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Performance of Garden Pea Progenies for their Growth and Yield Characteristics in Mid Hills of Himachal Pradesh

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Abstract

Low genetic diversity acts as a major bottleneck in garden pea breeding and diverse parents are required to generate new genetic material. In the present investigation, fifteen hybrids were developed during 2014-15 by utilizing five lines (Line 12, Line 13, Line 14, Line 15 and Line 17) and three testers (Matar Ageta, Palam Triloki and Arkel) and, were evaluated along with their parents following randomized complete block design during 2015-16. Same material was evaluated in F_2 during 2016-17. Observations were recorded for pod yield and related horticultural traits on ten randomly selected plants. On the basis of mean performance, cross line 17×Palam Triloki showed significantly best results for early traits viz., first flowering and days to 50% flowering. For pod yield, best cross was line 17×Arkel in F_1. While in F_2 generation, mean performance for first picking observed best for cross line 13×Palam Triloki. For pod yield, best cross was line 17×Palam Triloki. Mean pod yield plant^{-1} as exhibited by cross line 17×Palam Triloki was highest. Thus, cross line 17×Palam Triloki was superior in pod yield as compared to parents involved.

Keywords: Agronomic performance, garden pea, mean value

1. Introduction

Garden pea (*Pisum sativum* L.; 2n=2x=14), a member of family Leguminaceae, is one of the principal vegetable crops which is cultivated for its green pods in the temperate and sub-tropical areas of the world. It is the second most important food legume worldwide after *Phaseolus vulgaris* (Jaiswal et al., 2015). Blixt (1970) indicated Mediterranean region as its principal centre of genetic diversity while the Near East and Ethiopia as its secondary habitats.

The success of any breeding programme depends upon the genetic variability present in the germplasm (Adunga and Labuschange, 2003) which provides better chances of selecting desirable types. Therefore, the genetic reconstruction of pea germplasm is first step to identify the potential genotypes for use in breeding programme. In early group of peas, only three varieties have been recommended, thus the farmers of the state have limited choice. Few early lines have been recovered in the previous study on RIL population of a cross, NDVP-250×Palam Priya. A line×tester analysis was done to determine the genetic interactions in the expression of earliness and various pod characters including pod yield. Line×tester mating design was proposed by Kempthorne (1957), offer means of obtaining useful information on differential parental combinations through an assessment of overall genetic architecture of the parental lines, in relation to the characters studied.

2. Materials and Methods

The experiment was conducted for three consecutive years *viz.*, 2014-15, 2015-16 and 2016-17 at Vegetable Research Farm of the Department of Vegetable Science and Floriculture, CSK HPKV, Palampur (H.P.), India. The experimental material consisted of 21 genotypes (Table 1 and 2), including five parental lines (Line 12, Line 13, Line 14, Line 15 and Line 17), three testers (Matar Ageta, Palam Triloki and Arkel) and their 15 crosses. The parents along with the hybrids were evaluated along with one standard check; Palam Triloki in randomized block design with three replications in 2014-15 with row to row and plant to plant spacing of 45 cm (in parents 30 cm) and 10 cm respectively. Each experimental plot was of 3×1.8 m^2 size accommodating 6 rows. The promising genotypes were selected and evaluated along with three checks; Matar Ageta, Palam Triloki and Arkel in randomized block design with three replications during *rabi*, 2016-17. Ten plants per genotype per replication were randomly selected for recording the observations at appropriate stages of crop growth during both the seasons on characters *viz*., days to 50% flowering, days to first picking, pod length, pods plant, seeds pod^{-1}, pod yield

Table 1: List of lines (female parents) and testers (male parents)

Sl. No	Code. No	Name	Source
a) Female parents			
1.	L_{12}	Line 12	CSKHPKV Palampur
2.	L_{13}	Line 13	CSKHPKV Palampur
3.	L_{14}	Line 14	CSKHPKV Palampur
4.	L_{15}	Line 15	CSKHPKV Palampur
5.	L_{17}	Line 17	CSKHPKV Palampur
b) Male parents			
1.	T_1	Matar Ageta	IARI, New Delhi
2.	T_2	Palam Triloki	CSKHPKV, Palampur
3.	T_3	Arkel	PAU, Ludhiana

Table 2: List of progenies

Sl. No.	Code no.	Name of F_2 progenies
1.	$L_{12}\times T_1$	12×Matar Ageta
2.	$L_{12}\times T_2$	12×Palam Triloki
3.	$L_{12}\times T_3$	12×Arkel
4.	$L_{13}\times T_1$	13×Matar Ageta
5.	$L_{13}\times T_2$	13×Palam Triloki
6.	$L_{13}\times T_3$	13×Arkel
7.	$L_{14}\times T_1$	14×Matar Ageta
8.	$L_{14}\times T_2$	14×Palam Triloki
9.	$L_{14}\times T_3$	14×Arkel
10.	$L_{15}\times T_1$	15×Matar Ageta
11.	$L_{15}\times T_2$	15×Palam Triloki
12.	$L_{15}\times T_3$	15×Arkel
13.	$L_{17}\times T_1$	17×Matar Ageta
14.	$L_{17}\times T_2$	17×Palam Triloki
15.	$L_{17}\times T_3$	17×Arkel

plant^{-1}, shelling percentage, primary branches plant^{-1}, plant height and total soluble solids. The data were analysed for randomized block design given by Panse and Sukhatme (1984). The mean values of both the generation for each trait were subjected to statistical analysis using the model suggested by Kempthorne (1957) and Singh and Chaudhary (1977).

3. Results and Discussion

Analysis of variance for genotypes under study revealed significant differences among the parents for all the traits except for harvest duration in F_1 and for pods per plant, pod yield per plant and shelling percentage in F_2. This indicated that parents used in present study were genetically diverse. Gupta and Singh (2004) have reported similar results.

In F_1, when comparison was done between best cross combination and the parents involved for earliness, it was observed that for days to first picking, mean value observed for cross line 17×Palam Triloki was 116.67, which was a week earlier than parents involved (Table 3) (mean value of 123.67 was exhibited by line 17 and Palam Triloki). Mean value of cross combination line 17×Palam Triloki for days to 50% flowering was 84 as compared to 89 (mean value exhibited by both line 17 and Palam Triloki), which clearly indicates earliness of the cross.

For pod yield, best cross was line $17\times T_1$, with mean value of 44.43 for number of pods per plant, while it was just 14.40 for line 17 and 12.67 for Arkel. Mean pod yield per plant as exhibited by cross line $17\times T_1$ was 192.20 g, while it was only 69.23 g for line 17 and 60.60 g for Arkel. Thus, cross line $17\times T_1$ was superior in pod yield as compared to parents involved. While in F_2 when comparison was done between best cross combination and the parents involved for earliness, it was observed that for days to first picking, mean value observed for cross L_{13}×Palam Triloki was 108 days, which was 1.67 days (Table 4) later than the parent, Palam Triloki (106.33) and was ten days earlier than Line 13 (119.33). Mean value of cross combination L_{13}×Palam Triloki for days to 50% flowering was 69.67 days as compared to 90 and 69.33 (mean value exhibited by both line 13 and Palam Triloki respectively), which clearly indicates earliness of the cross. For pod yield, best cross was L_{17}×Palam Triloki, with mean value of 26.72 for number of pods per plant, while it was just 16.52 for line 17 and 15.22 for Palam Triloki.

The availability of early pea cultivars in the market fetches better prices due to less supply and high demand. Thus, '17×Palam Triloki' was the most desirable genotype for early maturity among the other recommended genotypes. For improving garden pea, wide variations for pod length, seeds per plant, pods per plant and pod yield per plant are needed along with superior lines in hybridization programme (Katoch et al., 2016). Mean pod yield plant^{-1} as exhibited by cross L_{17}×Palam Triloki was 134.61 g (Table 4), while it was only

Table 3: Mean performance of parents

Characters→	Days to 50% flowering	Days to first picking	Pod length (cm)	Pods plant^{-1}	Seeds pod^{-1}	Pod yield plant^{-1} (g)	Shelling percentage (%)	Primary branches plant^{-1}	Plant height (cm)	TSS (°brix)
L_{12}	84.67	119.00	8.53	17.21	5.47	90.85	51.04	1.48	48.35	17.63
L_{13}	90.00	119.33	7.76	19.39	5.24	101.61	50.17	1.71	51.36	15.20
L_{14}	88.67	120.00	8.61	18.18	5.80	91.26	48.42	2.23	63.59	17.53
L_{15}	86.67	120.00	8.54	19.80	5.60	98.15	50.01	2.02	55.18	17.80
L_{17}	88.33	127.33	8.23	16.52	5.50	83.54	52.39	2.20	52.37	18.27
T_1	84.33	119.00	7.98	13.55	4.90	67.57	48.54	1.41	39.89	17.80
T_2	69.33	106.33	8.44	15.22	5.98	75.25	51.15	2.30	55.91	18.07
T_3	91.33	123.33	8.12	16.30	6.72	83.75	50.13	2.13	62.23	17.33
Mean	85.42	119.29	8.28	17.02	5.65	86.50	50.23	1.94	53.61	17.45
Range lowest	69.33	106.33	7.76	13.55	4.90	67.57	48.42	1.41	39.89	15.20
Range highest	91.33	127.33	8.61	19.80	6.72	101.61	52.39	2.30	63.59	18.27
SEm±	1.54	2.88	0.18	1.83	0.29	9.34	0.99	0.16	3.38	0.42
CD (*p*=0.05)	4.39	8.20	0.52	5.20	0.83	26.62	2.82	0.46	9.62	1.21
CV (%)	8.12	5.01	3.70	12.33	9.64	13.16	2.65	18.27	14.17	5.48

Table 4: Mean performance of F_1 and F_2 progenies

Crosses	Days to 50% flowering		Days to first picking		Pod length (cm)		No. of pods plant^{-1}		No. of seeds plant^{-1}	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
$L_{12}\times T_1$	93.67	90.33	127.67	118.33	6.83	8.68	20.97	19.24	8.33	5.87
$L_{12}\times T_2$	88.33	71.67	121.33	114.00	8.27	8.62	24.37	19.10	8.17	6.00
$L_{12}\times T_3$	91.00	92.00	123.00	123.33	7.50	8.70	22.10	19.40	7.77	6.60
$L_{13}\times T_1$	94.67	86.33	128.33	119.00	6.90	8.63	13.63	15.20	7.13	6.13
$L_{13}\times T_2$	97.00	69.67	127.67	108.00	6.77	7.95	23.87	23.34	6.60	4.30
$L_{13}\times T_3$	93.33	90.08	127.67	117.33	6.93	8.09	26.00	19.67	6.67	6.23
$L_{14}\times T_1$	85.33	88.00	121.33	115.00	7.10	7.94	10.43	11.16	6.03	5.82
$L_{14}\times T_2$	87.00	80.33	121.33	111.67	8.30	7.90	19.60	13.57	8.00	5.13
$L_{14}\times T_3$	88.00	98.00	121.33	119.33	8.07	7.91	12.00	12.12	7.00	5.37
$L_{15}\times T_1$	96.00	86.00	127.67	114.00	6.50	8.04	32.17	19.53	5.67	5.23
$L_{15}\times T_2$	93.33	79.33	127.67	112.00	6.37	7.67	25.73	15.52	6.00	5.57
$L_{15}\times T_3$	90.00	92.00	127.00	123.33	6.57	7.89	17.47	14.12	6.10	5.90
$L_{17}\times T_1$	95.33	70.67	127.67	112.00	6.63	8.18	44.43	24.36	7.07	5.37
$L_{17}\times T_2$	84.00	82.33	116.67	111.00	6.53	8.45	30.87	26.72	6.07	5.77
$L_{17}\times T_3$	96.67	93.00	127.67	123.67	6.30	8.71	28.50	23.48	6.97	6.63
Range	84.00 to 97.00	69.67 to 98.00	116.67 to 128..33	108.00 to 123.67	6.30 to 8.30	7.67 to 8.71	10.43 to 44.43	11.16 to 26.72	5.67 to 8.33	4.30 to 6.63
SEm±	2.14	1.54	5.15	2.88	0.21	0.18	1.58	1.83	0.23	0.29
CD (*p*=0.05)	4.52	4.39	10.89	8.20	0.44	0.52	3.34	5.20	0.49	0.83
CV (%)	2.86	3.14	5.00	4.25	6.96	3.86	8.80	17.63	5.11	8.81

Table 4: Continue...

Crosses	Pod yield plant^{-1} (g)		Shelling percentage (%)		Primary branches plant^{-1}		Plant height (cm)		TSS (°Brix)	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
$L_{12}\times T_1$	90.53	101.95	39.53	54.04	1.87	1.90	55.77	51.90	17.10	17.70
$L_{12}\times T_2$	110.87	101.17	57.87	50.52	1.80	2.10	63.77	50.69	17.67	18.93
$L_{12}\times T_3$	95.00	101.90	42.80	51.23	2.07	1.76	64.17	47.59	15.93	17.40
$L_{13}\times T_1$	83.53	75.07	30.87	52.89	1.60	1.86	65.57	47.63	15.90	18.10
$L_{13}\times T_2$	100.00	111.34	37.63	45.38	1.80	1.64	68.20	56.98	16.77	19.17
$L_{13}\times T_3$	104.20	100.77	38.60	52.66	2.00	2.13	69.13	57.91	16.47	17.80
$L_{14}\times T_1$	60.00	55.78	37.57	51.59	1.20	1.49	60.90	48.75	16.20	18.13
$L_{14}\times T_2$	81.13	69.91	54.90	50.06	2.00	1.73	65.30	53.24	16.13	17.20
$L_{14}\times T_3$	53.07	59.58	45.20	47.71	1.33	1.67	67.40	60.61	16.03	16.87
$L_{15}\times T_1$	147.33	97.23	34.77	52.26	2.20	2.00	69.87	45.15	15.80	18.40
$L_{15}\times T_2$	102.63	85.30	36.57	49.37	1.87	2.27	65.00	57.60	16.13	18.27
$L_{15}\times T_3$	68.60	76.09	42.63	51.50	1.60	1.84	63.67	47.53	16.07	17.00
$L_{17}\times T_1$	192.20	109.51	43.33	53.38	2.47	1.72	76.03	48.75	16.40	17.80
$L_{17}\times T_2$	140.23	134.61	41.60	50.35	2.00	2.43	66.67	65.13	17.20	16.53
$L_{17}\times T_3$	88.70	119.21	37.63	50.75	2.13	1.50	74.30	56.19	16.00	17.47
Range	53.07 to 192.20	55.78 to 134.61	30.87 to 57.87	45.38 to 54.04	1.20 to 2.47	1.49 to 2.43	55.77 to 76.03	45.15 to 65.13	15.80 to 17.67	16.53 to 19.17
SEm±	6.70	9.34	1.73	0.99	0.16	0.16	3.36	3.38	0.22	0.42
CD (p=0.05)	8.17	26.62	3.65	2.82	0.34	0.46	7.08	9.62	0.27	1.21
CV (%)	8.62	17.79	3.67	3.38	10.80	14.64	6.14	10.98	7.27	4.16

83.54 g for line 17 and 75.25 g for Palam Triloki. Thus, cross $L_{17}\times$Palam Triloki was superior in pod yield as compared to parents involved.

4. Conclusion

From the present study it is concluded that, for pod yield, best cross was $L_{17}\times T_2$, with mean value of 26.72 for number of pods plant^{-1}. Mean pod yield plant^{-1} as exhibited by cross $L_{17}\times T_2$ was 134.61 g, whereas in F_1 line $17\times T_1$, with mean value of 30.87 for number of pods plant^{-1} was the best. Thus, crosses $L_{17}\times T_1$ and $L_{17}\times T_2$ were superior in pod yield as compared to parents involved both in F_1 and in F_2, respectively.

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