

Original Research Article

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Heterosis for Seed Yield and its Contributing Attributes in Castor (*Ricinus communis* L.)

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ABSTRACT

Keywords

Castor, Heterosis,
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A study was conducted in castor to estimate the magnitude of heterosis for yield and its eleven yield components. 32 F₁ hybrids generated line × tester mating design developed by Kempthorne (1957). These F₁S along with 12 parents were evaluated in a randomized block design with three replications at Agricultural Research Station at sansoli, Anand, Gujarat (India). Appreciable heterosis was found better and standard parent for all the traits studied in desirable direction. In order of merit F₁ hybrids VP 1 x JC 20 (49.15 %), SKP 84 x SKI 215 (29.4%) and VP 1 x ANDCI 9 (26.93 %) were observed significant heterobeltiosis (better parent heterosis) for seed yield per plant. In case of standard heterosis, significant and positive heterosis over standard check GCH 7 for seed yield per plant was observed in hybrid VP 1 x ANDCM 2 (14.03 %) followed by SKP 84 x ANDCM 2 (13.3 %). In No. of capsules on primary spike, The VP 1 x ANDCM 2 (50.70 %) over standard check. When number of effective branches per plant, the VP 1 x JC 20 (10.3 %) over standard check.

Introduction

The phenomenon of heterosis has proved to be the most important genetic tool in enhancing the yield of cross pollinated species in general and castor in particular. Heterosis breeding is an important crop improvement method adopted in many crops all over the world. It is a quick and convenient way of combining desirable characters which has assumed greater significance in the production of F₁ hybrids. Castor (*Ricinus communis* L., 2n = 2x = 20) is

an industrially an important non-edible oilseed crop widely cultivated in the arid and semi-arid regions of the world. Castor is a sexually polymorphic species with different sex forms viz., monoecious, pistillate, hermaphrodite and pistillate with interspersed staminate flowers (ISF). Heterosis has been successfully exploited in many cross pollinated crops like maize, pearl millet, sorghum and many others (Rai, 1979). The first castor hybrid GCH 3 (TSP-10 R x J-1)

was released for general cultivation in Gujarat as early as 1968 (Gopani *et al.*, 1968). The highest extent of heterobeltiosis for seed yield per plant was recorded by the hybrid VP1 x JC 20 (49.15 per cent) followed by SKP 84 x SKI 215 (29.4 per cent) and VP1 x ANDCI 9 (26.93 per cent). The best two hybrids on the basis of significant positive standard heterosis were VP 1 x ANDCM 2 and SKP 84 x ANDCM 2 per cent over GCH 7 (Chaudhari *et al.*, 2014). Seed yield per plant is an attribute of economic importance which the breeders attempt to improve by evolving new high yielding hybrids. The superiority of hybrids depends on their yield potential over the better released varieties and the extent of heterosis for seed yield on the basis of heterosis following objective 1, to estimate the nature and magnitude of heterotic effects for seed yield and its component traits.

Materials and Methods

The experimental material comprising of four lines (VP1, SKP 84, GEETA, JP 65) and eight testers (ANDCM 2, ANDCI 8, ANDCI 9, ANDCI10-4, SKI 215, JC 20, JC 22, JI 96) were selected on the basis of the morphological differences. All These twelve parents were crossed to produce 32 F₁S hybrids according to the line × tester mating design developed by Kempthorne (1957).

The resulting 32 hybrids along with 12 parents and one standard check was included in crosses were grown in a randomized block design replicated thrice at the Agricultural Research Station, Anand Agricultural University, Sansoli-387130, Gujarat in kharif 2014. Each entry was planted in a 6 meter long row with inter and intra row spacing of 120 × 60 cm. All the recommended agronomic and plant protection practices were uniformly applied throughout the crop growth period to raise a good crop.

The observations were recorded on five randomly selected plants for 11 characters in each replication for each genotype and the average value per plant was computed except for days to 50 per cent flowering and days to 50 per cent maturity of primary spike. The observations of both these characters were recorded on population basis. While the percentage increase or decrease in performance observed in F₁ over the standard check was calculated according to Meredith and Bridge (1971).

Results and Discussion

Thus, the aim of heterosis analysis in the present study was to search out the best combination of parents giving high degree of useful heterosis and characterization of parents for their prospects for future use in breeding programme. An examination of performance of hybrids in respect of heterosis over better parent revealed that 8 hybrids manifested significant positive heterosis over their better parents for seed yield per plant. The highest extent of heterobeltiosis for seed yield per plant was recorded by the hybrid VP1 x JC 20 (49.15 per cent) followed by SKP 84 x SKI 215 (29.4 per cent) and VP1 x ANDCI 9 (26.93 per cent). The best two hybrids on the basis of significant positive standard heterosis were VP 1 x ANDCM 2 and SKP 84 x ANDCM 2 per cent over GCH 7. The VP 1 x ANDCM 2 (90.37 %) and VP 1 x ANDCM 2 (50.70 %) over better parent and standard check. When number of effective branches per plant, The VP 1 x ANDCM 2 (38.87 %) and VP 1 x JC 20 (10.3 %) over better parent and standard check, the no of capsules on primary spike, the VP 1 X ANDCM 2 (90.37%) and VP 1 X ANDCM 2 (50.70%) over better parent and standard check. On the basis of this results VP 1 X ANDCM 2 hybrid performance positive indirection.

Several hybrids exhibited significant heterosis over better parent in desirable direction for different component traits such as days to 50 per cent flowering and maturity of primary spike (0), plant height up to primary spike (4), number of nodes up to primary spike (7), length of primary spike (15), number of capsules on primary spike (13), number of effective branches per plant (12), total number of branches per plant (1), 100-seed weight (5) and oil content (0). It was observed that

hybrids showing high heterobeltiosis for seed yield per plant in general also manifested heterotic effects for its contributing characters like length of primary spike, number of capsules on primary spike, number of effective branches per plant and 100-seed weight. This study thus substantiates the findings of Kaul and Prasad (1983), Thakker (1987), Mehta *et al.*, (1991a), Joshi (1993), Barad *et al.*, (2009a) and Dadheech *et al.*, (2010).

Table.1 The best significant hybrids for different traits with respect to heterosis better parent and Standard check

Characters	Heterosis over	
	better parent	Standard check
Days to 50 percent flowering	-	VP 1 x ANDCI 9 (-19.71%)
	-	VP 1 x ANDCM 2 (-19.44 %)
	-	VP 1 x ANDCI 10-4 (-16.53 %)
Days to 50 percent maturity of primary spike	-	VP 1 x ANDCI 9 (-10.04 %)
	-	Geeta x ANDCI 10-4 (-9.54)
	-	VP 1 x ANDCI 10-4 (-9.26 %)
Plant height up to primary spike	Geeta x SKI 215 (-17.34 %)	SKP 84 x JC 20 (-31.35 %)
	Geeta x ANDCI 8 (-11.73 %)	SKP 84 x JC 22 (-29.20 %)
	Geeta x ANDCI 10-4 (-10.94 %)	VP 1 x JC 22 (-27.99 %)
Number of nodes up to primary spike	JP 65 x ANDCM 2 (-18.65 %)	JP 65 x ANDCI 10-4 (-28.7 %)
	JP 65 x ANDCI 10-4 (-15.19 %)	JP 65 x ANDCI 9 (-28.4 %)
	VP 1 x ANDCI 10-4 (-14.18 %)	VP 1 x ANDCI 10-4 (-27.8 %)
Length of primary spike	JP 65 x JC 20 (52.08%)	SKP 84 x ANDCM 2 (7.34 %)
	VP 1 x ANDCM 2 (48.9%)	SKP 84 x ANDCI 8 (5.86 %)
	SKP 84 x ANDCM 2 (40.01%)	JP 65 x ANDCI 9 (5.03 %)
No. of capsules on primary spike	VP 1 x ANDCM 2 (90.37 %)	VP 1 x ANDCM 2 (50.70 %)
	VP 1 x ANDCI 9 (53.49 %)	SKP 84 x ANDCM 2 (38.6 %)
	SKP 84 x ANDCM 2 (41.65 %)	VP 1 x ANDCI 9 (21.4 %)
Number of effective branches per plant	VP 1 x ANDCM 2 (38.87 %)	VP 1 x JC 20 (10.3 %)
	Geeta x ANDCI 9 (36.39 %)	SKP 84 x ANDCM 2 (9.69%)
	VP 1 x ANDCI 10-4 (33.15 %)	-
Total number of branches per plant	VP 1 x ANDCM 2 (11.7 %)	JP 65 x JI 96 (16.80 %)
	-	JP 65 x JC 22 (13.8%)
	-	Geeta x SKI 215 (13.7 %)
100 seed weight	VP 1 x ANDCI 10-4 (16.31 %)	-
	VP 1 x JC 20 (14.87 %)	-
	VP 1 x ANDCM 2 (9.42 %)	-
Seed yield per plant	VP 1 x JC 20 (49.15 %)	VP 1 x ANDCM 2 (14.3 %)
	SKP 84 x SKI 215 (29.4%)	SKP 84 x ANDCM 2 (13.3 %)
	VP 1 x ANDCI 9 (26.93%)	-
Oil content	-	JP 65 x ANDCM 2 (7.95%)
	-	VP 1 x SKI 215 (7.21 %)
	-	Geeta x ANDCI 8 (6.83%)

A result of revealed that several hybrids had significant heterosis over standard check hybrid GCH 7 in desired direction viz., days to 50 per cent flowering (11), days to 50 per cent maturity (23), plant height (12), number of nodes up to primary spike (31), length of primary spike (3), number of capsules on primary spike (6), number of effective branches per plant (2), total number of branches per plant (4), 100-seed weight (0), seed yield per plant (2) and oil content (6). Several workers have also reported the presence of considerable degree of heterosis for seed yield per plant in castor (Joshi *et al.*, 2001; Lavanya and Chandramohan, 2003; Patel, 2004 and Parmar, 2006) and number of effective branches per plant (Joshi *et al.*, 2002; Patel, 2004; Barad *et al.*, 2009 and Dadheech *et al.*, 2010). The promising two out of four hybrids in respect of seed yield per plant also showed significant positive heterosis over their respective better parent.

The negative heterobeltiosis expressed by a number of crosses for characters such as days to 50 per cent flowering, days to 50 per cent maturity of primary spike, plant height up to primary spike and number of nodes up to primary spike demonstrated that hybrids were superior to the parents for these traits and heterotic effects were in the desirable direction.

Several hybrids (figures in parenthesis) exhibited significant heterosis over better parent and standard heterosis in desirable direction for different component traits. The best two hybrids on the basis of significant positive standard heterosis were VP 1 x ANDCM 2 and SKP 84 x ANDCM 2 per cent over GCH7.

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