Vegetable Science (2018) 45(2) : 204-209

Heterosis for yield and its contributing traits in sponge gourd [*Luffa cylindrica* (Roem) L.]

Yamuna Prasad Singh* and VB Singh

Received: November 2017 / Accepted: January 2019

Abstract

The present study was conducted to estimate heterosis for yield and related traits in 40 hybrids of sponge gourd. The experiment was laid out in RBD with three replications. A wide range of variation in the estimates of heterobeltiosis and standard heterosis in positive and negative direction were observed for all the traits studied. In case of fruit yield per plant, heterobeltiosis ranged from -8.07 to 109.04 % and standard heterosis from -33.06 to 22.07 % in Y_1 and heterobeltiosis ranged from -17.35 to 118.59 % and standard heterosis from -34.47 to 36.73 % in Y_2. Out of 40 crosses, twenty nine F_1's showed significant and positive heterosis over better parent and twelve F_1's showed significant and positive heterosis over standard parent in Y_1 and twenty seven F_1's showed significant and positive heterosis over better parent and twelve F_1's showed significant and positive standard heterosis over standard parent in Y_2 for average fruits yield per plant (kg). The best three F_1's for heterobeltiosis were, NDSG-10 × NDSG-12, NDSG-10 × NDSG-15 and NDSG-4 × Pusa Chikni in both the years while the crosses NDSG-55 × NDSG-11, NDSG-63 × Pusa Chikni and NDSG-24 × Pusa Chikni were found superior over standard variety (Pusa Chikni) in both the years. The study suggested scope of heterosis breeding for improving yield and related traits in sponge gourd.

Keywords: Sponge gourd, standard heterosis, heterobeltiosis, average fruit yield per plant, hybrid

Introduction

Luffa [*Luffa cylindrica* (Roem) L. syn. *L. aegyptica* Mill.] commonly called as sponge gourd, loofah, vegetable sponge or dish cloth. It is one of the important cucurbits, both as rainy and summer season vegetable which is grown throughout world. It belongs to the family Cucurbitaceae with diploid chromosome number 2n = 2x = 26 which includes about 118 genera and 825 species. It originated in subtropical Asian region particularly India (Kalloo 1993). *Luffa cylindrica* (Roem) L. and *L. acutangula* (Roxb) L. are domesticated species. Sponge gourd is an annual and monoeceous cucurbit plant and it has a gelatinous compound luffien. In spite of such a large production, the per capita per day supply of vegetables could not rise above 175 g in the country which is lower than the recommended dietary allowance (RDA) of 350-400 g per capita per day for a balanced diet. The vegetable requirement of our country is estimated to be 220 mt by 2020.This target can best be achieved through use of improved varieties and hybrids technology in combination with superior crop management skills. The inflorescences of staminate flowers are raceme, while pistillate flowers are solitary and long penduncculate and it produces fruits containing a fibrous vascular system with vigorous vine length.

The main goal of research on cucurbitaceous vegetables in India is to improve productivity on sustainable basis through developing biotic and abiotic resistant variety/hybrid coupled with quality attributes. The nutritive value of sponge gourd fruits per 100 g edible portion (tough skin removed, edible portion 80%) is: water 93.2 g, energy 18 kcal, protein 1.2 g, fat 0.2 g, carbohydrate 2.9 g, fibre 2.0 g, Ca 36 mg, P 19 mg, Fe 1.1 mg, carotene 120 µg, thiamine 0.02 mg, riboflavin 0.06 mg, niacin 0.4 mg and the composition of young leaves per 100 g edible portion is: water 89 g, protein 5.1 g, carbohydrate 4.0 g, fibre 1.5 g, Ca 56 mg, Fe 11.5 mg, carotene 9.2 mg, ascorbic acid 95 mg. It has certain medicinal uses. It is quite useful in asthma, skin diseases, blood circulation and splenic enlargement. It is recommended by doctor to the patients suffering from malaria or other seasonal fevers because cooked fruits are easily digestible and very appetizing. Heterosis breeding depends mainly on choice of superior

Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad-224229, UP

*Corresponding author, E-mail: yamunasingh1947@gmail.com

homozygous parent, for hybridization. In India, little attention has been given for the genetic improvement of sponge gourd, which is evidenced by paucity of adequate sponge gourd hybrids. Therefore, the present study was conducted to estimate heterosis for different yield related traits and identify heterotic hybrids.

Materials and Methods

In the present study 40 F_1's along with fourteen parent (10 lines and 4 testers) were evaluated along in RBD with three replications at the Main Experiment Station, Department of Vegetable Science, NDUAT, Kumarganj, Faizabad (U.P.) under two *Zaid* seasons (February) during 2014 (Y_1) and 2015 (Y_2). Seeds were sown in rows spaced at 2.50 m apart with a plant to plant spacing of 0.50 m. All the recommended agronomical practices, protection measures and recommended dose of manures and fertilizers were applied to raise a good crop. Observations were recorded on all the six plants maintained carefully in each plot for fourteen quantitative characters *viz*., node number of first staminate flower, node number of first pistillate flower, days to anthesis of first staminate flower, days to anthesis of first pistillate flower, node number of first fruit harvest, days to first fruit harvest, number of primary branches per plant, inter nodal length (cm), vine length (m), fruit length (cm), fruit circumference (cm), average fruit weight (g), number of fruits per plant and average fruits yield per plant (kg).

Results and Discussion

The exploitation of heterosis refers as the superiority of F_1 hybrid over its parent in terms of yield and its attributing traits. The exploitation of heterosis requires an intensive evaluation of germplasm to find out diverse donors with high nicking of genes and further identification of heterotic crosses. In the present study, heterobeltiosis for fruit yield ranged from -8.07 to 109.04% and -17.35 to 118.59% and standard heterosis from -33.06 to 22.06% and -34.47 to 36.73% in Y_1 and Y_2, respectively. Twenty nine showed significant and positive heterosis over better parents and twelve F_1's over standard parents in Y_1 and twenty seven F_1's over better parent and twelve F_1's over standard parent Y_2 showed significant and positive heterosis. The best three F_1's for heterobeltiosis were, NDSG-10 × NDSG-12 (109.04 and 79.07%), NDSG-10 × NDSG-15 (95.58 and 78.55%) and NDSG-4 × Pusa Chikni (81.38 and 88.58%) in both the years while the crosses NDSG-55 × NDSG-11 (22.07 and 33.07%), NDSG-63 × Pusa Chikni (21.99 and 36.73%) and NDSG-24 × Pusa Chikni (19.99 and 29.68%) were found superior over standard variety (Pusa Chikni) in both the years(Table 1 and Table 2). In present study, crosses exhibiting significant and positive estimates of heterosis for one or both types of heterosis for average fruits yield per plant also exhibited significant heterosis for some other important yield and yield attributing traits. However, none of the crosses showed significant and desirable heterosis for all the traits. The above results are in conformity with the findings of Kennedy et al. (1995), Singh et al. (2001), Sadat et al. (2008), Bhatt et al. (2010) and Kumar et al. (2011).

For maturity traits negative heterosis is desirable. Since hybrids with heterosis for earliness produce first fruit earlier as compared to parents, thereby increasing their productivity per day per unit area and as a consequence fetch good prices in the market by early supply of produce. A close examination of heterosis values of six maturity traits *viz*., node number to first staminate and pistillate flower, days to first staminate and pistillate flower opening, node number of first fruit harvest and days to first fruit harvest revealed that the two top hybrids *i.e.,* NDSG-6 × NDSG-15 and NDSG-6 × Pusa Chikni, exhibited significant and desirable heterosis in respect to better parent and standard parent both the years. The top ranked crosses for fruit yield were almost of similar duration for earliness and thereby showing good scope for early high yielding hybrids. Our study further revealed that least one parent (NDSG-18, NDSG-10, NDSG-11, NDSG-4 and NDSG-63) with early days to first fruit harvest was invariably involved in the four top ranked F_1 hybrids for days to first fruit harvest over standard parent in both the years. The top ranked crosses for fruit yield, however, were not significantly early for days to first fruit harvest over better/standard parent. Similar findings were earlier reported by Narasannarvar et al. (2014). The earliness of parents as well as crosses were directly associated with the crosses having high magnitude of heterosis. It may therefore, safely be concluded that either of parents, NDSG-18, NDSG-10, NDSG-11, NDSG-4, NDSG-24 and NDSG-63 or any two of them may be a better choice in any heterosis breeding programme intended to breed high yielding hybrids with considerable earliness. Ram et al. (1997), Maurya et al. (2003) and Sundaram (2008) reported similar findings.

Twenty six crosses over better parent and eleven crosses over standard parents showed significant heterosis during both the years for fruit yield. The improvement in heterosis for yield component may not necessarily be reflected in increased yield. Contrarily, the increased fruit yield will definitely because of increase in one or more component traits. The best performing

Table 1: Lists of crosses with desirable and significant heterosis for 14 characters in sponge gourd (Y_1=2014)

S. N.	Characters	Y_1 BP: Cross combination	BP: No. of crosses with significant positive heterosis	BP: No. of crosses with significant negative heterosis	BP: Range of heterosis	SV: Cross combination	SV: No. of crosses with significant positive heterosis	SV: No. of crosses with significant negative heterosis	SV: Range of heterosis
1.	Node no. of first staminate flower	NDSG-1 × NDSG-15 (-9.50), NDSG-2 × NDSG15(39.93), NDSG6×NDSG-15(-43.59), NDSG-21 × NDSG-15(-28.37), NDSG-63 ×NDSG-15(-54.58)	12	5	-54.58 to 67.68	NDSG-10 × NDSG-12(27.20), NDSG-10 × NDSG-15(24.80), NDSG10×Pusa Chikni(c) (-15.20)	11	3	-27.20 to 44.80
2.	Node no. of first pistillate flower	NDSG-21 × NDSG-15 (-53.65), NDSG-2 × NDSG-15(-35.77), NDSG-1 × NDSG-11 (-15.53), NDSG-6 × NDSG-15(-31.39), NDSG-10 × NDSG-11(-15.98), NDSG-10 × Pusa Chikni(c) (-21.03), NDSG-18 × NDSG-11(-16.44), NDSG-24 × NDSG-15(-30.38), NDSG-63 × NDSG-15 (-21.11)	7	9	-53.65 to 82.09	NDSG-4 × NDSG-12(-24.79), NDSG-10 × NDSG-12(-23.11), NDSG-18 × NDSG-11(-23.11), NDSG-1 × NDSG-11 (-22.27), NDSG-6 × NDSG-12(-22.27), NDSG-10 × NDSG-11(-22.69), NDSG-10 × Pusa Chikni(c) (-22.69), NDSG-18 × NDSG-12 (-18.91) NDSG-4 × NDSG-11 (-15.13),	5	10	-24.79 to 53.78
3.	Days to anthesis of first staminate flower	NDSG-21 × NDSG-15 (-33.79) NDSG-2 × NDSG-15 (-18.68), NDSG-6 × NDSG-15 (-15.14), NDSG-4 × Pusa Chikni(c) (-12.80),	12	7	-33.79 to 52.37	NDSG-4 × NDSG-11 (-19.16), NDSG-18 × NDSG-11 (-26.25) NDSG-4 × Pusa Chikni(c) (-16.14), NDSG-10 × NDSG-11 (-19.28),	11	6	-26.25 to 23.34
4.	Days to anthesis of first pistillate flower	NDSG-21 × NDSG-15 (-20.64), NDSG-6 × NDSG-12 (-23.52), NDSG-21 × NDSG-15 (-20.64), NDSG-6 × NDSG-15 (-15.69)	10	17	-23.52 to 40.71	NDSG-10 × NDSG-11 (-30.92), NDSG-18 × NDSG-11 (-30.02), NDSG-24 × NDSG-11 (-28.84), NDSG-63 × NDSG-11 (-26.22)	2	21	-30.92 to 14.38
5.	Node no. of first fruit harvest	NDSG-21 × NDSG-15 (-48.20), NDSG-24 × NDSG-15 (-33.97), NDSG-6 × NDSG-15 (-32.37), NDSG-2 × NDSG-15 (-25.31), NDSG-10 × Pusa Chikni(c) (-23.97)	8	12	-48.20 to 84.72	NDSG-10 × Pusa Chikni(c) (-24.28), NDSG-18 × NDSG-11 (-24.28), NDSG-18 × NDSG-12 (-20.58), NDSG-4 × NDSG-12 (-24.28)	13	10	-24.28 to 64.20
6.	Days to first fruit harvest	NDSG-6 × NDSG-15 (-17.40), NDSG-6 × Pusa Chikni(c) (-15.77), NDSG-55 × NDSG-11 (-12.08)	2	5	-17.40 to 25.72	NDSG-55 × NDSG-11 (-25.66), NDSG-21 × NDSG-11 (-22.43), NDSG-24 × NDSG-11 (-20.04), NDSG-6 × NDSG-11 (-19.97), NDSG-10 × NDSG-12 (-22.24), NDSG-10 × NDSG-15 (-21.78)	0	25	-25.99 to 7.11
7	No.of primary branches per plant	NDSG-1 × NDSG-11 (52.46), NDSG-21 × Pusa Chikni(c) (51.64), NDSG-2 × NDSG-11 (50.36), NDSG-1 × Pusa Chikni(c) (50.00), NDSG-21 × NDSG-11 (49.18), NDSG-55 × NDSG-11 (47.33)	17	1	-28.97 to 52.46	---	0	36	-48.36 to 3.69
8	Inter nodal length (cm)	---	32	0	9.44 to 134.58	---	37	0	-.80 to 115.20
9	Vine length (m)	NDSG-63 × NDSG-11 (203.17), NDSG-24 × Pusa Chikni(c) (111.49), NDSG-18 × Pusa Chikni(c) (82.76), NDSG-4 × NDSG-12 (80.85),	19	5	-30.85 to 203.17	NDSG-63 × NDSG-11 (119.54), NDSG-24 × Pusa Chikni(c) (111.49), NDSG-4 × NDSG-12 (95.40), NDSG-18 × Pusa Chikni(c) (82.76), NDSG-24 × NDSG-15 (83.91)	14	9	-25.29 to 119.54
10	Fruit length (cm)	NDSG-6 × NDSG-15 (54.61), NDSG-10 × NDSG-11 (48.74), NDSG-4 × NDSG-15 (43.31), NDSG-2 × NDSG-12 (38.84), NDSG-2 × NDSG-11 (31.42)	23	3	-19.47 to 54.61	NDSG-6 × NDSG-11 (17.90) NDSG-2 × NDSG-11 (13.30)	3	26	-35.91 to 17.90
11	Fruit circumference (cm)	NDSG-1 × NDSG-12 (21.61), NDSG-6 × NDSG-15 (20.90), NDSG-55 × NDSG-12 (20.33), NDSG-10 × NDSG-12 (17.27)	10	0	-8.14 to 21.61	NDSG-6 × NDSG-15 (11.74), NDSG-18 × NDSG-12 (11.36),	3	1	-10.23 to 11.74
12	Average fruit weight (g)	NDSG-55 × NDSG-11 (50.06), NDSG-55 × NDSG-15 (47.58), NDSG-55 × NDSG-12 (25.29), NDSG-10 × NDSG-15 (29.71), NDSG-10 × NDSG-12 (24.70)	22	1	-13.50 to 50.06	NDSG-10 × NDSG-15 (28.28), NDSG-10 × NDSG-12 (15.34)	4	16	-36.32 to 28.28
13	No. of fruits per plant	NDSG-4 × NDSG-12 (83.00), NDSG-10 × NDSG-11 (74.58), NDSG-10 × NDSG-12 (73.24), NDSG-10 × Pusa Chikni(c) (73.24), NDSG-4 × NDSG-15 (72.80)	29	2	-18.68 to 83.00	NDSG-55 × NDSG-11 (36.67), NDSG-55 × Pusa Chikni(c) (35.59), NDSG-1 × NDSG-11 (24.36)	14	10	-34.37 to 52.77
14	Average fruits yield per plant (kg)	NDSG-10 × NDSG-12 (109.04), NDSG-4 × Pusa Chikni(c) (81.38), NDSG-10 × NDSG-15 (95.58), NDSG-4 × NDSG-15 (70.83)	29	0	-8.07 to 109.04	NDSG-55 × NDSG-11 (22.07), NDSG-63 × Pusa Chikni(c) (21.99), NDSG-24 × Pusa Chikni(c) (19.99)	12	12	-33.05 to 22.07

BP=Better Parent, SV= Standard Variety

Table 2: Lists of crosses with desirable and significant heterosis for 14 characters in sponge gourd (Y_2=2015)

S. N.	Characters	Y_2							
		BP				SV			
		Cross combination	No. of crosses with significant positive heterosis	No. of crosses with significant negative heterosis	Range of heterosis	Cross combination	No. of crosses with significant positive heterosis	No. of crosses with significant negative heterosis	Range of heterosis
1.	Node no. of first staminate flower	NDSG-2 × NDSG-15 (-52.84), NDSG-6 ×NDSG15(51.64), NDSG21×NDSG-15 (-41.61), NDSG-63 × NDSG-15 (-63.28)	19	4	-63.28 to 59.22	NDSG-10 × NDSG12(24.59), NDSG-10 × NDSG-15 (-18.03)	15	2	-24.59 to 36.07
2.	Node no. of first pistillate flower	NDSG-6 × NDSG-15(-50.81), NDSG-21 × NDSG-15(-46.44), NDSG-1 × NDSG-11 (-17.55), NDSG-2 × NDSG-15 (-42.33), NDSG-24 × NDSG-15(-29.34), NDSG-18 × NDSG-11(-22.04), NDSG-1 × NDSG-15 (-21.24), NDSG-4 × NDSG-11(-20.82), NDSG-4 × NDSG-15 (-19.85), NDSG-63 × NDSG-15 (-15.17)	11	14	-58.81 to 112.80	NDSG-4 × NDSG-12 (-26.57)	17	1	-26.57 to 68.60
3.	Days to anthesis of first staminate flower	NDSG-2 × NDSG-15 (-17.66), NDSG-4 × Pusa Chikni(c) (-14.21), NDSG-6 × NDSG-15 (-17.37), NDSG-21 × NDSG-15 (-28.32),	15	6	-28.32 to 56.01	NDSG-4 × NDSG-11 (-25.38), NDSG-4 × Pusa Chikni(c) (-16.74), NDSG-10 × NDSG-11 (-24.07), NDSG-18 × NDSG-11 (-28.88), NDSG-24 × NDSG-11 (-19.58)	6	11	-28.88 to 20.35
4.	Days to anthesis of first pistillate flower	NDSG-6 × NDSG-12 (-22.82), NDSG-18 × NDSG-11 (-17.98), NDSG-21 × NDSG-15 (-16.19)	6	10	-22.82 to 42.38	NDSG-18 × NDSG-11 (-39.58), NDSG-10 × NDSG-11 (-30.63), NDSG-63 × NDSG-11 (-30.13), NDSG-6 × NDSG-11 (-27.76)	0	26	-39.58 to 4.89
5.	Node no. of first fruit harvest	NDSG-10 × Pusa Chikni(c) (-29.04), NDSG-18 × NDSG-11 (-11.57), NDSG-21 × NDSG-15 (-46.65), NDSG-6 × NDSG-15 (-41.27), NDSG-24 × NDSG-15 (-31.52)	5	14	-46.65 to 55.00	NDSG-10 × Pusa Chikni(c) (-29.04), NDSG-18 × NDSG-11 (-21.32), NDSG-18 × NDSG-12 (-21.69), NDSG-1 × NDSG-11(-20.22)	5	19	-30.51 to 36.76
6.	Days to first fruit harvest	NDSG-6 × NDSG-15 (-21.82), NDSG-6 × Pusa Chikni(c) (-16.93), NDSG-6 × NDSG-12 (-13.75), NDSG-2 × NDSG-15 (-12.45)	4	7	-21.82 to 16.65	NDSG-4 × NDSG-11 (-28.17), NDSG-6 × NDSG-11 (-26.68), NDSG-55 × NDSG-11 (-30.04), NDSG-63 × NDSG-11 (-25.12), NDSG-18 × NDSG-11 (-24.19)	0	30	-30.04 to 1.93
7	No.of primary branches per plant	NDSG-21 × NDSG-11 (74.11), NDSG-2 × NDSG-11 (69.35), NDSG-21 × Pusa Chikni(c) (68.75), NDSG-2 × Pusa Chikni(c) (57.26)	15	17	-20.33 to 74.11	---	0	39	-10.99 to -53.11
8	Inter nodal length (cm)	NDSG-18 × NDSG-11 (-21.51)	33	1	-21.51 to 111.38	---	36	0	-13.25 to 82.12
9	Vine length (m)	NDSG-63 × NDSG-11 (171.83), NDSG-24 × Pusa Chikni(c) (117.07), NDSG-4 × NDSG-12 (85.39) NDSG-18 × Pusa Chikni(c) (81.71),	19	3	-26.97 to 171.83	NDSG-63 × NDSG-11 (135.37), NDSG-24 × Pusa Chikni(c) (117.07), NDSG-18 × Pusa Chikni(c) (81.71), NDSG-4 × NDSG-12 (101.22), NDSG-24 × NDSG-15 (84.15)	21	3	-20.73 to 135.37
10	Fruit length (cm)	NDSG-2 × NDSG-11 (44.68) NDSG-4 × NDSG-15 (43.80), NDSG-2 × NDSG-12 (41.80), NDSG-10 × NDSG-11 (33.59), NDSG-6 × NDSG-15 (29.74)	27	1	-12.43 to 55.88	NDSG-6 × NDSG-11 (29.58), NDSG-2 × NDSG-11 (26.31), NDSG-4 × NDSG-11 (19.76)	7	14	-28.40 to 29.58
11	Fruit circumference (cm)	NDSG-18 × NDSG-11 (23.50), NDSG-63 × NDSG-11 (20.09), NDSG-55 × NDSG-12 (18.47), NDSG-4 × NDSG-12 (19.57), NDSG-2 × NDSG-12 (18.64)	11	1	-17.88 to 23.50	NDSG-18 × NDSG-12 (10.22)	1	8	-17.88 to 10.22
12	Average fruit weight (g)	NDSG-55 × NDSG-11 (32.85), NDSG-55 × NDSG-15 (30.30), NDSG-55 × NDSG-12 (13.79), NDSG-10 × NDSG-15 (28.87), NDSG-4 × Pusa Chikni(c) (10.85)	27	2	-12.77 to 34.97	NDSG-10 × NDSG-15 (13.71), NDSG-6 × Pusa Chikni(c) (15.31)	2	26	-36.07 to 15.31
13	No. of fruits per plant	NDSG-4 × NDSG-12 (113.23), NDSG-55 × Pusa Chikni(c) (43.68), NDSG-10 × Pusa Chikni(c) (85.21), NDSG-18 × Pusa Chikni(c) (67.16)	31	3	-14.83 to 115.16	NDSG-55 × NDSG-11 (39.52), NDSG-55 × Pusa Chikni(c) (43.68), NDSG-18 × NDSG-12 (39.82), NDSG-55 × NDSG-11 (39.52), NDSG-18 × Pusa Chikni(c) (67.16)	21	6	-31.05 to 72.07
14	Average fruits yield per plant (kg)	NDSG-10 × NDSG-12 (79.07), NDSG-4 × Pusa Chikni(c) (88.58), NDSG-10 × NDSG-15 (78.55), NDSG-4 × NDSG-15 (118.59), NDSG-55 × NDSG-11 (72.18)	27	1	-17.35 to 118.59	NDSG-55 × NDSG-11 (33.07), NDSG-63 × Pusa Chikni(c) (36.73), NDSG-21 × Pusa Chikni(c) (22.38), NDSG-24 × Pusa Chikni(c) (29.68)	12	13	-34.47 to 36.73

BP=Better Parent, SV= Standard Variety

heterobeltiotic F_1 (NDSG-63 × Pusa Chikni) for yield common over seasons and NDSG-18 × NDSG-11 showed significant and top ranked heterobeltiosis for number of fruits per plant in both the seasons. This hybrid also showed significant heterosis for fruit circumference. Likewise, out of forty, twenty one crosses were found significant heterotic over better parent common over both the seasons, best three crosses *i.e.* NDSG-55 × NDSG-11, NDSG-55 × NDSG-15 and NDSG-18 × NDSG-11, and two crosses (NDSG-6 × Pusa Chikni and NDSG-10 × NDSG-15) showed significant standard heterosis. Among top heterotic crosses some of the parents were more frequently involved. As the performance of hybrids depends upon the heterotic capability of parents involved, from economic point of view it will be useful to select and utilize the parental inbreds with strong heterotic capability for important economic traits associated with yield in order to achieve higher gains in F_1 hybrids through exploitation of heterosis. Increased yield in crosses of sponge gourd observed in present investigations are in conformity with the findings of various workers (Rajeswari and Natarajan (1999), Singh et al. (2001) and Naliyadhara et al. (2007), and Karmakar et al. (2013) in ridge gourd.

A perusal of Table 1 and Table 2 which showed best three crosses on the basis of desirable and significant heterobeltiosis for fourteen traits in both the years revealed that common crosses on the basis of better parent heterosis for fruit yield per plant were NDSG-63 × Pusa Chikni, NDSG-55 × NDSG-11, NDSG-24 × Pusa Chikni, NDSG-18 × Pusa Chikni and NDSG-18 × NDSG-11. All of them were common in both the years in respect to better parent heterosis for average fruit yield as well as some other traits like number of fruits per plant, fruit weight and fruit length. Standard heterosis of three best cross combinations had been presented in Table 1 and Table 2. Two crosses showed significant standard heterosis for days to first fruit harvest in both the years for earliness. The extent of heterosis of three best crosses *i.e.* NDSG-63 × Pusa Chikni, NDSG-55 × NDSG-11 and NDSG-24 × Pusa Chikni in year Y_1 (56.51 to 62.22%) and Y_2 (51.71 to 84.43%) for average fruit yield per plant revealed that there was a great scope of realizing higher yield in sponge gourd through heterosis breeding (Sabina et al. 2008). Besides fruit yield per plant, substantial heterosis over better-parent and standard variety was also observed in negative as well as positive direction for remaining characters in both the years. However, the number of crosses showing significant estimates and the range of heterosis varied from one character to another. In general, some crosses showed appreciable and high heterosis for number of traits under study. The existence of wide spectrum of heterosis in either direction with expression of high degree of desirable heterosis by some crosses for number of traits observed in present study is in conformity with the earlier reports of high heterosis for such characters in sponge gourd.

Ikjka'k

वर्तमान अध्ययन में चिकनी तोरई के 40 संकरों का मूल्यांकन उपज एवं सम्बन्धित गुणों में संकर ओज ज्ञात करने के लिये किया गया। प्रयोग को यादृच्छिक अभिकल्प में तीन प्रतिकृतियों के साथ किया गया। सकारात्मक एवं नकारात्मक दिशा में सभी गणों के लिये ओजस्विता एवं मानक ओज आंकलन में वृहद् विविधता पायी गयी। प्रति पौध उपज के लिये ओजस्विता सीमा विस्तार– 8.07 से 109.4 प्रतिशत तथा मानक ओज–33.06 से 22.07 प्रतिशत वाई–1 में पाया गया तथा ओजस्विता सीमा विस्तार–17.35–118.59 प्रतिशत व मानक ओज– 34.47–36.73 प्रतिशत वाई–2 में पाया गया। कुल 40 संकरों में 20 संकरों ने सार्थक व धनात्मक ओज उत्तम पितृ एवं 12 संकरों ने सार्थक व धनात्मक ओज उत्तम पितृ वाई–1 तथा 27 संकरों ने सार्थक व धनात्मक ओज उत्तम पितृ तथा 12 संकरों ने सार्थक व धनात्मक मानक ओज मानक पितृ के लिए प्रभेद वाई–2 में प्रति पौध फल उपज (किलोग्राम) के लिए पाया गया। तीन उत्कृष्ट संकरों– एन डी एस जी–10 x एन डी एस जी–12, एनडीएसजी–10 x एनडीएसजी–15 तथा एनडीएसजी–4 x पूसा चिकनी में दोनों वर्ष ओजस्विता अधिक पायी गयी जबकि तीन संकरों एनडीएसजी–55 x एनडीएसजी–11, एनडीएसजी–63 x पूसा चिकनी एवं एनडीएसजी–64 x पूसा चिकनी मानक किस्म पूसा चिकनी की तुलना में दोनों वर्ष उत्तम पायी गयी। अध्ययन से सुझाव मिलता है कि चिकनी तोरई के संकर प्रजनन में उपज सम्बन्धित गुणों में सुधार हेतु ओजस्विता व ओज का ज्यादा योगदान पर ध्यान देना चाहिए।

References

Bhatt MM, Sadhu BB and Acharya RR (2010) Exploitation of hybrid vigour in ridge gourd [*Luffa acuangulata* (Roxb.) L.]. Res Crops 11 (2): 401-403.

Islam S, Munshi AD, Kumar R, Behera TK and Lal SK (2008) Evaluation of sponge gourd hybrids for yield and related traits. Cucurbit Genetics Cooperative 31/32: 34-35.

Kalloo G (1993) Loofah-Luff. Genetic Improvement of Vegetable Crops. pp 265-266.

Karmakar P, Munshi AD, Behera TK, Kumar R, Kaur C and Singh BK (2013) Hermaphrodite inbreds with better combining ability improve antioxidant properties in ridge gourd [*Luffa acutangula* (Roxb.) L.]. Euphytica 191(1): 75-84.

Kumar A, Singh B and Kumar M (2011) Exploitation of hybrid vigour for yield in [*Lagenaria siceraria* (Molina) Standl.] using line × tester analysis. Vegetos 24(2): 45-48.

Maurya SK, Ram HH and Singh JP (2003) Hybrid breeding in bottle gourd. Prog Hort 35: 46-50.

Narasannavar AR, Gasti VD, Shantappa T, Mulge R, Allolli TB and Thammaiah N (2014) Heterosis studies in ridge gourd [*Luffa acutangula* (L.) Roxb.]. Karnataka J Agric Sci 27 (1): 47-51.

Rajeswari KS and Natarajan S (1999) Studies on heterosis for growth, yield and quality parameters in bitter gourd (*Momordica charantia* L.). South Indian Hort. 47: 208-209.

Ram D, Kalloo G and Singh M (1997) Heterosis in bitter gourd (*Mornordica charantia* L.). Veg Sci 24(2): 99-102.

Sadat MA, Uddin MJ and Bhuiyan MSR (2008) Heterosis in pointed gourd. Hort Envi Biotech 49(6): 427-433.

Singh R, Khattra AS and Thakur JC (2001) Studies on heterosis in bitter gourd (*Momordica charantia* L.). Haryana J Hort Sci 30: 224-227.

Sundaram V (2008) Heterosis for yield and attributing traits in bitter gourd. Mysore J Agri Sci 42(2): 297-303.