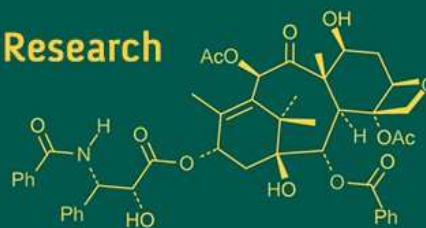
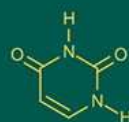
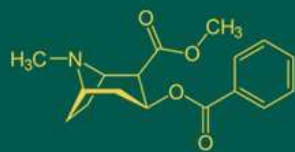


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Rabi and kharif season evaluation of sponge gourd [*Luffa cylindrica* (L.) Roem.] for yield and quality traits

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Abstract

Sponge gourd (*Luffa cylindrica* L. Roem.) is a short-day crop that thrives under cool temperatures and short photoperiods, with kharif season providing favorable conditions. Evaluation of genotypes is crucial to assess variability in growth, earliness, yield, and quality-related traits. The present study was conducted at the Department of Vegetable Science, College of Horticulture, Bagalkot, Karnataka during rabi 2023 and kharif 2024 seasons. Twenty inbred lines of sponge gourd were evaluated in a Randomized Block Design (RBD) with two replications, using the variety Pusa Chikni as a check. Observations were recorded on growth, earliness, flowering, and yield parameters. The results revealed significant seasonal influence on genotype performance. The longest vine length was recorded in G4 (8.18 m) during rabi and G6 (7.49 m) in kharif. Branching was highest in G6 (6.22) and G12 (5.25) in rabi and kharif, respectively. Earliness for female flowering was observed in G5, while the earliest male flowering was noted in G20 across both seasons. The earliest harvest was obtained in G17 (51.70 days) during rabi and G2 (52.20 days) in kharif, while extended harvest duration was shown by G15 and G4. Female flower production was highest in G11 (15.75) in rabi and G9 (18.39) in kharif, whereas G14 and G5 recorded maximum male flowers in respective seasons. Yield parameters also varied with seasons and genotypes. G6 exhibited the highest fruit number (34.40), fruit yield per vine (4.59 kg), and yield per hectare (32.49 t) during rabi. In kharif, maximum yield was recorded in G3 (2.17 kg vine⁻¹, 20.47 t ha⁻¹). Enhanced performance under kharif conditions could be attributed to moderate temperatures, high humidity, and soil moisture supporting vigorous vegetative growth and reproductive efficiency. The identified stable and high-yielding genotypes can be exploited in breeding programs and commercial cultivation.

Keywords: Sponge gourd, genotypes, growth, flowering, yield, variability

Introduction

Sponge gourd (*Luffa cylindrica* M. Roem.) is an important cucurbitaceous vegetable crop with chromosome number 2n=26. It is an annual climbing and naturally cross-pollinated plant. Major commercial producers include China, Korea, India, Japan and Central America. In India, it is extensively cultivated in states such as Uttar Pradesh, Bihar, West Bengal, Odisha, Assam, Andhra Pradesh and Kerala (Mohiddin *et al.*, 2022) ^[12]. The crop is grown both for its immature fruits, consumed as a nutritious vegetable (Hai and Thao, 2019) ^[3] and for its mature fruits, which develop a strong fibrous vascular system used in making cleansing sponges, mats and shoe soles (Verma *et al.*, 2024) ^[18].

Recent research has highlighted sponge gourd as a rich source of carbohydrates, vitamin C and essential minerals including magnesium, calcium, sodium, potassium, iron, copper, zinc and manganese. It also contains tannins, oxalates, phytin, phosphorus and phytic acid, underscoring its nutritional importance in the human diet. Furthermore, extracts and bioactive compounds derived from the fruit exhibit notable pharmaceutical properties such as immunomodulatory, antioxidant, anticancer and anti-inflammatory activities, making it highly beneficial for human health (Tyagi *et al.*, 2023) ^[16]. The dried fruits of sponge gourd are commonly used as natural bath sponges, which are believed to stimulate blood circulation and provide relief to individuals suffering from rheumatism and arthritis. Additionally, sponge gourd fruits are nutritionally superior to ridge gourd, as they contain higher amounts

of protein and carotene (More and Shinde, 2001) ^[13]. Sponge gourd is a short-day plant, it performs better under short days and cool temperature. This crop also comes up well in *kharif* season. Evaluating genotypes in sponge gourd is crucial for identifying variability in growth, yield and quality-related traits (Islam *et al.*, 2009) ^[5]. Since the crop is highly cross-pollinated and influenced by environmental conditions, wide genetic diversity exists among available lines. Assessing this diversity helps in recognizing superior genotypes that are adaptable to specific agro-climatic conditions (Kumar *et al.*, 2019) ^[7]. Through systematic evaluation, promising lines with desirable attributes like earliness, higher female flower production, fruit quality and resistance to biotic and abiotic stresses can be identified. Such genotypes can be directly recommended for cultivation to improve productivity and profitability. Moreover, they serve as valuable parental material in breeding programs aimed at developing high-yielding, stress-tolerant, and nutritionally rich varieties (Mashilo *et al.*, 2025) ^[11].

Material and Methods

The experiment was conducted during the *rabi* season of 2023 and *kharif* season of 2024 at the research field of the department of vegetable science, College of Horticulture, Bagalkot, Karnataka. The trial was laid out in a Randomized Block Design (RBD) with two replications. The twenty sponge gourd inbred lines were selected for the evaluation and the observations for various growth and yield parameters were recorded at different stage of the plant growth and the Pusa Chikni variety released from IARI,

New Delhi for throughout the year cultivation was used as check for the evaluation.

Results and Discussion

In *rabi* and *kharif* season, the longest vine length was observed in the genotype G4 (8.18 m) and G6 (7.49 m) respectively, whereas number of branches during *rabi* was found highest in the genotype G6 (6.22) and the other side the maximum number of branches were found in G12 (5.25). The enhanced vegetative growth was due to adequate soil moisture, moderate temperatures and high relative humidity, resulting in longer vine length (Veena *et al.*, 2012) ^[17]. The internodal length in both *rabi* and *kharif* season were found maximum in the genotype G13, 7.67 cm and 9.97 cm respectively.

Considering the earliness parameters the node at which first female flower appears was found lowest in the genotype G5, 7.80 in *rabi* and 6.90 in *kharif* season evaluation. The days to first male flower appearance in *rabi* and *kharif* was found lowest in G20 genotype *i.e.*, 45.80 days and 42.30 days respectively. The sex expression in cucurbits is a highly plastic and environmentally responsive trait, cooler temperatures, shorter days and higher humidity conditions more common in *kharif* (monsoon) and *rabi* (post-rainy) seasons, tend to enhance the production of female flowers, possibly due to the elevated ethylene levels, which are known to promote femaleness in cucurbits (Hume and Lovell, 1983; Yongan *et al.*, 2002; Nwofia *et al.*, 2015; Manjunathagowda and Bommesh, 2017; Martínez and Jamilena, 2021) ^[4, 19, 15, 9, 10].

Table 1a: *Per se* performance of sponge gourd genotypes for growth and earliness parameters during *rabi* and *kharif* months

Sl. No.	Code	Genotype	VL @ 90 DAS		NPB @ 90 DAS		IL (cm)		NFF	
			<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>
1	G1	SG-1	7.40	6.69	4.35	3.50	13.92	15.82	11.10	11.40
2	G2	SG-3	7.82	7.13	6.15	4.95	11.22	12.39	14.10	13.75
3	G3	SG-4	6.30	6.04	5.22	4.05	12.73	14.89	9.90	11.35
4	G4	SG-6	8.18	7.24	5.15	4.15	12.58	14.09	11.60	9.20
5	G5	KSG-2	7.32	6.31	5.98	4.00	11.53	14.11	7.80	6.90
6	G6	KSG-12	8.16	7.49	6.22	5.00	12.90	15.20	13.40	10.80
7	G7	KSG-14	7.47	6.30	3.83	3.95	12.12	14.28	13.70	12.00
8	G8	KSG-32	5.42	4.47	3.88	2.70	10.33	12.11	12.90	11.50
9	G9	KSG-36	7.53	6.84	5.73	5.30	10.72	13.76	12.10	15.05
10	G10	KSG-44	6.67	6.59	5.32	4.55	13.25	15.61	10.90	8.25
11	G11	KSG-63	7.34	6.71	5.70	5.00	11.62	14.08	12.70	15.35
12	G12	HUB-3	7.60	6.65	6.18	5.25	9.68	11.89	11.30	9.50
13	G13	Bagalkot Local-2	6.82	6.18	5.63	4.60	7.67	9.97	12.30	14.95
14	G14	COH Mandsaur-2	6.48	6.13	4.04	3.50	9.58	11.96	12.50	12.00
15	G15	Bagalkot local-3	6.40	5.24	4.12	4.66	8.67	11.48	11.10	13.35
16	G16	Pusa Chikni (check)	6.09	5.98	5.91	5.10	10.90	13.39	10.00	9.00
17	G17	Kashi Divya	7.44	7.39	4.82	3.95	10.15	11.51	9.30	9.30
18	G18	Kashi Shreya	6.38	6.22	4.64	3.65	9.42	12.17	12.30	14.05
19	G19	Konkan Ghoshali	6.22	7.07	4.33	3.60	12.00	14.18	11.60	17.00
20	G20	Pusa Sneha	6.10	5.84	3.46	2.95	11.83	13.67	11.00	12.25
		SEm±	0.12	0.20	0.05	0.30	1.13	1.14	0.59	0.84
		CD at 5%	0.36	0.60	0.14	0.88	3.35	3.39	1.74	2.48

VL @ 90 DAS-Vine length at 90 days after sowing

NPB @ 90 DAS-No. of primary branches at 90 days after sowing

IL-Internodal length (cm)

NFF-Node at first female flower appearance

Table 1b: *Per se* performance of sponge gourd genotypes for growth and earliness parameters during *rabi* and *kharif* months

Sl. No.	Code	Genotype	DFF		DFM		DFH		DLH	
			<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>
1	G1	SG-1	47.90	45.83	47.80	45.20	55.95	54.40	112.40	112.90
2	G2	SG-3	46.80	46.20	54.40	51.00	53.35	52.20	107.95	107.60
3	G3	SG-4	48.60	48.85	50.10	46.85	57.90	56.10	122.50	119.85
4	G4	SG-6	49.90	45.50	49.50	45.25	60.00	66.45	126.95	124.00
5	G5	KSG-2	54.70	53.70	51.20	46.70	65.30	60.55	115.45	102.55
6	G6	KSG-12	54.90	53.90	51.50	48.80	62.95	60.95	117.05	102.05
7	G7	KSG-14	58.10	59.40	48.80	45.50	67.80	67.10	127.70	109.50
8	G8	KSG-32	52.80	50.80	50.40	45.90	62.60	58.90	120.15	101.65
9	G9	KSG-36	49.20	46.90	49.30	45.75	57.40	58.50	116.90	104.80
10	G10	KSG-44	50.30	54.90	49.40	45.40	59.20	61.95	105.80	111.80
11	G11	KSG-63	49.00	52.30	48.70	44.25	59.20	63.95	115.50	119.85
12	G12	HUB-3	47.50	53.70	52.20	47.65	57.50	60.90	117.55	108.35
13	G13	Bagalkot Local-2	54.10	50.40	52.90	48.05	63.60	63.95	122.55	111.95
14	G14	COH Mandsaur-2	48.90	49.45	46.80	42.65	56.70	57.40	119.50	109.40
15	G15	Bagalkot local-3	52.00	52.00	52.20	47.90	61.80	63.10	128.60	106.85
16	G16	Pusa Chikni (check)	49.90	52.10	48.50	45.60	57.10	62.60	118.10	108.95
17	G17	Kashi Divya	42.50	48.30	51.20	46.70	51.70	54.50	119.40	111.90
18	G18	Kashi Shreya	50.30	52.90	49.80	45.55	59.00	61.05	121.05	96.00
19	G19	Konkan Ghoshali	48.00	51.50	48.00	45.20	57.30	56.20	110.80	102.05
20	G20	Pusa Sneha	49.70	48.15	45.80	42.30	55.30	54.10	111.10	97.85
		SEm \pm	2.25	1.22	1.06	0.86	1.44	1.23	3.60	2.85
		CD at 5%	6.65	3.62	3.13	2.54	4.26	3.64	10.66	8.44

DFF-Days to first female flower appearance

DFM-Days to first male flower appearance

DFH-Days to first harvest

DLH-Days to last harvest

Table 2a: *Per se* performance of sponge gourd genotypes for yield parameters during *rabi* and *kharif* months

Sl. No.	Code	Genotype	NoFF		NoMF		FL		FD	
			<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>
1	G1	SG-1	11.95	10.88	140.98	172.70	23.27	19.30	32.62	31.99
2	G2	SG-3	13.75	9.05	198.28	154.80	21.19	20.29	42.06	36.12
3	G3	SG-4	13.90	9.39	182.14	150.70	25.63	24.79	32.23	33.67
4	G4	SG-6	14.00	9.39	177.22	151.70	23.55	18.79	30.03	28.31
5	G5	KSG-2	9.90	4.87	141.85	111.18	18.09	32.03	29.29	34.89
6	G6	KSG-12	15.25	7.91	168.70	130.53	29.18	23.12	32.48	26.25
7	G7	KSG-14	11.45	6.24	161.34	123.69	16.07	24.38	34.82	39.23
8	G8	KSG-32	13.75	12.23	186.60	180.25	18.84	13.80	37.10	29.31
9	G9	KSG-36	9.40	18.39	140.96	255.40	20.06	14.93	49.60	32.79
10	G10	KSG-44	13.85	10.29	187.38	162.10	22.62	20.93	38.33	28.54
11	G11	KSG-63	15.75	9.92	203.76	148.00	19.67	21.38	37.80	32.87
12	G12	HUB-3	12.80	12.30	171.18	191.25	21.29	21.18	32.15	28.40
13	G13	Bagalkot Local-2	14.05	9.89	187.78	171.88	19.20	17.11	38.72	30.46
14	G14	COH Mandsaur-2	6.43	13.23	116.88	191.25	22.89	18.71	40.60	25.77
15	G15	Bagalkot local-3	11.75	11.29	172.32	173.25	17.97	16.57	27.41	28.88
16	G16	Pusa Chikni (check)	13.90	9.04	187.43	131.24	20.50	19.42	29.74	30.70
17	G17	Kashi Divya	7.60	8.87	132.36	137.25	27.13	24.38	32.85	31.93
18	G18	Kashi Shreya	9.95	8.24	156.40	138.72	24.05	20.79	32.82	30.78
19	G19	Konkan Ghoshali	6.40	7.25	116.90	123.90	22.08	21.57	31.27	31.25
20	G20	Pusa Sneha	7.90	12.00	138.75	176.38	22.42	17.77	29.35	26.14
		SEm \pm	1.24	1.09	3.76	3.70	0.69	1.67	1.03	2.45
		CD at 5%	3.66	3.21	11.12	10.94	2.06	4.94	3.05	7.25

#-Observations were recorded during peak flowering stage for 15 days

NoFF-No. of female flowers per vine

NoMF-No. of male flowers per vine

FL-Fruit length (cm)

FD-Fruit diameter (mm)

Table 2b: *Per se* performance of sponge gourd genotypes for yield parameters during *rabi* and *kharif* months

Sl. No.	Code	Genotype	NFV		AFW		FYP		FYHa	
			<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>
1	G1	SG-1	21.95	17.35	138.27	101.00	2.34	1.63	18.60	17.23
2	G2	SG-3	26.20	13.95	174.81	102.13	4.23	1.65	30.91	15.65
3	G3	SG-4	25.00	17.20	123.55	134.83	3.42	2.17	29.50	20.47
4	G4	SG-6	23.85	15.30	110.51	84.54	2.46	1.28	24.17	10.46
5	G5	KSG-2	18.55	7.85	74.90	194.25	1.55	1.57	11.78	16.84
6	G6	KSG-12	34.40	11.60	151.28	153.03	4.59	1.84	32.49	15.92
7	G7	KSG-14	15.30	11.30	168.30	174.88	2.12	1.66	18.44	13.42
8	G8	KSG-32	20.45	18.50	118.43	71.49	2.03	1.29	16.54	12.90
9	G9	KSG-36	14.30	27.35	166.38	75.92	2.28	2.08	23.96	16.94
10	G10	KSG-44	18.85	17.35	136.13	79.21	2.70	1.35	22.19	13.76
11	G11	KSG-63	22.00	16.40	125.46	112.13	2.89	1.32	23.19	13.04
12	G12	HUB-3	12.85	21.00	91.71	82.67	1.20	1.79	10.92	16.42
13	G13	Bagalkot Local-2	21.85	15.90	114.89	77.00	2.40	1.30	18.14	13.03
14	G14	COH Mandsaur-2	9.40	23.20	153.14	77.38	0.98	1.68	9.79	15.76
15	G15	Bagalkot local-3	17.85	16.35	76.20	84.51	1.44	1.32	12.76	12.98
16	G16	Pusa Chikni (check)	23.35	13.10	97.19	98.67	2.20	1.21	17.51	12.14
17	G17	Kashi Divya	12.40	13.40	157.62	100.83	1.61	1.30	14.38	11.00
18	G18	Kashi Shreya	15.35	14.00	121.50	98.17	2.27	1.33	17.63	12.59
19	G19	Konkan Ghoshali	11.35	11.20	107.66	103.21	1.21	1.16	12.76	11.19
20	G20	Pusa Sneha	13.50	20.50	100.23	57.67	1.38	1.50	13.36	15.53
		SEm±	1.27	2.03	3.88	21.83	0.20	0.19	0.46	1.04
		CD at 5%	3.76	6.00	11.49	64.63	0.58	0.57	1.35	3.07

NFV-No. of fruits per vine

AFW-Average fruit weight (g)

FYP-Fruit yield per vine (kg)

FYHa-Fruit yield per hectare

The earliest harvest during *rabi* was recorded in G17 (51.70 days) and in *kharif*, it was found in G2 (52.20 days). The extended harvest was noted by days to last harvest during *rabi* was noted in the genotype G15 (128.60 days) and in *kharif* in the genotype G4 (124 days), which reflect the earliness or precocity of the genotype and also may be due to the inherent earliness. The female and male flower production was influenced by the cropping season where in the *rabi* season crop G11 produced 15.75 female flowers and in *kharif* season the highest number of female flowers were produced by G9 (18.39). The male flower count at peak flowering stage where G14 during *rabi* recorded maximum male flowers 116.88 and in *kharif* G5 recorded highest male flowers (111.15). In *rabi* and *kharif* season, the moderate temperatures, higher humidity and ample soil moisture prolong the vine vigour and flowering, leading to extended harvesting periods, these findings were also reported in the studies conducted by Mostafa *et al.* (2021) [14] in cucumber and Jalindar (2023) [6] in ridge gourd.

Moving on the yield parameters, fruit length during *rabi* was found highest in the genotype G6 (29.18 cm) and in *kharif* in the genotype G5 (32.03 cm), which is due to the moderate temperatures and adequate moisture, commonly observed during the *kharif* (monsoon) and *rabi* (winter) seasons are favorable for optimal cell division and elongation, resulting in longer fruits (Behera *et al.*, 2012; Lv *et al.*, 2012) [1, 8]. The fruit diameter during both the season of evaluation was observed highest in the genotypes G15 (27.41mm) and G14 (25.77 mm). The number of fruits per vine during *rabi* was recorded maximum in the genotype G6 (34.40) whereas in *kharif* it was found highest in the genotype G9 (27.35). Estimating the average fruit weight of both the seasons of evaluation it was recorded maximum in the genotype G2 (174.81 g) and G5 (194.25 g) in *rabi* and *kharif* seasons

respectively. The fruit yield per vine and hectare during *rabi* was found highest in the genotype G6 (4.59 kg & 32.49 t) and in *kharif* it was found maximum in the genotype G3 (2.17 kg & 20.47 t). The seasons significantly affect the flowering, pollination, fruit set and fruit retention thereby influencing the final fruit count (Celine *et al.*, 2010) [2]. In general cucurbits grown during *rabi* and *kharif* seasons produce more fruits, due to favorable vegetative growth and better pistillate flower development.

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