Effect of Different Spacing on Growth and Yield of Sweet Potato

Shalini Badge*, G. B. Ganvir and Maya Raut

Agriculture Research Station, Sonapur- Gadchiroli, Maharastra, India
*Corresponding author

Abstract

The present experiment is carried out at Agriculture research Station, Sonapur –Gadchiroli during the year 2019-20 with six different spacing (60 x 30, 60 x 45, 90 x 30, 90 x 45, 120 cm x 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
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 P₂O₅ ha⁻¹ and 120kg K₂O 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).

| Spacing    | Plant population /m² | 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 x 30 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 x 30 cm compared with those where the plants were spaced 60 cm x 30 cm, 60 cm x 45 cm, and 90 cm x 30 cm. Similar finding were observed by Adubasim et al., (2017).

References

Abdissa, T., Chali, A., Tolessa, K., Tadese, K. and Awas, G. 2011. Yield and yield component of sweet potato as influenced by plant density in Adami Tulu Jido Kombolcha district, Central Rift Valley of Ethiopia. American J. Experimental Agriculture. 1(2): 40-48.

Adubasim, C.V., Law-Ogbomo, K.E. and Obalum, S.E. 2017. Sweet potato (Ipomoea batatas) growth and tuber yield as influenced by plant spacing on sandy loam in humid tropical environment. J. Tropical Agriculture, Food, Environment and Extension. 16 (3): 46 – 50.

Anonymous. 2003. Treasure for the poor in sweet potato. CIP (International Potato Centre) Lime Peru. Pp. 25.

FAO STAT (2016). Food and Agriculture
Organization of the United Nations. FAO Statistics Division.

Gomez, A.K. and Gomez, A.A. 1984. Statistical procedure for Agricultural Research. 2nd Edition Awileg – International publication, Singapur. pp. 20-25

Ikeorgu, J.E.G. (2003). Creating employment opportunities in the agro-allied sub-sector: The case of yam production. Bullion Magazine, pp. 15-22

Joshi, P.C. and Patil, N.S. 1992. Note on effect of plant density, nitrogen and phosphorous on yield of radish. Indian J. Hort. 149(3): 265-266.

Kumar, M., Kumar S., Kumar, P., Rathore, S.V.S., Singh, R.N and Singh S.K. 2012. Effect of steckling size and spacing on growth, yield and quality of radish cv. Pusa Rashmi. Progressive Agriculture. 12(1): 194 - 198.

Mannan, M.A.1984. Effect of plant spacing on the yield contributing characters and yield of sweet potato. Bangladesh Hort. 12 (1): 57-58.

Nisha Kumari Meena, Rathore, R. S. and Mithlesh Kumari, Meena. 2020. Effect of planting dates and plant spacing on growth and yield attributes of sweet potato (Ipomoea batatas (L.) Lam.) cv.CO-3-4. Int.J.Curr.Microbiol.App.Sci. 9(4): 2602-2608

Sarkar, AK.1985. Effect of plant density on yield of sweet potato. ARC Training, sweet potato. 1- 4. http://www.arc-avrdc. org/pdf_files/Asit(3-N).pdf.

Shahana, Sultana and Shahiduzzaman, Md.. 2016. Effect of plant spacing on the growth and yield of sweet potato cultivars in medium highland condition under AEZ-9. International J. Applied Research. 2(3) 108-112

Sounda, G., Ghanti, P., Ghatak, S.1989. Effect of levels of nitrogen and different spacing on vegetative growth and yield of radish. Environmental Science and Ecology. 7(1):178-180

Sunita, Koodi, Singh, S.P., Manoj Kumar, Rolaniya and Prem Raj. 2017. The growth, yield and quality of sweet potato (Ipomoea batatas Lam.) Influenced by different plant densities International J. Chemical Studies. 5(4): 359-361

USDA. Data base. 2013. National nutrient data base for standard reference release

How to cite this article:

Shalini Badge, G. B. Ganvir and Maya Raut. 2021. Effect of Different Spacing on Growth and Yield of Sweet Potato. Int.J.Curr.Microbiol.App.Sci. 10(02): 643-647.
doi: https://doi.org/10.20546/ijcmas.2021.1002.077