



# Performance of Different Hybrids of Sponge Gourd (*Luffa cylindrica* L.) in Terms of Growth, Yield and Quality

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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 present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the year 2023-24 with a view to check the performance of different hybrids of sponge gourd in terms of growth, yield and quality. Hybrids comprised of H1 (AVT-1 2021/SPGHYB-1), H2 (AVT-1 2021/SPGHYB-2), H3 (AVT-1 2021/SPGHYB-3), H4 (AVT-1

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2021/SPGHYB-4), H5 (AVT-1 2021/SPGHYB-5), H6 (AVT-1 2021/SPGHYB-6), H7 (GENNEXT Ayushi) and H8 (VNR Alok). Among the different hybrids VNR Alok performs best in terms of growth parameters like early germination, maximum vine length, flowering parameters like earliness in flowering and maturity, yield parameters like early fruit setting, maximum length of fruit, early harvesting, highest fruit yield/ha and quality parameters like Vit-C and TSS. Maximum B:C ratio was obtained in the same hybrid.

**Keywords:** *Sponge gourd; performance; hybrids; vegetable crop.*

## 1. INTRODUCTION

Sponge gourd (*Luffa cylindrica* L.) is an important vegetable crop having chromosomes ( $2n=26$ ). It is monoecious, flowers open in the early morning and remain open for a day. The flowers are big and bright yellow, highly attractive and are a rich source of pollen for the foraging insects, chiefly bees. It is an annual climbing plant with cross pollinated nature. It is difficult to assign with accuracy 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 centre of diversity for sponge gourd and is originated in subtropical Asian region particularly India.

*Luffa* belongs to cucurbitaceous family and it is a cross-pollination crop [1] widely cultivated in kharif and summer seasons in India. According to FAO estimate, cucurbits are cultivated in an area of about 5.46 lakh ha having annual production of 5.40 lakh tonnes. The productivity of this crop is 10.52 tonnes per hectare. The main cucurbits producing countries are China, Korea, India, Japan, Nepal and Central America. In India, major cucurbits growing states are U.P., Punjab, Bihar, Jharkhand, Gujarat, Rajasthan, Haryana, Karnataka and Delhi. Sponge gourd being a monoecious and crosspollinated crop, it exhibits considerable heterozygosity in population and does not suffer much due to inbreeding depression resulting in natural variability in the population. Thus provides ample scope for utilization of hybrid vigour on commercial scale to increase the production and productivity. In spite of the availability of wide range of genetic variability in plant and fruit characters and also produce large number of hybrid seed at reasonable cost, very little work has been done to exploit the hybrid vigour in this crop. Hence, there is there is major scope for production hybrids seeds which are required to achieve high yields, uniformity, earliness and higher quality fruits. The genus is closely related to 'Loofah' and has similar cultural requirements as cucumber. The young fruit, hen small (around 6

inches) is delicious and is used in soup or stew as a vegetable, which is good for diabetes. Oil extracted from seeds has industrial use. Older fruits have been reported to develop purgative chemicals. It has a smooth surface and is one of the popular vegetables. It is a good source of vitamin A and C and has laxative properties. Fully ripen Sponge Gourds have high fibre content which are used as a cleansing agent [bathing and utensils] and making shoe soles, tablemats. The sponge of the mature fruit helps the skin in increasing the blood circulation and as a relief for rheumatic and arthritis sufferers. The fruits are used to cure jaundice, diabetes, to purify blood and to cure skin diseases also. The tender fruit used as vegetable which is easily digestible and increases appetite when consumed. The edible fresh and tender fruit contains 94% moisture and large number of chemical components including 16Cal per 100g with 9.5g carbohydrates, 2g of protein, 0.25g of fat, 10ug of vitamin A. Besides being a vegetable, the mature, dry fruit consist of a hard shell surrounding a stiff, dense network of cellulose fibre (sponge) which is a good source of fibre used in industries for filler and cleaning the motor car, glass wares. Luffein is a gelatinous compound present in sponge gourd. Sponge gourd cultivation is widespread across India, and specific local varieties have gained significance, especially in the climatic conditions of Uttar Pradesh. Growing sponge gourd in Prayagraj faces challenges like adapting to the region's climate, ensuring well-drained and fertile soil, managing water supply, addressing pests and diseases, and maintaining proper pollination. Effective support structures, nutrient management, and weed control are vital. Localized solutions and proper harvesting timing are essential for a successful yield. Before initiating a successful breeding program, it is crucial to assess various cultivars within the group.

## 2. MATERIALS AND METHODS

This experiment was carried out during 2023 at Horticulture Research Farm, SHUATS, Prayagraj, UP, which is located at 25.28°N

latitude, 81.54°E longitude and 98 m altitude above the mean sea level. This area situated on the right side of the river Yamuna by the side of Prayagraj Rewa Road about 5 km away from Prayagraj, city. The climate of this region is typically sub-tropical and semi-arid with monsoon commencing by the third week of June and with drawing by end of September. The average rainfall is around 1042 mm with maximum concentration during July to September months with occasional showers in winters. The temperature reached up to 48°C and in winter it goes down to as low as 7-9°C. The experiment was laid out in randomized block design with 8 hybrids comprised of AVT-1 2021/SPGHYB-1, AVT-12021/SPGHYB-2, AVT-1 2021/SPGHYB-3, AVT-1 2021/SPGHYB-4, AVT-1 2021/SPGHYB-5, AVT-1 2021/SPGHYB-6, GENNEXT Ayushi, VNR Alok and three replications. The crop was grown under open field condition. The seeds were sown in third week of the February at (2.5×0.5) m spacing by ridge and furrow method. The experimental material for this study six hybrid seeds were collected from IIVR, Varanasi research station and the other two hybrids were from private seed company. The experimental plot was ploughed twice, harrowed and planked to remove weeds and crush the clods. Then it was made into required size plots and levelled after incorporation of FYM @ 25t/ha. Then the individual plots of scheduled size were laid out as per the plant design with intermittent bunds & irrigation channels. The necessary recommended cultural practices like fertilizer application, irrigation, weeding. Observations were recorded at different stages of plant like days to germination, vine length, days to flower emergence, fruit length, fruit weight, yield/ha and quality parameters like TSS and Vit-C content. The data were statistically analysed by the method suggested by Fisher and Yates [2].

### 3. RESULTS AND DISCUSSION

#### 3.1 Growth Parameters (Days to Germination, Vine Length at Last Harvest and No. of Nodes at Last Harvest)

Among different hybrids the minimum no. of days to germination 7.60 were observed in H8 (VNR Alok) and the maximum no. of days to germination 10.47 were observed in H2 (2021/SPGHYB-2). The seeds of H8 (VNR Alok) germinate earlier than the other hybrids but H7 (GENNEXT Ayushi) also performs well. It takes 7.80 days to germinate just after the germination of H8 (VNR Alok).

Among the different hybrids maximum vine length 522.80 cm was observed with H8 (VNR Alok) followed H7 (GENNEXT Ayushi) with 518.33 cm. Minimum vine length 475.20 cm was observed in H2 (2021/SPGHYB-2). The difference in vine length among hybrids can be explained by a blend of genetic elements and the surrounding environment. Hybrids possessing genetic traits that encourage longer vines, like improved internode elongation or increased branching, tend to display greater vine length. Additionally, external factors such as sunlight exposure, temperature, and soil fertility play a role in vine growth. Hybrids that are genetically suited to specific environmental conditions or have been selectively bred for longer vine length are likely to exhibit superior vine elongation performance. Similar findings were reported by Rathore et al., [3]; Pongen et al., [4] in sponge gourd; Quamruzzaman et al., [5] in bottle gourd; Ara et al., [6] in pointed gourd; Ramya et al., [7] in Bitter gourd.

Among the different hybrids maximum number of nodes (46.07 nodes) were observed with H5 (2021/SPGHYB-5) followed H2 (2021/SPGHYB-2) & H4 (2021/SPGHYB-4) with (45.67 nodes). Minimum number of nodes (41.73 nodes) were observed in H1 (2021/SPGHYB-1). The higher number of nodes in one hybrid of sponge gourd, compared to other hybrids, can be attributed to a combination of genetic and environmental factors. This specific hybrid may possess genetic traits that promote enhanced branching and internode elongation, leading to more nodes. Additionally, favourable environmental conditions, such as ample sunlight, optimal temperature, and nutrient-rich soil, may further stimulate robust growth and node development. The cumulative effect of these genetic and environmental advantages results in the observed increase in the number of nodes, contributing to the overall superior performance of this particular sponge gourd hybrid. Similar findings were reported by Haque et al., [8] in snake gourd; Sangma et al., [9] in sponge gourd; Ara et al., [6] in pointed gourd; Ramya et al., [7] in Bitter gourd.

#### 3.2 Flowering Parameters (Days to 1<sup>st</sup> Male and Female Flower, Total No. of Male and Female Flower, Sex Ratio)

Among the different hybrids the minimum no. of 30.60 days taken to emergence of first male flower was observed with H4 (2021/SPGHYB-4) and the maximum no. of days 34.47 days was

observed in H7 (GENNEXT Ayushi). The minimum no. of 40.27 days taken to emergence of first female flower was observed in H8 (VNR Alok) followed H7 (GENNEXT Ayushi) with 41.73 days and the maximum no. of 53.07 days was observed in H3 (2021/SPGHYB-3). The maximum no. of male flower (155.20) was observed in H6 (2021/SPGHYB-6) and the minimum no. of male flower (142.73) was observed in H2 (2021/SPGHYB-2).

Maximum no. of female flower (37.27) was observed in H7 (GENNEXT Ayushi) followed H8 (VNR Alok) with (35.33) and the minimum no. of female flower (31.33) observed in H5 (2021/SPGHYB-5). In all hybrids sex ratio (ratio of male to female flower) were same i.e (5:1), but H7 (GENNEXT Ayushi) observed with (4:1) ratio. Additionally, environmental factors such as temperature, photoperiod, and nutrient availability can influence flowering time. Hybrids that are genetically predisposed to respond more favourably to the prevailing environmental conditions, or those that have been selectively bred for early flowering, may show superior performance in terms of early initiation of flowering and thus maturing too. The findings were reported similarly earlier by Quamruzzaman et al., [5] in bottle gourd and Phanet al., [10]; Reddy et al., [11] in sponge gourd; Ramya et al., [7] in Bitter gourd.

### 3.3 Yield and Quality Parameters

Among the different hybrids minimum days to first fruit picking (49.33 days) was observed in H8 (VNR Alok) followed H7 (GENNEXT Ayushi) with 50.90 days. Maximum days to first fruit picking

(58.93 days) was observed in H3 (2021/SPGHYB-3). Among the different hybrids maximum number of fruits per plant (36.07 fruits) were observed in H7 (GENNEXT Ayushi) followed H8 (VNR Alok) with 33.87 fruits. Minimum number of fruits per plant (30.20) were observed in H5 (2021/SPGHYB-5). The better performance of one hybrid over another in terms of producing a higher number of fruits per plant can be attributed to genetic factors and environmental conditions [12-16]. Among the different hybrids maximum fruit length (27.33 cm) was observed with H8 (VNR Alok) followed H5 (2021/SPGHYB-5) with 26.67 cm. Minimum fruit length (23.33 cm) was observed in two hybrids H3 (2021/SPGHYB-3) & H4 (2021/SPGHYB-4). Among the different hybrids maximum fruit diameter (29.33 cm) was observed in H2 (2021/SPGHYB-2) & H7 (GENNEXT Ayushi) followed H8 (VNR Alok) with (28.33cm). Minimum fruit diameter (24.67 cm) was observed in H1 (2021/SPGHYB-1). The better performance of one variety over another in terms of enhanced fruit length, diameter and weight can be attributed to genetic factors and environmental conditions [17-21]. Varieties with genetic traits that promote increased cell division and elongation in fruits can result in longer and larger fruits. Environmental factors such as optimal temperature, sunlight exposure, and nutrient availability can also influence fruit growth and development. Varieties that are genetically predisposed or have been selectively bred for longer and thicker fruits may demonstrate superior performance in terms of fruit length, diameter and weight. Similar conclusions were drawn earlier by Pongen et al., [4] in sponge gourd; Ramya et al., [7] in Bitter gourd.

**Table 1. Performance of different hybrids of sponge gourd in terms of growth parameters**

Hybrids	Days to Germination	Vine Length (cm)	No. of Nodes
H <sub>1</sub>	8.47	502.87	41.73
H <sub>2</sub>	10.47	475.20	45.67
H <sub>3</sub>	9.53	485.33	45.20
H <sub>4</sub>	9.73	488.93	45.67
H <sub>5</sub>	9.80	514.27	46.07
H <sub>6</sub>	8.80	504.73	44.80
H <sub>7</sub>	7.80	518.33	42.67
H <sub>8</sub>	7.60	522.80	43.80
<b>F test</b>	S	NS	NS
<b>S.E (d) (±)</b>	0.45	50.58	1.70
<b>C.V</b>	6.14	12.35	4.68
<b>CD 5%</b>	0.97	108.49	3.64

**Table 2. Performance of different hybrids of sponge gourd in terms of flowering parameters**

Hybrids	Days to First Male Flower	Days to First Female Flower	Total no. of Male flower/ Plant	Total no. of Female Flower/Plant	Sex Ratio
H <sub>1</sub>	30.73	51.93	149.00	32.07	5:1
H <sub>2</sub>	33.13	50.33	142.73	33.13	5:1
H <sub>3</sub>	33.07	53.07	154.73	33.67	5:1
H <sub>4</sub>	30.60	52.13	153.73	33.40	5:1
H <sub>5</sub>	31.07	52.87	152.13	31.33	5:1
H <sub>6</sub>	31.87	50.60	155.20	32.33	5:1
H <sub>7</sub>	34.47	41.73	153.47	37.27	4:1
H <sub>8</sub>	31.67	40.27	153.00	35.33	5:1
<b>F test</b>	S	S	NS	S	S
<b>S.E (d) (±)</b>	0.66	0.91	5.01	1.39	0.23
<b>C.V</b>	2.54	2.27	4.05	5.06	5.77
<b>CD 5%</b>	<b>1.42</b>	<b>1.96</b>	<b>10.75</b>	<b>2.97</b>	<b>0.48</b>

**Table 3. Performance of different hybrids of sponge gourd in terms of yield and quality (TSS and Vit-C content) parameters**

Hybrids	Days to 1 <sup>st</sup> Fruit Picking	Total No. of Fruit/ Plant	Fruit Length (cm)	Diameter (cm)	Fruit Wt. (g)	TSS [°Brix]	Vit-C (mg/ 100g)	Color of Fruit
H <sub>1</sub>	57.67	30.60	24.33	24.67	74.4	1.50	1.50	Green
H <sub>2</sub>	56.07	32.20	25.00	29.33	67.0	1.50	1.00	Green
H <sub>3</sub>	58.93	32.80	23.33	27.33	62.2	2.00	1.00	Green
H <sub>4</sub>	58.40	32.33	23.33	26.00	57.0	1.50	1.50	Green
H <sub>5</sub>	57.67	30.20	26.67	26.67	72.2	2.00	1.50	Light green
H <sub>6</sub>	56.47	31.40	26.00	26.67	73.4	1.50	1.50	Green
H <sub>7</sub>	50.90	36.07	25.67	29.33	65.0	2.47	1.93	Green
H <sub>8</sub>	49.33	33.87	27.33	28.33	72.8	2.80	2.07	Dark green
<b>F test</b>	S	S	S	S	S	S	S	
<b>S.E (d) (±)</b>	1.06	1.50	1.10	0.63	2.21	0.14	0.10	
<b>C.V</b>	2.33	5.66	5.35	2.83	3.97	9.09	8.03	
<b>CD 5%</b>	2.27	3.21	2.36	1.35	4.73	0.30	0.21	

**Table 4. Total yield and marketable yield**

Hybrids	Yield (t/ha)	Marketable Yield (t/ha)
H <sub>1</sub>	17.97	14.50
H <sub>2</sub>	17.30	14.00
H <sub>3</sub>	16.00	14.50
H <sub>4</sub>	15.52	13.30
H <sub>5</sub>	16.98	13.50
H <sub>6</sub>	18.64	15.00
H <sub>7</sub>	18.23	16.00
H <sub>8</sub>	19.71	17.00
<b>F-test</b>	NS	
<b>SE(d)</b>	12.80	
<b>C.V.</b>	8.94	
<b>CD at 5% level</b>	27.45	

**Table 5. Economics of sponge gourd**

Hybrids	Marketable Yield (t/ha)	Cultivation Cost (Rs./ha)	Gross Return (Rs./ha)	Net Benefit (Rs./ha)	B:C Ratio
H <sub>1</sub>	14.50	1,10,000	319000	209000	1.90
H <sub>2</sub>	14.00	1,10,000	308000	198000	1.80
H <sub>3</sub>	14.50	1,10,000	319000	209000	1.90
H <sub>4</sub>	13.30	1,10,000	292600	182600	1.66
H <sub>5</sub>	13.50	1,10,000	297000	187000	1.70
H <sub>6</sub>	15.00	1,10,000	330000	220000	2.00
H <sub>7</sub>	16.00	1,10,000	352000	242000	2.20
H <sub>8</sub>	17.00	1,10,000	374000	264000	2.40

Among the different hybrids maximum average fruit weight (74.4 g) was observed with H<sub>1</sub> (2021/SPGHYB-1) followed H<sub>6</sub> (2021/SPGHYB-6) with (73.4 g). Minimum average fruit weight (57.0 g) was observed in H<sub>4</sub> (2021/SPGHYB-4). Among the different hybrids maximum Total Soluble Solid (2.80°Brix) was observed H<sub>8</sub>(VNR Alok) followed H<sub>7</sub> (GENNEXT Ayushi) with (2.47°Brix). Minimum Total Soluble Solid (1.50°Brix) was observed in H<sub>1</sub>, H<sub>2</sub>, H<sub>4</sub>, H<sub>6</sub>. Among the different hybrids maximum Ascorbic acid content (2.07 mg/100g) was observed with H<sub>8</sub> (VNR Alok) followed H<sub>7</sub> (GENNEXT Ayushi) with (1.93 mg/100g). Minimum Ascorbic acid content (1.00 mg/100g) was observed in H<sub>2</sub> (2021/SPGHYB-2) & H<sub>3</sub> (2021/SPGHYB-3). And only H<sub>8</sub> (VNR Alok) obtained dark green colour & H<sub>5</sub> (2021/SPGHYB-5) obtained light green colour of fruit. The better performance of one hybrid over another in terms of better Ascorbic acid content can be attributed to genetic factors and environmental conditions. Hybrids 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. Hybrids 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. The findings were in accordance with earlier reports of Pongen et al., [4] in sponge gourd; Ramya et al., [7] in Bitter gourd. Among the different hybrids maximum average fruit yield per hectare (19.71 t/ha) was obtained with H<sub>8</sub> (VNR Alok). Minimum average fruit yield per hectare (15.52 t/ha) was obtained with H<sub>4</sub> (2021/SPGHYB-4). Hybrids with genetic traits that promote increased fruit set, such as higher flower-to-fruit conversion rates or enhanced reproductive

capacity, can result in a greater number of fruits per plant. Additionally, environmental factors such as pollination efficiency, availability of nutrients and water, and optimal growing conditions can influence fruit production. Hybrids that are genetically predisposed or have been selectively bred for higher fruit yield can demonstrate superior performance in terms of fruit quantity per plant. Similar conclusions were drawn earlier by Phan et al., [10]; Pongen et al., [4] in sponge gourd; Ara et al., [6] in pointed gourd; Ramya et al., [7] in Bitter gourd.

The marketable yield of the fruit was lesser than the total yield of fruit because of some factors like over maturing of fruit, fruits affected by disease & pest, fruit showed some physiological disorder, some fruits were harvested before reached their harvesting index and loss during transportation. The maximum marketable yield per hectare (17.00 t/ha) was obtained in H<sub>8</sub> (VNR Alok) followed H<sub>7</sub> (GENNEXT Ayushi) with (16.00t/ha) and the minimum marketable yield (13.30) was obtained with H<sub>4</sub> (2021/SPGHYB-4).

#### 4. CONCLUSION

From the above experimental finding it is concluded that the hybrid VNR Alok performed best in terms of growth parameters like early germination in 7.60 days, vine length (522.80 cm), earliness in female flowering with (40.27 days), yield parameters like early maturity and harvesting of fruit in (49.33 days), fruit length (27.33 cm), fruit yield/ha with (19.71 t/ha) and quality parameters like TSS (2.80 °Brix) & Vit-C (2.07 mg/100g) content. The maximum B:C ratio (2.40) was also obtained in the same hybrid.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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