

Original Research Article

Evaluation of Sponge Gourd Genotypes and Hybrids for Yield and Related Traits

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ABSTRACT

Thirty-six F₁ hybrids of sponge gourd developed through diallel fashion (excluding reciprocals) method from nine parental genotypes, were evaluated for yield and related traits. Significant variation in mean performance was noticed for all the characters studied. Different parents and hybrids were found best for different traits. The best performing parents and hybrids for different characters viz., SwarnaPrabha (13.04 m) and SG-5 × SG-3(13.40 m) was observed for vine length, SG-3 (135.78) and SG-6 × Pusa Chikni (132.28) for number of leaves per plant, SG-3 (14.57 cm) and SG-5 × KRCCH-2 (11.74 cm) for internodal length, SG-3 (13.82) and Kulgod local × Pusa Chikni (14.88) for number of branches per plant, SG-3 (140.11 cm²) and Kulgod local × Pusa Chikni (155.67 cm²) for leaf area, KRCCH-2 (14.49) and SG-5 × SwarnaPrabha (17.95) for sex ratio, SG-3 (87.47 %) and SG-5 × KRCCH-1 (89.17 %) for fruit set, SG-3 (28.33 cm) and SwarnaPrabha × KRCCH-1 (30.17 cm) for fruit length, SG-3 (3.95 cm) and SG-6 × SG-5 (4.03 cm) for fruit diameter, SG-3 (206.27 g) and SG-5 × KRCCH-1 (213.82 g) for average fruit weight, SG-3 (24.33) and Kulgod local × Pusa Chikni (22.91) for number of fruits per plant, SG-3 (2.67 kg) and Kulgod local × Pusa Chikni (2.99 kg) for fruit yield per plant.

Keywords

Sponge gourd,
Performance of
parents and
hybrids, Number
of fruits per plant,
Fruit yield per
plant and
genotypes
variability

Introduction

Sponge gourd [*Luffa cylindrica* (L.) Roem.] is a very popular vegetable in the tropical and subtropical regions. It is commonly called as smooth luffa, climbing okra, dishcloth gourd and Chinese okra. It is an important component of crop rotation during spring-summer and rainy season in North Indian condition and is cultivated both on commercial scale and in kitchen gardens (Choudhury, 1996). This crop has a long history of cultivation in the tropical countries of Asia and Africa (Oboh and Aluyor, 2009). *Luffa* is a diploid species with 26 chromosomes (2n = 26). *Luffa* belongs to cucurbitaceous family and it is a cross-

pollinated crop (Bal *et al.*, 2004) 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 (Anon., 2016). 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 cross pollinated 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.

Materials and Methods

The present investigation was conducted during *Kharif* season of year 2017, at the Horticulture farm of Main Agricultural Research Station (MARS), University of Agricultural Sciences, Raichur, Karnataka, India-584104. Nine diverse parents (Kulgod local, SG-4, SG-6, SG-5, SG-3, Pusa Chikni, KRCCH-2, Swarna Prabha, KRCCH-1 and KRCCH-1) were crossed in a half diallel fashion (excluding reciprocals) for generating the 36 F₁ hybrids. All the nine parents, 36 hybrids and one standard check were grown in a randomized block design with three replications. Plant to plant distance was maintained 1 m and rows were made at 1.5 m apart. Data were recorded on ten randomly selected plants in each treatment (hybrids and parents) for 12 characters *viz.*, vine length, number of leaves per plant, internodal length, number of branches per plant, leaf area, sex ratio, fruit set, fruit length, fruit diameter, average fruit weight, number of fruits per plant, fruit yield per plant in sponge gourd.

Results and Discussion

The mean performances of parents (inbreeds) and hybrids for various traits have been presented in Table 1. The analysis of variance was carried out to test the significance of differences among parents and their hybrids.

This result clearly indicated that there were significant variations in mean performance among parents and their hybrids for all the characters studied. A perusal on average performance of parents and hybrids (Table 1) revealed that the mean values of parents for vine length ranged from 8.28 (Kulgod local) to 13.04 m (SwarnaPrabha) with a grand mean of 11.17 m whereas cross combinations SG-5 × SG-3 recorded the maximum vine length with the mean value of 13.40 m, followed by the crosses Kulgod local × Pusa Chikni (13.37 m) and SG-5 × KRCCH-1 (12.90 m) with a grand mean of 11.40 m. The lowest number of leaves per plant observed in the Pusa Chikni (82.11) and highest number of leaves observed in the SG-3 (135.78) with mean value of 104.31. Among the crosses, SG-6 × Pusa Chikni (132.28) exhibited highest number of leaves per plant followed by Kulgod local × KRCCH-1 (125.20) and SG-4 × KRCCH-1 (124.69). lowest intermodal length was recorded from the parent SG-3 (14.57) significantly followed by parents SG-4 (14.62) and KRCCH-2 (14.76). The cross combinations SG-5 × KRCCH-2 (11.74) recorded the lowest intermodal length with the mean value of 16.39 followed by the crosses Kulgod local × SG-4 (13.23) and SG-3 × Pusa Chikni (13.88). The parent SG-3 recorded significantly more number of primary branches per plant *i.e.* 13.82 followed by the parents, SwarnaPrabha (13.14) and KRCCH-2 (9.22). Among the different cross combinations, the cross Kulgod local × Pusa Chikni recorded highest number of primary branches per vine (14.88) followed by Kulgod local × KRCCH-1 (14.06) and SG-4 × KRCCH-1 (13.25).

Leaf area per plant varied significantly in different genotypes of sponge gourd. Among different parents, SG-3 (140.11 cm²) recorded significantly maximum leaf area followed by SG-4 (128.92 cm²) and Swarnaprabha (128.86 cm²). Whereas, minimum leaf area

was noticed in KRCCH-1 (99.98 cm²).The cross combinations Kulgod local × Pusa Chikni (155.67 cm²) recorded the maximum leaf area per plant followed by the crosses SG-4 × SG-3 (147.07 cm²) and SG-5 × SG-3 (145.78 cm²).Significantly minimum sex ratio was displayed by the parent SG-5 (9.45) followed by SG-6 (9.96) and maximum sex ratio was displayed by KRCCH-2 (14.49) followed by KRCCH-1 (14.20). Among the crosses, significantly maximum sex ratio was exhibited by SG-5 × SwarnaPrabha (17.95) followed by Kulgod local × SG-6(17.11).Highest fruit set was recorded by the parent SG-3 (87.47 %) followed by the parent, SG-5 (86.47 %) with the mean value of 78.73 per cent. Parent SG-6 showed minimum fruit set(71.39 %).Cross SG-5 × KRCCH-1 (89.17 %) recorded highest fruit set followed by SG-6 × SwarnaPrabha (88.66 %) and lowest fruit set was observed in Kulgod local × SG-3 (70.29 %).The fruit length was ranged from 15.97 to 28.33 cm in parents and 18.39 to 30.17 cm in crosses with mean performance of 24.64 and 25.94 cm respectively. The minimum fruit length was recorded in parent Pusa Chikni (15.97 cm) whereas it was maximum in SG-3 (28.33 cm). Among the crosses, the minimum fruit length was recorded in Kulgod local × SG-5 (18.37 cm) and maximum in SwarnaPrabha × KRCCH-1 (30.17 cm).

The fruit diameter minimum (3.30 cm) was recorded in parent KRCCH-1 and maximum in SG-3 (3.95 cm) with mean value of 3.71 cm. Similarly, among the crosses, the fruit diameter was minimum (3.06 cm) in cross combination SG-6 × SwarnaPrabha and maximum in SG-6 × SG-5 (4.03 cm) with mean value of 3.75 cm. Fruit weight ranged from 109.59 to 206.27 g with mean value of 146.03 g in parents and 90.04 to 213.82 g with mean value of 169.93 g in crosses. Among the parents KRCCH-2 (109.59 g) and SG-3 (206.27 g) and in crosses SG-6 × SG-5 (90.04

g) and SG-5 × KRCCH-1 (213.82 g) had minimum and maximum fruit weight, respectively.

The minimum number of fruits per plant was recorded in parent KRCCH-1 (12.27) whereas it was maximum in SG-3 (24.33). Similarly, among the crosses, Kulgod local × SG-4 (11.87) recorded minimum number of fruit per plant whereas the cross Kulgod local × Pusa Chikni (22.91) registered maximum number of fruits per plant. The mean performance of fruits per plant was recorded 17.70 in parents and 16.55 in crosses. The lowest fruit yield was recorded in parent SG-4 (1.25 kg) and the highest was in SG-3 (2.67 kg) followed by SwarnaPrabha (2.58 kg) with grand total mean of 1.75 kg. Among the crosses, SG-3 × KRCCH-2 (1.14 kg) recorded the lowest yield whereas Kulgod local × Pusa Chikni (2.99 kg) followed by SG-5 × SG-3 (2.91 kg) recorded the highest yield with mean of 1.65 kg.

For identifying most desirable parents based on *per se* performance as well as GCA effects three best parents were considered for each trait separately and finally the common parents, if any was/ were identified based on both criteria (Table 1).

Taking above two parameters into consideration, the parent SG-3 was most desirable for most of yield and yield attributing traits *viz.*, number of leaves per plant, number of branches per plant, leaf area, average fruit weight, number of fruits per plant and fruit yield per plant.

Similar association between these two parameters was also observed by Gill and Kumar (1988) in water melon, Musmade and Kale (1986) in cucumber, Maurya (1991) and Maurya and Singh (1994) in bottle gourd, Matoria and Khandelwal (1999) in bitter gourd and Shaha *et al.*, (1999) in ridge gourd.

Table.1 *Per se* performance of parents, hybrids and check for different characters in sponge gourd

Genotype	Vine length (m)	Number of leaves/plant	Internodal length (cm)	Number of branches/plant	Leaf area (cm ²)	Sex ratio
Kulgod local	8.28	91.30	15.54	8.79	122.58	10.78
SG-4	8.42	133.0	14.62	7.49	128.92	10.72
SG-6	12.68	96.03	16.76	6.77	118.31	9.96
SG-5	12.75	89.60	16.94	7.30	109.30	9.45
SG-3	12.02	135.78	14.57	13.82	140.11	12.18
Pusa Chikni	10.06	82.11	15.40	8.83	104.57	10.90
KRCCH-2	11.22	124.4	14.76	9.22	110.36	14.49
SwarnaPrabha	13.04	89.60	17.57	13.14	128.86	11.57
KRCCH-1	12.05	96.99	15.40	8.75	99.98	14.20
Kulgod local × SG-4	11.22	84.34	13.23	6.98	122.87	14.37
Kulgod local × SG-6	12.04	95.83	17.03	8.11	123.24	17.11
Kulgod local × SG-5	8.33	93.55	17.08	8.79	119.46	11.52
Kulgod local × SG-3	9.35	114.65	17.08	9.17	118.32	13.21
Kulgod local × Pusa Chikni	13.37	114.81	19.30	14.88	155.67	11.21
Kulgod local × KRCCH-2	12.30	81.93	16.42	6.86	113.37	11.54
Kulgod local × SwarnaPrabha	11.42	91.15	18.05	8.28	116.78	13.33
Kulgod local × KRCCH-1	12.51	125.20	15.18	14.06	139.55	11.85
SG-4 × SG-6	12.17	104.78	16.97	6.71	136.40	12.46
SG-4 × SG-5	12.03	93.82	16.19	8.25	115.07	13.66
SG-4 × SG-3	11.47	78.66	16.83	8.18	147.07	11.37
SG-4 × Pusa Chikni	12.18	104.83	16.18	6.17	107.75	15.49
SG-4 × KRCCH-2	10.13	79.45	18.53	8.34	109.79	12.98
SG-4 × SwarnaPrabha	11.22	76.45	14.10	8.51	118.91	11.88
SG-4 × KRCCH-1	12.49	124.69	15.27	13.25	124.40	11.25
SG-6 × SG-5	10.49	98.98	18.67	9.37	132.17	13.75
SG-6 × SG-3	10.55	123.29	16.58	12.58	127.47	11.57

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Genotype	Vine length (m)	Number of leaves/plant	Internodal length (cm)	Number of branches/plant	Leaf area (cm ²)	Sex ratio
SG-6 × Pusa Chikni	12.89	132.28	15.02	8.64	135.31	13.74
SG-6 × KRCCH-2	11.51	92.37	16.17	7.83	136.24	12.84
SG-6 × SwarnaPrabha	11.14	84.55	15.99	7.16	140.55	13.72
SG-6 × KRCCH-1	12.40	102.47	17.17	5.65	135.11	11.23
SG-5 × SG-3	13.40	84.7	20.08	14.00	145.78	11.02
SG-5 × Pusa Chikni	11.16	79.92	15.39	9.96	126.06	12.35
SG-5 × KRCCH-2	10.00	81.25	11.74	7.93	125.37	15.53
SG-5 × SwarnaPrabha	12.03	89.30	16.57	9.13	133.78	17.95
SG-5 × KRCCH-1	12.90	70.41	19.21	7.76	107.57	14.00
SG-3 × Pusa Chikni	11.81	87.84	13.88	7.58	119.60	14.95
SG-3 × KRCCH-2	10.75	77.34	15.44	6.69	122.40	13.24
SG-3 × SwarnaPrabha	9.03	96.48	17.45	6.91	112.07	12.45
SG-3 × KRCCH-1	8.48	78.23	16.38	10.64	133.70	16.50
Pusa Chikni × KRCCH-2	11.69	117.42	15.37	12.96	129.86	11.40
Pusa Chikni × SwarnaPrabha	11.98	93.71	17.61	10.49	131.13	12.13
Pusa Chikni × KRCCH-1	11.47	84.78	16.40	8.95	126.26	12.25
KRCCH-2 × SwarnaPrabha	9.95	85.78	15.88	7.43	107.78	15.11
KRCCH-2 × KRCCH-1	12.34	84.56	16.31	9.23	107.94	11.77
SwarnaPrabha × KRCCH-1	12.25	80.06	15.18	7.04	108.52	13.43
Anisha (check)	10.63	82.89	16.17	10.50	123.06	15.73
Mean	11.34	95.90	16.25	9.11	123.90	12.92
S.Em±	0.66	5.09	1.34	0.58	7.25	0.90
C.D. @ 5%	1.84	14.29	3.77	1.64	20.37	2.52
C.D. @ 1%	2.44	18.94	4.99	2.17	26.98	3.34
Range	8.28-13.40	70.41-135.78	11.74-20.31	5.65-14.88	99.98-155.67	9.45-17.95

Genotype	Fruit length (cm)	Fruit set (%)	Average fruit weight in grams	Fruit diameter (cm)	Number of fruits/plant	Fruit yield per plant (kg)
Kulgod local	24.20	78.83	139.32	3.63	16.60	1.47
SG-4	22.73	74.33	156.40	3.93	17.80	1.25
SG-6	26.17	71.39	148.56	3.48	19.07	1.46
SG-5	27.53	86.46	131.66	3.64	19.70	1.29
SG-3	28.33	87.47	206.27	3.95	24.33	2.67
Pusa Chikni	15.97	75.61	139.38	3.90	16.70	1.68
KRCCH-2	25.23	78.66	109.59	3.92	13.47	1.64
SwarnaPrabha	24.50	83.22	166.82	3.64	19.34	2.58
KRCCH-1	27.07	72.64	116.26	3.30	12.27	1.72
Kulgod local × SG-4	26.53	75.80	194.54	3.90	11.87	1.51
Kulgod local × SG-6	27.33	83.16	183.48	3.44	14.10	1.38
Kulgod local × SG-5	18.37	80.21	201.44	3.87	15.53	1.39
Kulgod local × SG-3	25.90	70.29	197.33	3.62	13.27	1.57
Kulgod local × Pusa Chikni	29.20	87.28	173.81	3.67	22.91	2.99
Kulgod local × KRCCH-2	22.50	85.13	149.68	3.98	20.40	1.48
Kulgod local × SwarnaPrabha	28.33	86.77	158.86	3.84	15.73	1.38
Kulgod local × KRCCH-1	29.33	85.38	177.49	3.32	18.80	2.54
SG-4 × SG-6	26.57	87.46	155.02	3.49	17.53	1.50
SG-4 × SG-5	26.43	85.75	209.34	3.95	16.70	1.48
SG-4 × SG-3	28.43	85.52	197.36	3.62	17.17	1.61
SG-4 × Pusa Chikni	26.03	85.23	191.69	3.57	14.50	1.45
SG-4 × KRCCH-2	29.90	87.16	109.15	4.01	16.20	1.20
SG-4 × SwarnaPrabha	27.87	78.88	125.70	3.82	16.37	1.33
SG-4 × KRCCH-1	27.87	87.13	196.02	3.83	22.11	2.42
SG-6 × SG-5	25.80	86.46	90.04	4.03	15.70	1.48

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Genotype	Fruit length (cm)	Fruit set (%)	Average fruit weight in grams	Fruit diameter (cm)	Number of fruits/plant	Fruit yield per plant (kg)
SG-6 × SG-3	27.20	82.55	154.25	3.54	19.35	2.11
SG-6 × Pusa Chikni	26.27	85.90	97.39	3.89	16.60	1.69
SG-6 × KRCCH-2	24.67	85.24	176.02	3.89	16.03	1.84
SG-6 × SwarnaPrabha	24.47	88.66	154.77	3.06	17.37	1.24
SG-6 × KRCCH-1	25.80	83.93	202.72	3.93	17.13	1.72
SG-5 × SG-3	25.43	85.54	189.35	3.86	20.44	2.91
SG-5 × Pusa Chikni	28.70	83.98	181.38	3.84	15.27	1.73
SG-5 × KRCCH-2	27.57	84.17	169.52	3.69	15.03	1.63
SG-5 × SwarnaPrabha	27.03	82.51	194.58	3.68	12.77	1.47
SG-5 × KRCCH-1	25.63	89.17	213.82	3.74	16.10	1.46
SG-3 × Pusa Chikni	24.37	84.96	193.96	3.98	15.47	1.44
SG-3 × KRCCH-2	21.67	70.93	178.38	3.48	14.70	1.14
SG-3 × SwarnaPrabha	22.33	87.41	198.61	3.92	17.37	1.67
SG-3 × KRCCH-1	21.97	85.68	185.70	4.01	13.20	1.61
Pusa Chikni × KRCCH-2	24.60	82.79	167.55	3.64	17.40	2.00
Pusa Chikni × SwarnaPrabha	28.07	88.45	173.22	3.98	15.97	1.84
Pusa Chikni × KRCCH-1	23.37	84.99	165.70	3.34	18.57	1.34
KRCCH-2 × SwarnaPrabha	23.87	83.99	110.67	3.91	14.67	1.33
KRCCH-2 × KRCCH-1	24.10	83.71	184.46	3.88	20.03	1.46
SwarnaPrabha × KRCCH-1	30.17	83.10	114.53	3.84	13.57	1.22
Anisha (check)	25.03	79.68	188.60	3.88	13.80	1.49
Mean	25.66	82.90	165.66	3.75	16.72	1.67
S.Em±	2.10	2.83	9.15	0.16	1.53	0.13
C.D. @ 5%	5.90	7.96	25.71	0.46	4.31	0.37
C.D. @ 1%	7.81	10.55	34.06	0.61	5.71	0.49
Range	15.97-30.17	70.29-89.17	90.04-213.82	3.06-4.03	11.87-24.33	1.14-2.99

The best cross combination on the basis of *per se* performance and desirable SCA effects for all the characters have been presented in Table 55. On the above two criteria, the best common cross combinations found promising were Kulgod local × Pusa Chikni for most of yield and yield attributing traits like number of branches per plant, leaf area, number of fruits per plant and fruit yield per plant. These promising parent (SG-3) and hybrid (Kulgod local × Pusa Chikni) can be recommended for commercial cultivation in South Indian Regions to benefit the growers to catch the early market as well as increased yield. Similar reports of superior performance of hybrids were reported by Shaha and Kale (2003), Hedau and Sirohi (2004) in ridge gourd, Islam *et al.*, (2009) and Lou *et al.*, (2005) in sponge gourd.

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