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Short communication

Exploitation of heterosis in cucumber (*Cucumis sativus* L.)

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The cucumber is one of the commercially important cucurbitaceous vegetables grown throughout the country. Its tender fruits are in great demand for salad and pickles round the year in almost every part of the world. In spite of its importance, large variability, adaptability and uses, the research priority given to this crop especially in crop improvement aspect is highly meager in our country. There is a paramount need to develop suitable hybrids, which may be utilized on commercial scale especially in the plains. Assessing the genetic variability and exploitation of heterosis can bring out a speedy improvement. The present investigation was therefore taken to study the magnitude of heterosis for yield and its components in cucumber through 10x10 diallel analysis.

The experimental material for the present study consisted of 10 promising and distinct pure lines and varieties of cucumber collected from different parts of the country, namely, P_1 (DC-1), P_2 (CHC-1), P_3 (DC-2), P_4 (CH-20), P_5 (CHC-2), P_6 (Himangi), P_7 (PCUC-28), P_8 (VRC-11-1), P_9 (Poona Khira), P_{10} (DARL-81). These lines were crossed in a half-diallel fashion and 45 F_1 hybrids were obtained. These 45 F_1's along with the 10 parents were assessed in an experiment at Division of Vegetable Science, I.A.R.I. to study the heterosis for yield and its contributing characters. All the crosses and their parents were sown in randomized block design with three replications. The crop was grown in rows at 2 m apart with spacing of 0.60 m between the plants. All the recommended practices for irrigated conditions were followed to raise the crop. Ten plants in each replication per treatment were randomly selected for observations on plant, fruit and yield characters. The observations were recorded for ten important characters namely, vine length, days to first male flowering opening, days to first female flower opening, node number of first female flower opening, days to first fruit harvest, fruit weight, fruit diameter, fruit length, number of fruits per plant, total yield per plant.

The analysis of variance showed highly significant differences among the varieties and lines studied. The range of parental and F_1 means, range of heterosis percentage over better and top parent, three top parents with their mean values and three top F_1 hybrids with percentage heterosis over better and top parent are presented in Table 1. Among 10 parents used in the study, the parent P_3 (DC-2) had lowest node number of first female flower, maximum fruit diameter, highest number of fruits per plant and total yield per plant (1510.33 g per plant). The highest fruit weight and maximum fruit length was recorded in P_{10} (DARL-81). P_9 (Poona Khira) took minimum number of days for first male as well as female flower opening. Shortest vine length and minimum days to first fruit harvest were observed in P_5 (CHC-2) and P_6 (Himangi), respectively. In order of merit, P_3 (DC-2), P_7 (PCUC-28) and P_1 (DC-1) were found to be best performing lines for total yield per plant. The F_1 hybrids had higher range of mean values than that of parents for all the characters studied except days to first male and female flower opening and days to first fruit harvest.

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Table 1. Best performing parents and F1 hybrids

Characters	Vine length (m)	Days to first male flower opening	Days to first female flower opening	Node number of first female flower	Days to first fruit harvest
Top three parents	P_5 (0.70)	P_9 (46.30)	P_9 (51.03)	P_3 (3.80)	P_6 (60.20)
	P_9 (0.80)	P_3 (46.90)	P_6 (52.17)	P_7 (3.90)	P_9 (60.37)
	P_4 (0.92)	P_6 (48.40)	P_3 (53.50)	P_8 (4.00)	P_7 (61.03)
Top three F1 hybrids over B.P.	P_3xP_{10} (-26.13)	P_1xP_4 (-16.01)	P_1xP_4 (-11.53)	P_6xP_{10} (-25.93)	P_4xP_6 (-8.23)
	P_2xP_7 (-8.20)	P_1xP_2 (-10.79)	P_4xP_6 (-9.53)	P_2xP_{10} (-24.56)	P_1xP_2 (-7.55)
	P_1xP_3 (-7.21)	P_1xP_5 (-10.07)	P_1xP_2 (-9.51)	P_1xP_6 (-20.00)	P_1xP_4 (-5.88)
Top three F1 hybrids over T.P.	-	P_1xP_4 (-8.21)	P_4xP_6 (-7.51)	P_7xP_8 (-10.53)	P_4xP_6 (-8.23)
	-	P_1xP_9 (-5.77)	P_1xP_4 (-4.17)	P_3xP_4 (-9.74)	P_1xP_2 (-4.70)
	-	P_4xP_6 (-5.62)	P_3xP_5 (-3.72)	P_3xP_8 (-8.68)	P_6xP_7 (-3.60)

Characters	Fruit weight (g)	Fruit diameter (cm)	Fruit length (cm)	Number of fruits per plant	Total yield per plant (g)
Top three parents	P_{10} (197.67)	P_3 (4.77)	P_{10} (18.12)	P_3 (8.66)	P_3 (1510.3)
	P_1 (175.00)	P_{10} (4.57)	P_1 (17.59)	P_7 (8.41)	P_7 (1440.33)
	P_9 (177.67)	P_8 (4.45)	P_9 (16.52)	P_5 (7.26)	P_1 (1063.47)
Top three F1 hybrids over B.P.	P_5xP_6 (53.23)	P_4xP_5 (26.09)	P_5xP_6 (32.47)	P_1xP_2 (64.90)	P_5xP_6 (98.15)
	P_3xP_7 (33.98)	P_4xP_9 (21.36)	P_3xP_7 (30.43)	P_1xP_6 (52.37)	P_1xP_5 (91.42)
	P_4xP_6 (33.88)	P_4xP_7 (19.04)	P_7xP_8 (28.95)	P_1xP_9 (49.00)	P_1xP_6 (90.51)
Top three F1 hybrids over T.P.	P_3xP_7 (16.36)	P_4xP_9 (11.95)	P_1xP_7 (12.47)	P_3xP_4 (27.71)	P_3xP_7 (50.43)
	P_3xP_8 (14.33)	P_3xP_7 (11.53)	P_7xP_8 (10.87)	P_3xP_7 (15.59)	P_7xP_8 (43.61)
	P_1xP_6 (13.83)	P_7xP_8 (10.69)	P_3xP_7 (9.77)	P_7xP_8 (15.24)	P_3xP_8 (35.32)

Appreciable heterosis was observed in the F_1 hybrids over their respective better and top parents for all the characters studied in desirable direction. Out of 45 crosses, the number of heterotic crosses over the corresponding better and top parent were 9 and nil for vine length, 28 and 16 for days to first male flower opening, 17 and 11 for days to first female flower opening, 18 and 9 for node number of first female flower, 12 and 8 for days to first fruit harvest, 18 and 11 for fruit weight, 14 and 7 for fruit diameter, 25 and 8 for fruit length, 20 and 12 for number of fruits per plant and 20 and 13 for total yield per plant, respectively.

The best performing crosses along with their heterosis percentage over top parent for different characters included none for vine length, P_1 x P_4 (-8.21) for days to first male flower opening, P_4 x P_6 (-7.51) for days to first female flower opening, P_7 x P_8 (-10.53) for node number of first female flower, P_4 x P_6 (-8.23) for days to first fruit harvest, P_3 x P_7 (16.36) for fruit weight, P_4 x P_9 (11.95) for fruit diameter, P_1 x P_7 (12.47) for fruit length, P_3 x P_4 (27.71) for number of fruits per plant The three best performing F_1 hybrids for total yield per plant were P_3 x P_7 (DC-2 x PCUC-28) (2272 g yield per plant), P_7 x P_8 (PCUC-28 x VRC-11-1) and P_3 x P_8 (DC-2 x VRC-11-1) and they showed 50.43, 43.61 and 35.32 per cent, respectively significant heterosis over top parent, P_3 (DC-2). Musmade and Kale (1986) reported a fairly high degree of heterosis in cucumber for earliness and yield per vine in most of the crosses. Similar findings have been reported by Dogra *et al.* (1997), Singh *et al.* (1999) and Bairagi *et al.* (2002) in cucumber.

From the present investigation it is concluded that to achieve higher yield through F_1 hybrid, the parental lines chosen should possess one or more of the important characters like fruit weight, length, diameter and number of fruits per plant. In view of the best performance in yield, the F_1 hybrid, P_3 x P_7 (DC-2 x PCUC-28) may be recommended for commercial cultivation.

References

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