop and grows best in abundant sunshine, temperatures above 24°C, sandy loam soil and a well-distributed rainfall of 850-900 mm per annum. It matures in 3-4 months duration depending on the variety (Anonymous, 2003). It is a very nutritive vegetable, producing substantially high edible energy per hectare per day compared to rice, wheat, maize and cassava. It contains starch (12.7 g), sugar (4.2 g), vitamin A (709 µg) and protein (1.6 g) per 100 g of edible part (USDA, 2013). Sweet potato tuber is a major source of carbohydrate and can be eaten without processing. The succulent vines can also be eaten as vegetable to enrich dietary intake. In India, it is cultivated in almost all the states but major contribution comes from four states namely Bihar, Orissa, Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka and Rajasthan. The area under sweet potato cultivation in India is 0.13 million ha with a production of 1.47 million tonnes (FAO, 2016). In spite of its importance as a food and vegetable, very little attention has been given on improved cultural practices *i.e.* spacing. Plant population is one of the most important factors contributions to higher yield of sweet potato (Sarkar, 1985). The yield of tuberous roots per plant increases with the increase in plant spacing (Mannan, 2009). Most farmers in the humid and sub-humid tropics grow the crop at wide and random spacing because of the prevailing intercropping system. Closer spacing may be preferred for sweet potato to achieve maximum tuber yield. According to Farooque *et al.,* (1983) reported that increase in plant population increased total yield per unit area. It is therefore logical phenomena that, a adequate spacing may probably leads to greater crop yield through rapid attainment of ground cover for better interception of solar radiation and hence an increases in photosynthetic ability of crop. Scanty research works are available on the spacing in context of Maharashtra especially in Vidarbha. Therefore, it is need to find out optimum spacing for higher yield in sweet potato.

Materials and Methods

A field experiment was carried out at farm of Agriculture Research Station, Sonapur Gadchiroli during *rabi* season of the year 2019-2020. Mean annual rainfall of 1500 mm and daily mean temperature of 26 to 40°C. The experiment was started early (October – March) in the growing season. The experiment was laid out in a Randomized Block Design with four replications. The experiment comprised five plant spacing namely 60 × 30, 60 × 45, 90 × 30, 90 × 45, 120 cm × 30 cm and 120 cm x 45 cm corresponding to plant densities of 55555, 37037, 37037,24691, 27778 and 18518 plants per ha respectively. The experimental plot was ploughed and subsequent harrowing was done and soil was brought to fine tilth. At the time of land preparation, well rotted FYM @ 20t ha^{-1} was mixed uniformly in the soil before last harrowing. Layout of broad furrow of a dimension 3.60 m × 2.70 m was made. Row to row spacing and plant to plant spacing within the row was maintained as per treatments. Two vines sets of 30 cm length were planted per hill. Fifty per cent of the vine was inserted into the soil at acute angle to the ground. Two week after transplanting the crop was thinned to one vine per hill. 60 kg N and 60 kg P_2O_5 ha^{-1} and 120kg K_2O was applied in the form of urea, SSP and murate of potash respectively. Half of N, all P and K were applied at the time of land preparation remaining half dose of nitrogen were applied 30 days of planting.

Observations like vine length, number of branches, intermodal length of vine, length of tuber, diameter of tuber, number of tuber per plant, tuber yield per plant, per plot and per ha was recorded and data was statistically analyzed as per method suggested by Gomez and Gomez (1984).

Plant population density

Spacing	Plant population /m^2	Plants population /ha
60 X 30 cm	6	55555
60 X 45 cm	4	37037
90 X 30 cm	4	37037
90 X 45 cm	2	24691
120 X30cm	3	27778
120X45 cm	2	18518

Results and Discussion

Growth parameter

Data from table 1 showed that six different spacing were statistically significant in respect of growth parameter except intermodal length of sweet potato. Data from table 1 revealed that, vine length was varied significantly due to the variation of spacing. It ranged from 130.30 cm to 149.10 cm. The maximum vine length was observed from the spacing of 120 cm x 45 cm (S6) which was at par with spacing 120 cm x30 cm. while the minimum length (130.30 cm) from the spacing of 60 cm x 30 cm (S1). Significantly maximum number of branches per vine (7.80) was recorded in wider spacing i.e.120 cm x 45 cm which was at par with spacing 120 cm x30 cm. However; minimum number of branches per vine (5.25) was recorded in spacing 60 cm x 30 cm. Inter nodal length of vine found to be non significant value. The vine under the treatment of S6 (120 cm x 45 cm) had enough space for vegetative growth and had less nutrition competition compared to other vines grown under the treatments S1 (60 cm x45 cm), S2 (60 cm x 30 cm) and S3 (90 cm x 45 cm), S-4 (90 x30 cm) and S5 (120cm x 30 cm). This might be due to wider spacing helped the individual plant to utilize more water, nutrient, light and air. In closer spacing, the plant population per unit area was higher, which led to keen competition among the plants, resulting in poor growth. These results are in agreement with the results of Joshi (1987), Sounda *et al.,* (1989) and Kumar *et al.,* (2012) in radish, Shahana and Shahiduzzaman (2016) in sweet potato.

Yield parameters

Data from the table 2 significantly maximum length of tuber (25.10 cm) and diameter of tuber (6.57cm) were recorded in spacing 120 cm x 45 cm (S6) than other spacing. Minimum length of tuber (22.05 cm) and diameter of tuber (4.56 cm) was observed in spacing 60 cm x 30 cm. Similar results were observed by Nisha *et al.,* (2020) and Sunita *et al.,* (2017) in sweet potato.

Table.1 Effect of spacing on growth parameters of sweet potato

Treatments	Vine length(cm)	No. of branches	Intermodal length (cm)
T1: 60 cm X 30 cm	130.30	5.25	0.87
T2: 60 cm X 45 cm	135.10	5.60	0.86
T3: 90 cm X 30 cm	134.10	6.00	1.22
T4: 90 cm X 45 cm	133.85	6.65	1.18
T5: 120 cm X 30 cm	141.80	6.95	1.35
T6: 120 cm X 45 cm	149.10	7.80	1.35
“F” test	Sig.	Sig.	N.S.
SE(m)	3.03	0.31	0.07
CD at 5%	9.24	0.95	-

Table.2 Effect of spacing on yield parameters of sweet potato

Treatments	length of tuber (cm)	Diameter of tuber (cm)	No. of tuber	Tuber yield per vine (g)	Tuber yield per plot (kg)	Tuber yield per ha (t)
T1: 60 cm X 30 cm	24.85	4.80	3.37	243.585	13.098	13.475
T2: 60 cm X 45 cm	26.80	4.56	3.05	256.710	9.242	9.508
T3: 90 cm X 30 cm	22.05	5.01	2.97	342.590	12.333	12.689
T4: 90 cm X 45 cm	29.85	5.56	3.33	373.790	8.721	9.229
T5: 120 cm X 30 cm	25.10	6.35	3.60	361.940	9.772	10.054
T6: 120 cm X 45 cm	22.75	6.57	4.13	405.480	7.299	7.509
"F" test	Sig	Sig	Sig.	Sig.	Sig.	Sig.
SE(m)	2.26	0.17	0.13	8.87	0.743	1.122
CD at 5%	6.78	0.54	0.39	26.61	2.192	3.307

Spacing 120 cm x 45 cm (S6) gave significantly maximum number of tuber (5.13) per vine which was followed by spacing 120 cm x 30 cm. The minimum number of tuber per vine (2.97) was recorded in closer spacing i.e. 60 cm x 30 cm. Maximum number of tuber per vine might be due to the more land area available per plant. It showed that closer spacing produced comparatively less number of tubers. Abdissa *et al.*, (2011) found that number of tuber was maximum in wider spacing.

Maximum yield of tuber per vine (405.48) was recorded in wider spacing 120 cm x 45 cm than other spacing. Minimum weight of tuber per vine (243.58g) was recorded in closer spacing 60 cm x 30 cm. However, significantly maximum tuber yield per plot (13.09 kg) and tuber yield ha^{-1} (13.47t) were recorded under closer spacing S1 (60 cm x 30 cm) which was at par with spacing 90 cm x 30 cm (S3) and 120 cm x 30 cm (S5). Similar result was observed by Nisha *et al.*, (2020) in sweet potato. This could be due to more plant population per unit area. Generally as the plant spacing became closer and plant density higher, tuber weight plant^{-1} decreased. By contrast, tuber yield, which was significantly influenced also by plant spacing increased progressively as plant spacing became closer and hence plant density higher. The tuber yield was lower per plots where the plants were spaced 120 cm × 30 cm compared with those where the plants were spaced 60 cm × 30 cm, 60 cm × 45 cm, and 90 cm × 30 cm. Similar finding were observed by Adubasim *et al.*, (2017).

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