➔DOI : 10.15740/HAS/AJBS/10.2/158-161
e ISSN-0976-8343 | ■ Visit us : *www.researchjournal.co.in*
ASIAN JOURNAL OF BIO SCIENCE
Volume **10** | Issue 2 | October, 2015 | 158-161

RESEARCH **P**APER

Heterosis studies for grain yield and it's contributing traits in fieldpea [*Pisum sativum* (L.) var *arvense*.]

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Article Info : Received : 11.10.2014; Revised : 29.08.2015; Accepted : 15.09.2015

A field experiment was conducted to study the extent of heterosis in fifty five genotypes of fieldpea including ten parents and their forty five F_1's developed through half diallel mating design. Based on overall study of forty five hybrids for heterobeltiosis and economic heterosis the cross HUDP 954 x LFP 477 followed by HFP-4 x IPFD 10-13 and IPFD-1-10 x LFP 477 were found best heterotic combinations for yield and its contributing traits *viz.,* number of pods per plant, number of seeds per pod, number of primary branches, test weight and harvest index in fieldpea. These crosses could be exploited for isolating useful transgressive segregants in fieldpea.

Key words : Heterosis, Heterobeltiosis, Fieldpea

How to cite this paper : Joshi, D.J., Ravindrababu, Y., Patel, A.M. and Chauhan, S.S. (2015). Heterosis studies for grain yield and it's contributing traits in fieldpea [*Pisum sativum* (L.) var *arvense*.]. *Asian J. Bio. Sci.*, **10** (2) : 158-161.

INTRODUCTION

Fieldpea [*Pisum sativum* (L.) *var arvense*.] is an important *Rabi* pulse crop grown in India. Two types of peas are generally cultivated, *i.e.*, one is the fieldpea [*Pisum sativum* (L.) var arvense] and other is gardenpea [*Pisum sativavum* (L.) var hortens]. Fieldpea is generally used as a pulse crop and gardenpea as vegetable. Dry pea seed is valued primarily for the nutritional quality. Pea protein (19-27 %) is low in sulphur-containing amino acids, cysteine and methionine, but rich in lysine and other essential amino acids. Among the states, fieldpea is grown in Punjab, J & K, Himachal Pradesh, UP, Bihar, West Bengal, Assam, Rajasthan, Maharashtra and Madhya Pradesh. It is cultivated only as vegetable crop in north and middle parts of Gujarat. The scope for exploiting hybrid vigour in highly self- pollinated crops like fieldpea depends upon the direction and magnitude of heterosis. Present study was, thus, conducted to determine heterosis for yield and its contributing traits in fieldpea.

RESEARCH METHODOLOGY

The experimental material comprised of fifty five fieldpea genotypes including ten parents *viz.*, DF-1, HFP-4, HUDP 954, KPMR 400, HFP 715, Pant P 167, IPFD-1-10, LFP 477, IPFD 10-13, and GCO-703 and their forty five F_1's developed through half diallel mating design. The experimental material was grown in Randomized Block Design with three replications with 45 x 10 cm row to row and plant to plant spacing, respectively during *Rabi*, 2012 at Centre of Excellence for Research on Pulses, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. All the management practices were followed as per recommendations to raise the normal crop. The observations were recorded on five randomly selected plants from each genotype in each replication for six grain yield and its contributing

characters *viz.*, number of pods per plant, number of seeds per pod, number of primary branches per plant, test weight and harvest index in Fieldpea. Different types of heterosis, *i.e.* heterosis over better parent (heterobeltiosis) and heterosis over standard parent (economic or standard heterosis) were estimated using mean values according to Fonseca and Petterson (1968) and Meredith and Bridge (1962), respectively.

RESEARCH FINDINGS AND ANALYSIS

The details about range of heterosis, number of significant hybrids and best heterotic combinations for grain yield and its contributing traits are given in Table 1.

For grain yield per plant wider range of heterobeltiosis (-58.82 to 130.82) and standard heterosis (-72.61 to 39.24) was recorded. Out of forty five hybrids nineteen and seven crosses were found significantly superior for better and standard parent heterosis, respectively. Based on the overall heterotic performance for grain yield per plant the cross HUDP 954 x LFP 477 followed by IPFD-1-10 x LFP 477 and HUDP 954 x Pant P 167 were adjudged as best combinations for heterobeltiosis. On the other hand for standard heterosis the cross IPFD-1-10 x LFP 477 and HUDP 954 x Pant P 167 were found best among all the hybrids. These findings are in close agreement with the report of Lejeune-Henaut *et al.* (1992), Punia *et al.* (2011) and Singh *et al.* (2012).

In case of number of pods per plant a broad range of heterobeltiosis (-48.96 to 132.38) and standard heterosis (-63.54 to 27.08) was recorded. Out of forty five hybrids thirteen and one crosses were found significantly superior for better and standard parent heterosis, respectively. Based on the overall heterotic performance for number of pods per plant the cross HFP-4 x HFP 715 followed by IPFD-1-10 x IPFD 10-13and IPFD-1-10 x LFP 477 were adjudged as best combinations for heterobeltiosis. On the other hand for standard heterosis the cross HFP-4 x HFP 715 was found best among all the hybrids. These findings are in close agreement with the report of Karnwal and Kushwaha (2010); Punia *et al*. (2011) and Sharma and Lila Bora (2013).

Number of seeds per pod also depicted great range of heterobeltiosis (-51.85 to 35.29) and standard heterosis (-51.85 to 18.52). Out of forty five hybrids one cross was found significantly superior for better parent heterosis and none for standard parent heterosis. Based on the overall heterotic performance for number of seeds per pod the cross HFP-4 x LFP 477 was adjudged as best combinations for heterobeltiosis. On the other hand for standard heterosis the cross HFP 715 x IPFD-1-10 was found best among all the hybrids. These findings are in close agreement with the report of Borah (2009), Punia *et al*. (2011) and Kosev *et al*. (2012).

Table 1 : Heterobeltiosis, standard heterosis and best heterotic combinations for grain yield and its contributing traits in fieldpea.

Sr. No.	Traits	Range		No. of significant hybrids		Best heterotic combinations	
		Hetero-beltiosis (BP)	Standard heterosis (SC)	Hetero-beltiosis (BP)	Standard heterosis (SC)	Heterobeltiosis (BP)	Standard heterosis (SC)
1.	Grain yield per plant (g)	-58.82 to 130.82	-72.61 to 39.24	19	7	HUDP 954 x LFP477 Pant P 167 x GCO-703 HFP-4 x IPFD 10-13	IPFD-1-10 x LFP 477 HUDP 954 x Pant P 167 HFP-4 x Pant P 167
2.	Number of pods per plant	-48.96 to 132.38	-63.54 to 27.08	13	1	HFP-4 x HFP715 IPFD-1-10 x IPFD 10-13 IPFD-1-10 x LFP477	HFP-4 x HFP 715
3.	Number of seeds per pod	-51.85 to 35.29	-51.85 to 18.52	1	1	HFP-4 x LFP 477	HFP 715 x IPFD-1-10
4.	Number of primary branches	-22.33 to 40.78	-36.89 to 46.78	4	4	IPFD 10-13 x GCO-703 IPFD-1-10 x LFP477 DF-1 x Pant P 167	IPFD 10-13 x GCO-703 IPFD-1-10 x LFP 477 HFP-4 x IPFD-1-10
5.	Test weight (g)	-34.15 to 28.93	-34.15 to 13.28	2	2	HUDP 954 x KPMR 400 HFP 715 x GCO-703	LFP477 x GCO-703 HUDP 954 x KPMR 400
6.	Harvest Index (%)	-60.37 to 113.05	-71.03 to 40.10	13	8	LFP477 x IPFD 10-13 HUDP 954 x GCO-703 DF-1 x IPFD-1-10	DF-1 x IPFD-1-10 LFP 477 x IPFD 10-13 DF-1 x HFP-4

Number of primary branches showed good amount of range of heterobeltiosis (-22.33 to 40.78) and standard heterosis (-36.89 to 46.78). Out of forty five hybrids four and four crosses were found significantly superior for better and standard parent heterosis, respectively. Based on the overall heterotic performance for number of primary branches the cross IPFD 10-13 x GCO-703 followed by IPFD-1-10 x LFP 477 and DF-1 x Pant P 167 were adjudged as best combinations for heterobeltiosis. On the other hand for standard heterosis the cross IPFD 10-13 x GCO-703 followed by IPFD-1-10 x LFP 477 and HFP-4 x IPFD-1-10 was promising among all the hybrids. Similar findings were also reported by Lejeune-Henaut *et al*. (1992); Karnwal and Kushwaha (2010); Punia *et al*. (2011) and Sharma and Lila Bora (2013) in fieldpea.

In case of test weight higher range was observed for heterobeltiosis (-34.15 to 28.93) and standard (-34.15 to 13.28) heterosis. Among all the hybrids two and two crosses were found significantly superior for better and standard parent heterosis, respectively. The cross HUDP 954 x KPMR 400, and HFP 715 x GCO-703 showed best performances for heterobeltiosis. However, the cross LFP 477 x GCO-703 and HUDP 954 x KPMR 400 were also good for standard heterosis. Similar findings were also reported by Ercan Ceyhan *et al*. (2008) and Borah (2009) in fieldpea.

For harvest index wider range of heterobeltiosis (-60.37 to 113.05) and standard heterosis (-71.03 to 40.10) was recorded. Out of forty five hybrids thirteen and eight crosses were found significantly superior for better and standard parent heterosis, respectively. Based on the overall heterotic performance for harvest index the cross LFP 477 x IPFD 10-13 followed by HUDP 954 x GCO-703 and DF-1 x IPFD-1-10 were adjudged as best combinations for heterobeltiosis. On the other hand for standard heterosis the cross DF-1 x IPFD-1-10 followed by LFP 477 x IPFD 10-13 and DF-1 x HFP-4 were found promising among all the hybrids. Such types of findings were also reported by Punia *et al*. (2011) and Singh *et al.* (2012) in for one or more aforesaid characters in fieldpea.

Based on overall study of forty five hybrids for better parent (heterobeltiosis) and standard parent heterosis (economic or standard heterosis) the cross HUDP 954 x LFP 477 followed by HFP-4 x IPFD 10-13 and IPFD-1-10 x LFP 477 were found best heterotic combinations for yield and its contributing traits *viz.*, number of pods per plant, number of seeds per pod, number of primary branches, test weight and harvest index in fieldpea. In the present study, for almost all the characters varying number of crosses depicted heterosis in both positive and negative directions indicating that, genes with negative and positive effects or a complementary type of gene interaction or simply correlated gene distribution may seriously inflate the mean degree of dominance and convert partial dominance in to apparent over dominance (Hayman, 1957). Since fieldpea is highly self-pollinated crop and in absence of economical methods of large scale grain production the exploitation of heterosis is not possible. However, selection pressure can be applied in segregating generations to isolate pure lines having better performance.

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