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Performance of Different Varieties of Sponge Gourd (*Luffa cylindrica* L.) in Terms of Growth, Yield and Quality under Prayagraj Agro Climatic Condition

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The current study was conducted in the Zaid season of 2023–2024 at the horticulture department of the Naini Agricultural Institute Sam Higginbottom University of Agricultural Technology and Sciences in Prayagraj, Uttar Pradesh, in order to assess the performance of various sponge gourd varieties in terms of growth, yield, and quality under the agroclimatic conditions of Prayagraj. To evaluate the varietals of sponge gourds, the experiment was set up using a Randomized Block

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Design (RBD) with 8 types and 3 replications. AVT-2/2020/SPGVAR-1, V2 (AVT-2/2020/SPGVAR-2), V3 (AVT-2/2020/SPGVAR-3), V4 (AVT-2/2020/SPGVAR-4), V5 (AVT-2/2020/SPGVAR -5), V6 (AVT-2/2020/SPGVAR -6), V7 (AVT-2/2020 / SPGVAR-7) and V8 (PUSA CHIKNI) are the varieties that make up this group. The variety AVT-2/2020/SPGVAR-5 was found to perform the best among the others in terms of growth metrics such as vine length (189.14 cm) and early maturity (55.33 days) for ripeness (the first fruit should be picked in 55.33 days), as well as yield characteristics such fruit length (28.98 cm), fruit diameter (3.70 cm), and fruit output per hectare (11.64 t/ha). The best results were also shown for the quality metrics TSS (3.14°Brix) and ascorbic acid content (10.66 mg/100g) in AVT-2/2020/SPGVAR-5.

Keywords: Maturity; performance of variety; fruit production per hectare; sponge gourd; TSS; ascorbic acid.

1. INTRODUCTION

The sponge gourd (Luffa cylindrica) is also known as Kalitori. The plant is classified under the family Cucurbitaceae and is commonly referred to, 2009). L. cylindrica fruits are green, large, cylindrical in shape, and crawl on other materials. According to a nutritionist, sponge accurately the indigenous area of Luffa species. They have a long history of cultivation in tropical countries of Asia and Africa. Indo-Burma is reported to be the center of diversity.

Luffa is a member of the cucurbitaceous family and is sometimes referred to as a sponge gourd, loofah, vegetable sponge, bath sponge, or dish cloth gourd. Nowadays, Malaysia, Korea, Japan, Taiwan, and China cultivate sponge gourds extensively for medical purposes. According to Arya and Prakash (2002), the crop is extensively farmed in Kerala, W.B., U.P., Bihar, and Orrisa in India. Sponge gourd is cultivated on over 2597 hectares in Chhattisgarh, with an annual production of 23447 MT (Anon2017), mostly in the districts of Mahasamund, Kanker, Raigarh, Korba, and Koria.

The soft fruit that is used as a vegetable boosts hunger when eaten and is readily digested. The juicy, fresh fruit is 94% moisture-containing and has a high molecular content of 16 calories per 100g, with 9.5g of carbs, 2g of protein, 0.25g of fat, and 10ug of vitamin A. In addition to being a vegetable, the mature, dry fruit is composed of a stiff, dense network of cellulose fiber (sponge) encased in a hard shell. This fiber is useful in the automotive and glassware sectors as filler and for cleaning [1].

The sponge gourd is a monoecious vegetable that climbs every year. Fruit size varies greatly, ranging from a few centimeters to one meter. Its shape and color are also very variable, with multiple genes controlling these complex features (Beyer et al., 2002; Zalapa et al., 2006). In any initiative to improve crops, genotype evaluation is regarded as a necessary first step in determining the current level of variability. The current study was conducted to collect data on genetic variability, heritability, correlation, and path analysis for several sponge gourd traits in order to pursue an efficient breeding program.

For sponge gourd farming in Prayagraj to be effective, soil improvement techniques, disease and pest control, and water management are essential. The climate of Uttar Pradesh has given rise to the prominence of a few native types. Many high-yielding kinds and, according to estimates, a variety of sponge gourds are available in the market. Prayagraj's agroclimatic circumstances indicate that sprout gourd can be produced more effectively and yieldily. The current study on the varietal evaluation of Sponge gourd cultivars in Prayagraj agroclimatic conditions was conducted in light of the aforementioned facts.

2. MATERIALS AND METHODS

The goal of the current study was to comprehend how different types of sponge gourds develop, generate fruit, and vary in quality in the Prayagraj agroclimatic conditions. The investigation was conducted in the Jan–Jun 2023 season at Central Horticultural Research Farm (HCRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj. The investigation's materials and methodology are described in detail.With eight variations and three replications, the experiment was set up in a randomized block design. Varieties name of V1 (AVT-2/2020/SPGVAR-1), V2 (AVT-2/2020/SPGVAR-2), V3 (AVT-2/2020/SP GVAR-3), V4 (AVT-

2/2020/SPGVAR-4), V5 (AVT-2/2020/ SPGVAR -5), V6 (AVT-2/2020/ SPGVAR -6), V7 (AVT-2/2020/ SPGVAR-7) and V8 (PUSA CHIKNI) are the varieties that make up this group. At various growth phases, observations were made regarding quality parameters like TSS and vitamin C content as well as vine length, days to flower emergence, fruit length, and yield per plot. The Fisher and Yates method was used to statistically analyze the data.

3. RESULTS AND DISCUSSION

3.1 Vine Length (m) and Number of Branches Per Vine

There were substantial differences between the varieties in the data on the length of the vine and the number of branches per vine (Table 1). AVT-2/2020/SPGVAR-5 showed the maximum vine length of 189.14 cm among the several types, while AVT-2/2020/SPGVAR-3 showed the least vine length of 120.99. The variation in vine length between types can be attributed to a combination of environmental factors and genetic makeup. Superior vine elongation performance is likely to be exhibited by varieties that have been carefully selected for longer vine length or that are genetically suited to particular environmental circumstances. Similar results were noted in studies on sponge gourds by Pongen et al. [2], bottle gourds by Quamruzzaman et al. [3], pointed gourds by Ara et al., [4] and bitter gourds by

3.2 Days to First Male and Female Flowering and Days to First Fruit Harvest

The days until the first male and female flowers appeared, as well as the first fruit harvest, varied greatly between varieties, according to the data (Table 1). The AVT-2/22020/SPGVAR-5 variety showed the lowest days to first male flowering (30.78 days), however the AVT-2/22020/SPGVAR-3 variety showed the highest days to first male flowering (39.28 days). AVT-2/2020/SPGVAR-3 showed the lowest days to first female flower emergence (33.69 days) among the several types, while AVT-2/2020/SPGVAR-5 showed the most days to first female flower emergence (49.05 days). AVT-2/2020/ SPGVAR-5 was used to measure the minimum number of days required to harvest fruit (55.33 days) and the maximum number of days required to harvest fruit (71.92 days) for each variety. AVT-2/2020 / SPGVAR-3.

Genetic and environmental variables can explain why certain varieties do better than others in terms of flowering and maturity earlier. Varieties that have shorter vegetative growth stages or early maturation genes, for example, can show rapid blooming initiation and subsequently maturing. These genetic features can also encourage early flowering. Flowering time can also be influenced by environmental variables as temperature, photoperiod, and nutrition availability. Varieties that have been deliberately cultivated for early flowering or those that are genetically.

3.3 Number Fruits Per Plant, Fruit Length, Fruit Diameter and Fruit Weight

The information on fruit length, diameter, weight, and quantity of fruits per plant is displayed in Table 2. Using AVT-2/2020/SPGVAR-5, the maximum number of fruits per plant (25.3 fruits) and least number of fruits per plant (14.28 fruits) were observed among the various types. 2020/AVT-2/SPGVAR-3. Genetic and environmental factors may play a role in why one variety performs better than another in terms of yielding more fruits per plant. AVT-2/2020/SPGVAR-5 showed the largest fruit length of 28.96 cm among the several kinds, while AVT-2/2020/SPGVAR-3 showed the smallest fruit length of 16.76 cm. AVT-2/ 2020/SPGVAR-5 showed the largest fruit diameter of 3.70 cm among the various types, while 3.11 cm was the minimum. 2020/AVT-2/SPGVAR-3.

AVT-2/2020/SPGVAR-5 showed the highest average fruit weight of 51.45 g among the various types, whereas AVT-2/2020/SPGVAR-3 showed the lowest average fruit weight of 38.38 g. Genetic and environmental factors can be related to a variety's superior performance over another in terms of enhanced fruit length, diameter, and weight [5–9]. Larger and longer fruits can be produced by cultivating fruit varieties with genetic features that encourage greater cell division and elongation. The ideal temperature, amount of sunshine, and availability of nutrients are examples of environmental variables that might affect fruit growth and development. Fruit length, diameter, and weight may be better in varieties that are genetically predisposed to produce longer and thicker fruits or that have been carefully cultivated for them. Similar findings were made before by Pongen et al.

Table 1. Shows the performance of various sponge gourd varieties in terms of quality and yield metrics

Varieties Notation	Varieties details	Vine length(cm)	No of Nodes	Days to first male flowering	Days to Female flowering	Days to first fruit harvest
V1	AVT-2/2020/SPGVAR-1	150.28	33.84	34.61	38.84	56.65
V2	AVT-2/2020/SPGVAR-2	128.29	35.76	33.43	35.55	60.32
V3	AVT-2/2020/SPGVAR-3	120.97	29.14	39.28	33.69	71.92
V4	AVT-2/2020/SPGVAR-4	161.60	34.38	36.76	37.57	60.06
V5	AVT-2/2020/SPGVAR-5	189.14	40.12	30.78	49.05	55.33
V6	AVT-2/2020/SPGVAR-6	140.87	35.13	32.98	36.48	58.95
V7	AVT-2/2020/SPGVAR-7	170.76	31.08	37.82	33.11	61.19
V8	Pusa Chikni	134.82	38.43	34.11	34.10	68.17
‘F’ Test		S	S	S	S	S
SE (d)		0.46	1.14	0.79	1.43	0.93
C.D. at 5%		0.84	2.84	3.83	3.77	4.43
C. V.		5.43	4.91	0.58	1.74	8.93

Table 2 shows the performance of various sponge gourd varieties in terms of quality and yield metrics

Varieties Notation	Varieties details of fruits per plant	Number	Fruit Length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield per Hectare (qt/ha)	TSS [°Brix]	Vitamin C content (mg/100g)
V1	AVT-2/2020/	19.5 SPGVAR- 1	24.01	3.61	42.01	6.86	2.00	6.00
V2	AVT-2/2020/	SPGVAR-2 20.6	25.00	3.80	46.22	10.83	1.71	10.00
V3	AVT-2/2020/	SPGVAR-3 14.2	16.76	3.11	38.38	6.04	1.50	7.66
V4	AVT-2/2020/	SPGVAR-4 18.7	24.00	3.34	49.37	9.83	1.50	9.00
V5	AVT-2/2020/	25.3 SPGVAR-5	28.98	3.70	51.47	11.64	3.14	11.55
V6	AVT-2/2020/	16.4 SPGVAR-6	22.89	3.20	50.81	9.57	2.14	7.36
V7	AVT-2/2020/	SPGVAR-7 22.4	25.67	3.30	48.38	8.44	3.10	9.00
V8	PUSA CHIKNI	19.6	20.41	3.44	42.12	7.67	2.13	11.00
‘F’ Test	S		S	S	S	S	S	S
SE (d)	1.30		1.17	0.61	1.58	0.75	0.24	0.69
C.D. at 5%	1.08		1.08	0.45	10.02	0.30	0.40	12.30
C. V.	0.24		1.20	0.06	0.60	1.96	7.54	2.17

Table 3. Cost of cultivation of sponge gourd

Sr	Particular	Unit	Quantity	Rate/Unit	Cost (Rs/ha)
A.	Land Preparations	Hrs.	5	900	4,500
1	Ploughing	Hrs.	4	800	3,200
2	levelling with cultivars	Labour	10	300	3,000
B.	Fertilizers, manures, and seed				
1	Cost of seed	Kg	1.5	3500	5,250
2	Farmyard Manure	Tones	25	800	2,0000
3	Urea	Kg	458	6.5	2,977
4	DAP	Kg	217	24.4	5,294.8
5	MOP	Kg	166	18.5	3,071
6	Labour for Seed Sowing	Mandays	10	300	3,000
7	Labour for fertilizer application	Mandays	15	300	4,500
8	Gap filling	Mandays	10	200	2,000
C.	Intercultural Operations				
1	Weeding and Hoeing	Mandays	15	300	4,500
2	Insecticides and Pesticides		8	800	6,400
3	Neem Oil		4	400	1,600
4	Spraying of Chemicals 6 times	Mandays	15	300	4,500
D.	Irrigation				
1	Irrigation	Labour	24	300	7,200
2	Tuber well Charges	Irrigation	8	500	4,000
F.	Harvesting				
1	Mandays	Labour	30	300	9,000
2	Transportation		L.S		8,000
3	Rental value of land	Months	3	2000	6,000
4	Supervision charges	Days	90	150	13,500
			Total Cost of	Cultivation	1,21,493

3.4 Fruit Yield Per Hectare (qt/ha)

Among the different Varieties maximum average fruit yield per vine (11.64 qt/ha) was observed in with AVT-2/2020/SPGVAR-5 and minimum average fruit yield per hectare (6.04qt/ha) was observed in AVT-2/2020/SPGVAR-3 (Table 2) The better performance of one Variety over another in terms of enhanced fruit yield can be attributed to genetic factors and environmental conditions. Varieties with genetic traits that promote higher flower-to-fruit conversion rates, increased branching, or enhanced reproductive capacity can result in a greater yield of fruits. Additionally, environmental factors such as pollination efficiency, availability of nutrients and water, and optimal growing conditions can significantly influence fruit production. Varieties that are genetically predisposed or have been selectively bred for higher fruit yield can demonstrate superior performance in terms of overall fruit production per plant. The findings were in accordance with earlier reports of Ramya et al. [10].

3.5 T.S.S. [°Brix] and Vitamin C Content (mg/100g)

Among the different varieties maximum Total Soluble Solid (43.14°Brix) was observed with AVT-2/2020/SPGVAR-5 and minimum Total Soluble Solid (1.50°Brix) was observed AVT-2/2020/SPGVAR-3 [11-15]. Among the different varieties maximum Ascorbic acid content (11.55 mg/100g) was observed with AVT-2/2020/SPGVAR-5 and minimum Ascorbic acid content (7.66 mg/100g) was observed AVT-2/2020/SPGVAR-3 [16-20]. The better performance of one variety over another in terms of better Ascorbic acid and TSS content can be attributed to genetic factors and environmental conditions. Varieties with genetic traits that promote higher Vitamin C synthesis and accumulation in fruits can result in increased Ascorbic acid content. Additionally, environmental factors such as sunlight exposure, temperature, and nutrient availability can influence the production of Vitamin C in fruits. Varieties that are genetically predisposed or have been selectively bred for higher Ascorbic acid content may demonstrate superior

performance in terms of producing fruits with a better concentration of this essential nutrient [20-26].

4. CONCLUSION

Based on the experimental results shown above, it can be inferred that the AVT-2/ 2020/SPGVAR-5 variety outperformed the others in terms of yield factors such as fruit diameter, length, and early flowering and maturity, as well as growth metrics such as vine length. It performed highest for TSS and vitamin C content as well as quality metrics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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