PERFORMANCE OF DIFFERENT HYBRIDS OF SPONGE GOURD(*Luffa cylindrica* L.) IN TERMS OF GROWTH, YIELD AND QUALITY,UNDERPRAYAGRAJ AGRO CLIMATIC CONDITION

ABSTRACT

The present experiment 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 2022-23 with a view to check the performance of different hybrids of sponge gourd in terms of growth, yield and quality under Prayagrajagro climatic condition .The experiment was laid in a randomized block design having 8 hybrids with three replications Hybrids comprised of 2020/SPGHYB-1, 2020/SPGHYB-2, 2020/SPGHYB-3, 2020/SPGHYB-4, 2020/SPGHYB-5, 2020/SPGHYB-6, 2020/SPGHYB-7 and GENNEXT Ayushi .. The result from the present investigation revealed that among the different hybrids GENNEXT Ayushi performs best in terms of growth parameters like early germination, maximum vine length also best in flowering parameters like earliness in flowering and maturity,maximum numbers of female flowers ,maximum length of fruit , highest fruit yield/ha , quality parameters like high vit-c content, high TSS(Total Soluble Solid) content having dark green colour of fruit . In terms of economics, the best benefit- cost ratio was also obtained by GENNEXT Ayushi hybrid with high returns.

Keywords: Hybrids ; sponge gourd; growth, yield & quality .

1. INTRODUCTION

Sponge gourd (*Luffa cylindrica* L.) is an important vegetable crop having chromosomes (2n=26). It is a member of the cucurbitaceous family. It is an annual climbing plant & cross pollinated in nature. It is also known as chinese okra,smooth luffa, climbing okra and dishcloth gourd.Some local names of sponge gourd in India are tuppadaheeraykayi (Kannada), chikniturai (Hindi), janhi (Oriya), gisoda (Gujarati), neti beerakaya(Telugu), bhol (Assamese), jhinga (Bengali), peechinga (Malayalam) and pirkanga (Tamil) (Bal et al., 2004) The main commercial production countries are China, Korea, India, Japan & Central America. InIndia the crop is widely grown in Uttar Pradesh, Punjab, Bihar, Jharkhand, Gujarat, Rajasthan, Haryana, Karnataka and Delhi. Sponge gourds are popularly cultivated for harvesting both of mature-green fruit & dry fruit because of its high nutrient value (Bor, 2006; Partap, 2012) and tough fibrous vascular system (Klemm, 2001; Mazali and Alves, 2005; Hassan, 2006).In the past, most of the research relating to commercial luffa production has been conducted in the tropical & subtropical climates of India. Sponge gourd can be grown from tropical to subtropical climatic conditions and they grow best in warm and humid conditions. According to FAO (Food & Agriculture Organization) estimate, cucurbits are cultivated in an area of about 5.46

lakh hectare having annual production of 5.40 lakh tonnes. The productivity of this crop is 10.52 tonnes per hectare (Anon., 2016). Sponge gourd is a versatile vegetable that can be used in curries, chutneys, & stir-fries as well as eaten as a delicious deep-fried snack known as bhajiya. They're used in a variety of dishes as well as traditional medicine.Sponge gourd is a highly nutritive vegetable and contains moisture of 93.2 g, protein 1.2 g , carbohydrate 2.9 g, fat 0.20 g ,vitamins (thiamin 0.02 mg, riboflavin 0.06 mg, niacin 0.4 mg and carotene 120 mg), minerals (calcium 36 mg, phosphorus 19 mg and ferrous 1.1 mg) and fibers 0.20 g per 100 g of edible portion (Gopalan et al., 1999).Sponge gourd is a enormously, fast growing annual vine that produces a widely eaten vegetable. The inner fleshy part of the vegetable is used as a scrubber as it turns sponge-like when fully mature. Sponge gourd is an annual climber and monoecious vegetable having different sex form like hermaphrodite, staminate, pistillate, etc. are commonly found in nature (Takahashi, 1980). There is wide variability in its fruitsize ; ranging from a few centimeters to one meter, fruit shape and colour as traits are complex and controlled by several genes (Beyer et al., 2002; Zalapa et al., 2006).A good number of landraces of sponge gourd are present in Bangladesh. But no recommended or released varieties are availabletill now. Systematic research was not made in the past to evaluate the potentialities of the available hybrids considering the above facts, the present study was initiated with the objectives to evaluate performance of different hybrids in terms of growth, yield and quality of sponge gourd and to estimate the economics of various hybrids specifically suited for the agro-climatic conditions in Prayagraj.

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 experiment was laid out in randomized block design (RBD) with three replications having 8 hybrids . 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 seven hybrid seeds were collected from IIVR, Varanasi research station and one hybrid was 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 for parameters like vine length, days to flower emergence, fruit length, fruit weight and yield/ha and quality parameters like TSS and vit-c content. The data were statistically analysed by the method suggested by Fisher and yates.[1].

3. RESULTS AND DISCUSSION

3.1 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 was 9.13observed in H8(GENNEXT

Ayushi**)** and H3(AVT-II 2020/ SPGHYB -3) both and the maximum no. of days to germination was 12.20 observed in H2(AVT-II 2020 /SPGHYB-2.) Among the different hybrids maximum vine length 574 cm was observed with H8 (GENNEXT Ayushi) followed H6 (AVT-II 2020/ SPGHYB-6) with 457cm. Minimum vine length 349.67 cm was observed in H3 (AVT-II 2020/SPGHYB-3). 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., [2]; Pongen et al., [3]; in sponge gourd; Quamruzzaman et al., [4] in bottle gourd; Ara et al., [5] in pointed gourd; Ramya et al., [6] in Bitter gourd.

Table 1. Performance of different hybrids of Sponge gourd in terms of Growth parameters (Days taken for germination, Vine length at last harvest and No. of nodes at last harvest)

Hybrids	Day to germination	Vine length at lastharvest (cm)	No. of Nodes at last harvest
2020/SPGHYB-1	9.87	370.00	32.60
2020/SPGHYB-2	12.20	378.33	35.20
2020/SPGHYB-3	9.13	349.67	32.27
2020/SPGHYB-4	9.47	413.33	34.27
2020/SPGHYB-5	9.47	453.67	39.80
2020/SPGHYB-6	10.07	457.33	39.33
2020/SPGHYB-7	10.73	399.67	35.73
GENNEXT Ayushi	9.13	574.00	44.80
F test	**S**	**S**	**S**
S.E (d) (±)	**0.60**	**16.09**	**2.03**
C.V.	**7.33**	**4.64**	**6.75**
CD (5%)	**1.28**	**34.51**	**4.35**

Among the different hybrids maximum number of nodes (44.80 nodes) were observed with H8 (GENNEXT Ayushi) followed H6 (2020/SPGHYB-6) & H4 (2020/SPGHYB-4) with (39.33 & 34.27nodes). Minimum number of nodes (32.27 nodes) were observed in H3 (2020/SPGHYB-3). 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., [7] in snake gourd; Sangma et al., [8] in sponge gourd;

3.2 Flowering Parameters (Days to 1st male and female flower, total no. of male & female flower, sex ratio)

Among the different hybrids the minimum no. of days (30.45) taken to emergence of first male flower was observed in H6 (2020/SPGHYB-6) and the maximum no. of days 34.68 days was observed in H7 (2020/SPGHYB-7). The minimum no. of 39.53days taken to emergence of first female flower was observed in H6 (2020/SPGHYB-6) followed H7 (GENNEXT Ayushi) & H3 (2020/SPGHYB-3) with 41.27 days and the maximum no. of 46.52 days was observed in H7 (2020/SPGHYB-7) Followed H2(2020/ SPGHYB-2) With 45.40 days. The maximum no. of male flower (153.27) was observed in H6 (2020/SPGHYB-6) and the minimum no. of male flower (135.20) was observed in H2 (2020/SPGHYB-2).. Maximum no. of female flower (33.13) was observed in H8(GENNEXT Ayushi) & H6 (2020/SPGHYB-6). Minimum no. of female flower (28.53) observed in H7(2020/SPGHYB-7).

Table2. 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
2020/SPGHYB-1	33.78	42.53	139.47	31.73	5:1
2020/SPGHYB-2	34.21	45.40	135.20	28.60	5:1
2020/SPGHYB-3	32.28	41.27	140.87	31.07	5:1
2020/SPGHYB-4	31.77	43.73	137.73	30.40	5:1
2020/SPGHYB-5	31.40	42.13	148.07	32.27	5:1
2020/SPGHYB-6	30.45	39.53	153.27	33.13	5:1
2020/SPGHYB-7	34.68	46.53	142.27	28.53	5:1
GENNEXT Ayushi	30.87	41.27	151.73	33.13	5:1
F test	**S**	**S**	**NS**	**S**	**NS**
S.E(d) (±)	**0.61**	**0.97**	**5.71**	**0.27**	**0.19**
C.V	**2.31**	**2.79**	**4.87**	**1.06**	**4.93**
CD (5%)	**1.31**	**2.09**	**12.25**	**0.58**	**0.40**

The better performance of one hybrid over another in terms of earliness in flowering and maturing can be attributed to genetic factors and environmental conditions. Hybrids with genetic traits that promote early flowering, such as early maturation genes or shorter vegetative growth phases, can exhibit faster initiation of flowering and so maturing. 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., [4] in bottle gourd and Phan et al., [9]; Reddy et al., [10] in sponge gourd; Ramya et al., [6] in Bitter gourd. In all hybrids sex ratio (ratio of male to female flower) were same

i:e (5:1).. Sex expression in cucurbits is easily manipulated by controlling the environmental conditions as well as genetic factors, hence these two factors are major effect on sex manipulation. The non-genetic factors like environmental effect, cultural practices, plant growth regulators, and genetic factors like breeding behaviour and genetic constitution plays a significant role in altering the sex expression of cucurbits with the aid of conventional breeding methods .

3.3 Fruit Yield and Quality Parameters

Among the different hybrids minimum days to first fruit picking (45.40 days) was observed in H6 (2020/SPGHYB-6) followed H1 (2020/SPGHYB-1) with 47.07 days. Maximum days to first fruit picking (52.73 days) was observed in H7 (2020/SPGHYB-7) followed H2 (2020/SPGHYB-2) with 51.20 days. Among the different hybrids maximum number of fruits per plant (30.33 fruits) were observed in H6(2020/SPGHYB-6) followed H8 (GENNEXT Ayushi) with 30.00 fruits. Minimum number of fruits per plant (24.73) were observed in H7 (2020/SPGHYB-7).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 [11-15]. Among the different hybrids maximum fruit length (24.09cm) was observed with H8 (GENNEXT Ayushi) followed H4 (2020/SPGHYB-4) with 21.39 cm. Minimum fruit length (18.81 cm) was observed in hybrid H1 (2020/SPGHYB-1). Among the different hybrids maximum fruit diameter (32.92mm) was observed in H7 (2020/SPGHYB-7) followed H8 (GENNEXT Ayushi) with (30.30mm). Minimum fruit diameter (25.46 mm) was observed in H4 (2020/SPGHYB-4).Among the different hybrids maximum average fruit weight (76.58g) was observed with H8 (GENNEXT Ayushi) followed H4 (2020/SPGHYB-4) with (75.57 g). Minimum average fruit weight (67.47 g) was observed in H5 (2020/SPGHYB-5).The better performance of one hybrid over another in terms of enhanced fruit length, diameter and weight can be attributed to genetic factors and environmental conditions [16-20]. Hybrids 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. Among the different hybrids maximum Total Soluble Solid (2.08°Brix) was observed H8(GENNEXT Ayushi) followed H1 (2020/SPGHYB-1) with (2.07°Brix). Minimum Total Soluble Solid (1.91°Brix) was observed in H5 .Among the different hybrids maximum ascorbic acid content (4.88 mg/100g) was observed with H8 (GENNEXT Ayushi) followed H6 (2020/SPGHYB-6) with (4.11 mg/100g). Minimum Ascorbic acid content (2.73 mg/100g) was observed in H1 (2020/SPGHYB-1).H8 (GENNEXT Ayushi) obtained dark green colour& H6 (2020/SPGHYB-6) 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.,[3] in sponge gourd; Ramya et al.,[6] in Bitter gourd.

Table 3. Performance of different hybrids of Sponge gourd in terms of yield and qualitative (TSS & Vit-C content) parameters

Hybrids	Days to 1st fruit Picking	Total no. of fruit/ plant	Avg.fruit length (cm)	Avg.fruitDiameter (mm)	Avg. fruit weight (g)	TSS [°Brix]	Vit-C (mg/ 100g)	Color of fruit
2020/SPGHYB-1	47.07	29.07	18.81	26.19	70.19	2.07	2.73	Green
2020/SPGHYB-2	51.20	25.53	20.12	25.59	70.33	2.03	3.39	Green
2020/SPGHYB-3	47.27	27.93	20.99	26.17	71.40	1.92	3.67	Green
2020/SPGHYB-4	50.07	27.93	21.39	25.46	75.57	2.04	3.96	Green
2020/SPGHYB-5	47.87	30.13	19.85	26.81	67.47	1.91	3.91	Green
2020/SPGHYB-6	45.40	30.33	19.58	27.15	72.17	2.06	4.11	Light green
2020/SPGHYB-7	52.73	24.73	20.88	32.92	75.17	2.02	3.35	Green with stripes
GENNEXTAyushi	48.40	30.00	24.09	30.30	76.58	2.08	4.88	Dark green
F- test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	
S.E (d) (±)	**0.88**	**0.71**	**0.49**	**0.48**	**0.80**	**0.04**	**0.07**	
C.V	**2.20**	**3.06**	**2.90**	**2.12**	**1.36**	**2.57**	**2.28**	
CD (5%)	**1.88**	**1.51**	**1.05**	**1.02**	**1.72**	**0.09**	**0.15**	

3.4 Fruit yield and Economics

Among the different hybrids maximum average fruit yield per hectare (18.17 t/ha) was obtained with H8 (GENNEXT Ayushi) followed H6 (2020/SPGHYB-6) with (17.61 t/ha). Minimum average fruit yield per hectare (14.38 t/ha) was obtained with H2 (2020/SPGHYB-2).The better performance of one hybrid over another in terms of enhanced fruit yield can be attributed to genetic factors and environmental conditions. Hybrids 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. Hybrids 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 Sangma et al., [8]; Pongen et al., [3] in sponge gourd; Ara et al., [5] in pointed gourd.

Table 4. Total yield and Marketable yield

Hybrids	Fruit yield (q/ha)	Yield (t/ha)	Marketable Yield (t/ha)
2020/SPGHYB-1	163.15	16.32	14.33
2020/SPGHYB-2	143.84	14.38	12.51
2020/SPGHYB-3	160.12	16.01	14.00
2020/SPGHYB-4	168.68	16.87	14.10
2020/SPGHYB-5	163.09	16.31	14.55
2020/SPGHYB-6	176.07	17.61	15.70
2020/SPGHYB-7	148.08	14.81	13.00
GENNEXT Ayushi	181.72	18.17	16.80
F test	**S**		
S.E (d) (±)	**4.36**		
C.V	**3.27**		
CD (5%)	**9.35**		

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 (16.80 t/ha) was obtained in H8 (GENNEXT Ayushi) followed H6 (2020/SPGHYB-6) with (15.70t/ha) and the minimum marketable yield (12.51) was obtained with H2 (2020/SPGHYB-2).

Table 5. Economics of Sponge gourd

Hybrids	Marketable Yield (t/ha)	Cultivation cost (Rs./ha)	Gross return(Rs./ ha)	Net return (Rs./ha)	B:C ratio
2020/SPGHYB-1	14.33	1,29,500	358250	228750	1.8
2020/SPGHYB-2	12.51	1,29,500	312750	183408	1.4
2020/SPGHYB-3	14.00	1,29,500	350000	220658	1.7
2020/SPGHYB-4	14.10	1,29,500	352500	223158	1.7
2020/SPGHYB-5	14.55	1,29,500	363750	234408	1.8
2020/SPGHYB-6	15.70	1,29,500	392500	263158	2.0
2020/SPGHYB-7	13.00	1,29,500	325000	195658	1.5
GENNEXT Ayushi	16.80	1,29,500	420000	290658	2.2

4. CONCLUSION

From the above experimental finding it is concluded that the hybrid GENNEXT Ayushi performed best in terms of growth parameters like early germination, maximum vine length(574 cm), earliness in flowering and maturity and yield parameters like fruit length(24.09 cm), maximum fruit yield/ha (18.17 t/ha) and quality parameters like TSS (2.08)& Vitamin C content(4.88). The maximum BC ratio 2.2 was also obtained in the samehybrid.

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