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INFLUENCE OF PLANT DENSITIES AND STAKING ON VEGETATIVE GROWTH OF CERTAIN SWEET POTATO (*IPOMOEA BATATAS* L. LAM.) VARIETIES UNDER CENTRAL TELANGANA CONDITIONS

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ABSTRACT

An investigation was conducted during *spring summer* 2024-25 at the Post Graduate Institute of Horticultural Sciences, SKLTGHU, Mulugu, Telangana to evaluate the effect of plant densities and staking on vegetative growth of certain sweet potato (*Ipomoea batatas* (L.) Lam.) varieties under Central Telangana conditions. The experiment was laid out in a factorial randomized block design with two factors comprising of three varieties (Bhu Sona, Bhu Krishna, Samrat) and six spacings (60 cm × 20 cm, 50 cm × 20 cm, 40 cm × 20 cm, 30 cm × 20 cm, 20 cm × 20 cm, 30 cm × 30 cm) replicated twice, while a pandal was used to stake the plants. Results revealed that the variety Bhu Sona recorded maximum vine length (122.93 cm), maximum number of nodes (32.37), internodal length (2.32) and highest number of leaves per plant (85.17). Primary branches and secondary branches were maximum in Samrat (3.43 and 7.27). Longer vines, higher number of branches, number of nodes, internodal length, maximum number of leaves were recorded at 60 x 20 cm spacing. Chlorophyll content was highest (32.40 SPAD units) in the treatment Bhu Krishna at 20 × 20 cm. Wider spacing (60 × 20 cm) promoted better vegetative growth probably due reduced competition for resources.

Key words : High density, Plant population, Competition.

Introduction

Sweet potato [*Ipomoea batatas* (L.) Lam.] is native of South America and grown throughout the tropical and subtropical regions of the world. In India, it is widely known as "Sakarkhand" and serves as an essential component of the diet for tribal communities due to its resilience and adaptability to diverse farming systems. It grows well even in marginal soils with limited water availability, making it a valuable crop for ensuring nutritional security in agriculturally underdeveloped regions with poor soil fertility (Srinivas, 2009).

Globally, sweet potato ranks third among root and tuber crops after potato and cassava. It is the only tuber crop demonstrating a positive per capita annual growth rate in production (Adubasim *et al*., 2017). Sweet potato occupies about 130,000 ha in India, producing 1.788 m Mt at an average productivity of 11.32 t/ha (Anonymous, 2022).

Sweet potato offers a greater edible energy per hectare per day than crops like rice, wheat, maize and cassava. In addition, it is widely used in processing industries for the production of starch, glucose, pectin, sugar, alcohol and other products (Tan, 2015). Orange-fleshed sweet potatoes are rich in carotenoids and β-carotene and purple varieties are rich in anthocyanins. Due to low glycemic index, it is particularly recommended for individuals with diabetes and insulin resistance (Ludvik *et al*., 2004).

The present study was designed to assess the influence of high-density planting in sweet potato on growth parameters under specific soil and environmental conditions for increasing productivity. Identifying the better spacing for various sweet potato varieties will help achieve balanced vegetative growth, efficient resource utilization and ultimately increased productivity and tuber quality, ensuring the economic sustainability of sweet potato cultivation.

Materials and Methods

The experiment was conducted during *spring summer* 2024-2025 at the Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telangana Horticultural University, Mulugu, Siddipet district, Telangana, located at 17°43'16'' N latitude, 78°37'30'' E longitude and 614 m altitude. The experiment was laid out in a factorial randomized block (FRBD) design with two factors: Factor 1 consisting of three varieties (Bhu Sona (V_1), Bhu Krishna (V_2), Samrat (V_3)) and Factor 2 comprising different spacings (60 cm × 20 cm (S_1), 50 cm × 20 cm (S_2), 40 cm × 20 cm (S_3), 30 cm × 20 cm (S_4), 20 cm × 20 cm (S_5), 30 cm × 30 cm (S_6)) replicated twice. A pandal was erected for the purpose of staking the plants so that there will not be overlapping of plants at higher densities. The soil of the experimental site was well-drained sandy loam. Observations were recorded on growth parameters characters *viz*., vine length (cm), primary branches, secondary branches, number of nodes per vine, length of internode (cm), number of leaves per plant and chlorophyll content (SPAD units).

Observations recorded

Five Sweet potato plants were selected randomly from each plot to record observations.

Vine length (cm)

The length of the longest vine of five plants in each plot was measured with a measuring tape, from the collar region to the growing tip at 90 days after sowing and the average vine length was recorded in cm.

Number of primary branches per vine

The number of primary branches produced on each vine was recorded in five vines at 90 days after planting (DAP) and the average number of branches was calculated.

Number of secondary branches per vine

The number of secondary branches produced on each vine was recorded in five vines at 90 days after planting (DAP) and the average number of branches was calculated.

Number of nodes on each vine

The number of nodes on the longest vine was recorded for all observed vines at 90 days after sowing.

Length of inter node (cm)

The length between the fifth and sixth nodes from the base of the longest vine was measured in centimeters at 90 days after planting.

Number of leaves per plant

Fully opened leaves were counted on each of five randomly selected plants at 90 days after planting. The average number of leaves per plant was then calculated.

Chlorophyll content (SPAD)

The chlorophyll content as an index, measured in SPAD units, was determined using a handheld Apogee MC-100 meter on five randomly tagged leaves per treatment. The average value was then calculated for each treatment.

Table 1 : Treatment details.

Notations	Treatment combinations	Details of treatments
T_1	V_1S_1	Bhu Sona 60 cm × 20 cm
T_2	V_1S_2	Bhu Sona 50 cm × 20 cm
T_3	V_1S_3	Bhu Sona 40 cm × 20 cm
T_4	V_1S_4	Bhu Sona 30 cm × 20 cm
T_5	V_1S_5	Bhu Sona 20 cm × 20 cm
T_6	V_1S_6	Bhu Sona 30 cm × 30 cm
T_7	V_2S_1	Bhu Krishna 60 cm × 20 cm
T_8	V_2S_2	Bhu Krishna 50 cm × 20 cm
T_9	V_2S_3	Bhu Krishna 40 cm × 20 cm
T_{10}	V_2S_4	Bhu Krishna 30 cm × 20 cm
T_{11}	V_2S_5	Bhu Krishna 20 cm × 20 cm
T_{12}	V_2S_6	Bhu Krishna 30 cm × 30 cm
T_{13}	V_3S_1	Samrat 60 cm × 20 cm
T_{14}	V_3S_2	Samrat 50 cm × 20 cm
T_{15}	V_3S_3	Samrat 40 cm × 20 cm
T_{16}	V_3S_4	Samrat 30 cm × 20 cm
T_{17}	V_3S_5	Samrat 20 cm × 20 cm
T_{18}	V_3S_6	Samrat 30 cm × 30 cm

Results and Discussion

The results of the experiment were presented in the Table 2 and depicted in Fig. 1.

Vine length (cm)

Results revealed significant differences in vine length among the varieties and spacing but the interaction effects were non-significant.

Bhu Sona recorded maximum vine length (122.93 cm) while minimum vine length (84.033 cm) was recorded in Samrat. The widest spacing (60 cm × 20 cm) resulted

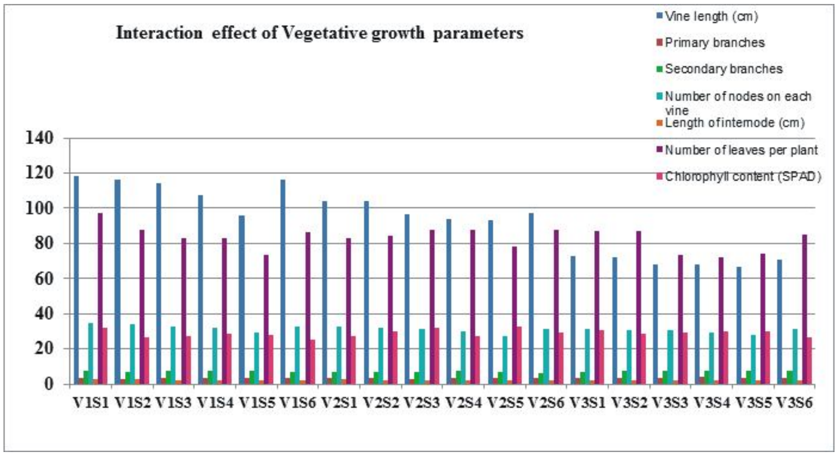

Fig. 1 : Vegetative growth in different varieties of sweet potato at different levels of spacing.

in the longest vine length (115.86 cm), while the lowest vines length was observed under the closer spacing of 20 x 20 cm (92.96 cm). The greater vine length at wider spacing could be attributed to reduced competition among plants for essential resources such as light, water, and nutrients, there by promoting more vigorous growth. Similar reports were published by Mary *et al*. (2022) and Baruah *et al*. (2024).

Primary branches

The results indicated significant differences in number of primary branches among the varieties, spacing and their interactions. The highest number of primary branches (3.43) were recorded in Samrat which was on par with Bhu Sona (3.32), while lowest number of primary branches were observed in Bhu Krishna (3.25).

The data of different spacings revealed that highest number of primary branches were recorded in 60 × 20 cm spacing (3.50), which was statistically on par with 30 × 20 cm spacing (3.40). However, the lowest number of primary branches were recorded under 50 × 30 cm and 40 × 30 cm spacing (3.23). Among the interactions between variety and spacing, Samrat at 30 × 20 cm spacing has recorded significantly maximum number of primary branches (3.80), while the lowest was recorded in Bhu Sona at 50 × 20 cm (3.00).

Secondary branches

The results revealed significant differences in the number of secondary branches among the varieties, spacing as well as their interactions. The variety Samrat recorded maximum number of secondary branches (7.27), which was statistically on par with Bhu Sona (7.18), while the minimum number of secondary branches was observed in Bhu Krishna (6.85). The data of different spacings revealed highest number of secondary branches in 50 × 20 cm spacing (7.47), while the lowest number of secondary branches were observed in 20 × 20 cm spacing (6.70).

Among the interactions, the variety Bhu Krishna at 30 × 20 cm, Bhu Sona at 60 × 20 cm and Samrat at 30 x 20 cm have recorded maximum number of secondary branches (7.60 both), while lowest was recorded in Bhu Krishna at 20× 20 cm (6.20).

It can be interpreted that the variety Samrat exhibited superior performance in branch development (both primary and secondary branches) making it a promising variety for biomass accumulation. Bhu Sona was also consistent and competed with Samrat in terms of both primary and secondary branching, indicating good vegetative vigour. Wider spacing (60 × 20 cm and 50 × 20 cm) positively influenced branch proliferation, possibly due to reduced intra-plant competition. Mekonnen *et al*. (2015), Birksew and Dikale (2016) have reported increased branching at wider spacing.

Number of nodes on each vine

Results revealed significant differences in number of nodes per vine among the varieties and spacing but the interaction effects were non-significant. Among the varieties, highest number of nodes per vine were recorded in Bhu Sona (32.37), followed by Bhu Krishna (30.97), while the lowest number of nodes were observed in Samrat variety (30.13). The maximum number of nodes were observed in 60 × 20 cm spacing (32.87), which was statistically on par with 50 × 20 cm, 40 × 20 cm and 30 × 30 cm spacing, while minimum number of nodes on each vine were observed in 20 × 20 cm spacing (28.13).

In the present investigation, the variety Bhu Sona consistently recorded the highest number of nodes indicating superior vine elongation and node development capacity. This was followed by Bhu Krishna, while Samrat consistently had the lowest number of nodes. Wider spacing of 60 × 20 cm consistently resulted in the maximum number of nodes, suggesting that reduced interplant competition promoted better vine growth and node development. Narrower spacing of 20 × 20 cm recorded the lowest node numbers. Njoku *et al*. (2009) and Essilfie *et al*. (2016) also reported that wider spacing resulted in maximum number of nodes.

Length of internode (cm)

There were significant differences in internodal length among spacings, while it was non-significant among the

Table 2 : Vegetative growth in different varieties of sweet potato at different levels of spacing.

	Vine length (cm)	Primary branches	Secondary branches	Number of nodes on each vine (g)	Length of internode (cm)	Number of leaves per plant	Chlorophyll content (SPAD units)
Varieties							
Bhu Sona	122.93	3.32	7.18	32.37	2.32	85.17	27.93
Bhu Krishna	108.33	3.25	6.85	30.97	2.27	84.72	29.77
Samrat	84.03	3.43	7.27	30.13	2.19	79.68	29.19
SEm ±	1.67	0.05	0.10	0.45	0.04	1.21	0.42
CD (p=0.05)	4.97	0.14	0.31	1.34	NS	3.61	1.25
Spacing and pl. density/ha							
60cm x 20 cm (83,300)	115.86	3.50	7.07	32.87	2.51	89.13	30.08
50 cm x 20 cm(100,000)	110.96	3.23	7.13	32.27	2.33	86.20	28.53
40 cm x 20 cm(1, 25,000)	103.80	3.23	7.13	31.53	2.28	81.25	29.30
30 cm x 20 cm(1,66,600)	99.50	3.40	7.47	30.43	2.16	81.07	28.71
20 cm x 20 cm(2,50,000)	92.96	3.23	7.10	28.13	2.07	75.32	30.11
30 cm x 30 cm(1,11,100)	107.50	3.40	6.70	31.70	2.20	86.17	27.06
SEm ±	2.35	0.69	0.15	0.64	0.04	1.71	0.60
CD (p=0.05)	21.97	0.20	0.31	1.90	NS	5.11	1.78
Interaction							
V_1S_1	135.5	3.50	7.60	34.50	2.78	97.39	31.95
V_1S_2	131.10	3.00	7.00	34.10	2.44	87.60	26.54
V_1S_3	121.80	3.20	7.30	32.40	2.33	83.20	27.00
V_1S_4	117.70	3.30	7.20	31.70	2.17	83.00	28.61
V_1S_5	106.60	3.30	7.30	29.10	2.04	73.50	27.98
V_1S_6	124.90	3.60	6.70	32.40	2.18	86.30	25.50
V_2S_1	116.80	3.40	7.10	32.90	2.41	82.99	27.40
V_2S_2	112.90	3.40	6.90	32.10	2.33	84.00	30.13
V_2S_3	105.90	3.00	6.80	31.60	2.32	87.44	31.97
V_2S_4	105.90	3.10	7.60	30.20	2.18	87.90	27.54
V_2S_5	96.70	3.20	6.50	27.40	2.13	78.50	32.40
V_2S_6	111.80	3.40	6.20	31.60	2.25	87.50	29.19
V_3S_1	95.30	3.60	6.50	31.20	2.33	87.00	30.89
V_3S_2	88.90	3.30	7.50	30.60	2.27	86.99	28.90
V_3S_3	83.70	3.50	7.30	30.60	2.18	73.10	28.93
V_3S_4	74.90	3.80	7.60	29.40	2.13	73.32	29.98
V_3S_5	75.60	3.20	7.50	27.90	2.03	73.96	29.95
V_3S_6	85.80	3.20	7.20	31.10	2.18	84.70	26.48
SEm ±	4.08	0.12	0.25	1.10	0.10	2.97	1.03
CD (p=0.05)	NS	0.35	0.75	NS	NS	NS	3.08

varieties and interactions. Among the different spacings, maximum internodal length was recorded in 60 × 20 cm spacing (2.51), followed by 50 × 20 cm spacing (2.35), while the shortest internode length was observed in 20 × 20 cm (2.07 cm).

Wider spacing, particularly 60 × 20 cm, consistently resulted in the longest internode length across all stages, indicating that reduced competition for light, water and nutrients in wider spacing likely encouraged greater cell elongation and vine extension, which was supported by Amoah (1997).

Number of leaves per plant

Results revealed significant differences in number leaves per plant among the varieties and spacing but the interaction effects were non-significant. The results indicated that highest number of leaves per plant were recorded in the variety Bhu Sona (85.17), which was on par with Bhu Krishna (84.72), while the lowest was observed in Samrat (79.68). The highest number of leaves per plant was observed at 60 × 20 cm spacing (89.13). The lowest number of leaves per plant (75.32) were noted in the closer spacing of 20 × 20 cm.

It was observed that wider spacing of 60 × 20 cm provided ample area for leaf expansion and reduced competition for light and nutrients, thereby promoting greater vegetative growth. Bhu Sona consistently performed best across all stages due to its higher inherent vegetative vigour. The present study points towards both genetic potential and adequate spacing which are crucial for maximizing leaf production in later stages, which can contribute to enhanced photosynthetic capacity and potentially better yield. These results are in agreement with Sharavati *et al*. (2018) in sweet potato.

Chlorophyll content (SPAD units)

The data revealed significant differences in chlorophyll content among the varieties, spacing and their interaction. The maximum chlorophyll content was observed in the variety Bhu Krishna (29.77 SPAD units), which was statistically on par with Samrat (29.19 SPAD units). The lowest chlorophyll content (27.93 SPAD units) was observed in Bhu Sona.

The chlorophyll content was highest in 60 × 20 cm spacing (30.11 SPAD units), while the lowest chlorophyll content (27.06 SPAD units) was observed in (30 × 30 cm). Among the interactions, maximum chlorophyll content was recorded in Bhu Krishna at 20 × 20 cm spacing (32.40 SPAD units), followed by Bhu Krishna at 40 × 20 cm spacing (31.97 SPAD units), while the minimum chlorophyll content was recorded in Bhu Sona at 30 × 30 cm spacing (25.50 SPAD units).

It can be inferred that the chlorophyll content was significantly influenced by variety, spacing, and their interaction at all stages. Bhu Krishna had consistently recorded the highest chlorophyll content, while Bhu Sona the lowest. Among spacings, 20 × 20 cm was most effective. The best interaction was V_2S_2 (Bhu Krishna at 20 × 20 cm) at all stages. Vigour of a variety coupled with enhanced light capture and nutrient use, may have promoted higher chlorophyll synthesis. These results were in accordance with Koshy *et al*. (2018) Dumbuya *et al*. (2021).

Conclusion

The study demonstrated that both sweet potato varieties and spacing significantly influenced growth in sweet potato, Bhu Sona exhibited superior performance in vine elongation and node development, whereas Samrat excelled in branching. Wider spacing (60 × 20 cm) promoted better vegetative growth by reducing competition for resources. Interaction effects indicated that optimal spacing coupled with vigorous varieties enhanced branching and chlorophyll content. Overall, appropriate variety selection and spacing management can maximize vegetative growth and photosynthetic efficiency in sweet potato.

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References

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. *Agro-Science*. 16(3): 46-50.

Amoah, R.S., Teye E., Abano E.E. and Tetteh J.P. (2011). The storage performance of sweet potatoes with different pre-storage treatments in an evaporative cooling barn. *Asian J. Agriult. Res*., **5(2)**, 137-145.

Anonymous (2022). Ministry of agriculture and farmers welfare. Third advance estimate. *https://agriwelfare.gov.in*.

Baruah, R., Pathak N., Neog M. and Sarma U.J. (2024). Evaluation of Biofortified Sweet Potato Varieties for their Growth, Yield and Economic Performance under Assam Condition. *Asian J. Agricult. Ext., Econ. Sociol*., **42(5)**, 316-322.

Birksew, A. and Dikale G. (2016). The Evaluation of growth performance of sweet potato (*Ipomoea batatas* L.) Awassa var. by using different type of vine cuttings. *Evaluation*, **54(4)**, 887-891.

Dumbuya, G., Alemayehu H.A., Hasan M.M., Matsunami M. and Shimono H. (2021). Effect of soil temperature on growth and yield of sweet potato (*Ipomoea batatas* L.) under cool climate. *J. Agricult. Meteorol*., **77(2)**, 118-127.

Essilfie, M.E., Dapaah H.K., Tevor J.W. and Darkwa K. (2016). Number of nodes and part of vine cutting effect on the growth and yield of sweet potato (*Ipomoea batatas* (L.) Lam) in transitional zone of Ghana. *Int. J. Plant Soil Sci*., **9(5)**, 1-14.

Koshy, A.M., Joseph V., Ravi V. and Byju G. (2018). Rapid method for estimation of total chlorophyll, chlorophyll a and b and carotene content in leaves of cassava and sweet potato using SPAD meter. *J. Root Crops*, **44(1)**, 37-40.

Ludvik, B., Neuffer B. and Pacini G. (2004). Efficacy of *Ipomoea batatas* (Caiapo) on diabetes control in type 2 diabetic subjects treated with diet. *Diabetes Care*, **27(2)**, 436-440.

Mary, J., Prameela P., Menon S.S. and Vijayan V.D. (2022).

Performance of high yielding sweet potato varieties under different seasons. *Int. J. Plant Soil Sci*., **34(23)**, 794-802.

Mekonnen, B., Tulu S. and Nego J. (2015). Evaluation of orange fleshed sweet potato (*Ipomoea batatas* L.) Varieties for yield and yield contributing parameters in the humid tropics of Southwestern Ethiopia. *J. Plant Sci*., **10(5)**, 191-199.

Njoku, J.C., Muoneke C.O., Okocha P.I. and Ekeleme F. (2009). Effect of propagule size and intra-row spacing on the growth and yield of sweetpotato in a humid agro-ecological zone. *Nigeria Agricult. J*., **40**, 1-2.

Panse, V.G. and Sukhatme P.V. (1985). *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.

Sharavati, M.B., Srinivasa V., Devaraju, Bhagwath A.R. and Shubha A.S. (2018). Evaluation of sweet potato (*Ipomoea batatas* (L.) Lam.) genotypes under hill zone of Karnataka. *Int. J. Chem. Stud*., **6(5)**, 882-886.

Srinivas, T. (2009). Economics of sweet potato production and marketing. In: Loebenstein, G. and Thottapilly G. (editors). *The sweet potato*. Spring Science Business Media. 235-267.

Tan, S.L. (2015). Sweet potato (*Ipomoea batatas*) a great health food. *Utar Agricult. Sci. J.*, **1(3)**, 15-28.