Horticultural Evaluation of Garden Pea Germplasm under Humid Sub-temperate Environment of Northwestern Himalaya

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Identification of new promising genotypes is essential for boosting the production and productivity of a crop. Involving seventy-five progenies or test cultures with five checks in augmented block design by replicating checks after 15 test cultures carried out the present investigation. The observations were recorded on ten horticultural traits viz., days to first flowering, days to first picking, pod length (cm), seeds/ pod, shelling percentage, total soluble solids (%), plant height (cm), branches/ plant, pods /plant and pod yield/ plant (g). Significant differences between the checks and the test culture genotypes were observed for all the traits studied except for days to first flowering, shelling percentage and TSS. Amongst the test cultures, PMR 10 and JP Plufela were found to be the high yielding. Similarly, JI 2432, VP 8005, JI 2436 and Arkel were observed as early maturing genotypes with good pod length, total soluble solids, shelling percentage and fairly high yield.

Key words: *Pisum sativum* L., Augmented design, Germplasm screening, Economic traits

Garden pea (*Pisum sativum* L.) is an important leguminous vegetable crop that provides us proteins and other valuable health building substances. It is a winter season crop of tropical and subtropical areas. However, in temperate and sub-temperate regions, it is cultivated during summer months. Evaluation of germplasm is important to identify horticulturally superior genotypes for utilization in breeding programmes or used as such as varieties in their own right after conducting preliminary yield evaluation trials. While evaluating a large array of germplasm, limited homogeneous land block is always a bottleneck; therefore such large collections cannot be accommodated in randomized block design due to soil heterogeneity. However, Federer (1956) proposed Augmented design to surmount this problem (Sharma, 1998). Therefore, the present investigation was aimed to identify promising genotypes having high yield and other desirable horticultural traits from 75 genotypes/breeding lines of garden pea developed/ introduced at Palampur, Himachal Pradesh for assessing their breeding potential in mid hills of sub-temperate zone of northwestern Himalaya.

Materials and Methods

The experimental material for the present investigation was comprised of eighty entries involving 75 progenies or test cultures and 5 checks. These progenies were grown in five blocks, each block accommodating 15 test cultures and 5 checks during cool season of 2004-05 at Vegetable Research Farm, Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh. The checks were repeated in all the five blocks. Two rows of each entry were sown with inter- and intra-row spacing of 45 cm and 10 cm, respectively. A recommended package of local practices followed for the crop included the application of 20 tonnes farmyard manure; 50 kg N: 60 kg P; and 60 kg K per hectare at the time of field preparation prior to seed sowing. Sufficient moisture was maintained during the crop growth span by applying irrigation at fortnightly interval. Besides two earthing ups were carried out at monthly intervals during early crop growth to check weeds and ensure better plant root aeration. The observations were recorded on five randomly selected plants of each genotype for days to first flowering, days to first picking, pod length (cm), seeds/pod, shelling percentage, total soluble solids (%), plant height (cm), branches/plant, pods /plant and pod yield/plant (g). The data was analysed by following standard procedure of Federer (1956).

Results and Discussion

The analysis of variance (Table 1) revealed that the block effects ignoring treatments were significant for days to first picking, pods per plant, seeds per pod, shelling percentage and plant height, while the effects eliminating treatments were significant for only three traits viz., pod length, seeds per pod and branches per plant. The mean squares due to the entries were significant for days to first flowering, pod length, seeds per pod and plant height irrespective of the fact whether the analysis was done eliminating or ignoring the treatments, thereby indicating the significant differences for these traits among the

Table 1. Analysis of variance for horticultural traits in garden pea

	Source of variation							
	Blocks ignoring treatments	Blocks eliminating treatments	Entries ignoring blocks	Entries eliminating blocks	Checks	Test cultures	Check Vs test cultures	Error
df	4	4	79	79	4	74	1	16
Trait								
Days to first flowering	90.61*	17.74	83.61*	87.55*	5.44	90.99*	161.32*	15.44
Days to first picking	95.91	55.74	63.91	65.94	40.14	67.12	82.03	40.54
Pod length (cm)	4.44*	0.82*	0.70*	0.89*	0.13	0.86*	6.18*	0.25
Seeds / pod	4.00*	0.90*	0.68*	0.83*	0.08	0.73*	11.21*	0.15
Shelling percentage	104.15*	43.67	22.04	25.10	4.95	26.40	9.30	16.26
Total Soluble Solids (%)	5.72	4.67	2.68	2.73	0.94	2.75	9.33	2.95
Plant height (cm)	401.38*	79.31	236.14*	252.45*	90.44	260.51*	304.25*	51.74
Branches / plant	0.14	0.19*	0.08	0.08	0.23*	0.06	0.27*	0.05
Pods /plant	16.46*	1.63	6.16	6.91	4.70	6.64	35.71*	5.43
Yield / plant (g)	355.15	76.31	169.96	184.07	19.43	157.58	2803.59*	235.06

*Significant at P=0.05

Table 2. Mean performance of test cultures and checks for pod yield and related horticultural traits in garden pea

S.No.	Entry	Days to first flowering	Days to first picking	Pod length (cm)	Seeds/ pod	Shelling (%)	Total soluble solids (%)	Plant height (cm)	Branches/ plant	Pods/ plant	Pod Yield/ plant (g)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	DPP 9411	91	126	6.8	4.0	40.00	14.0	49.00	1.4	5.6	21.6
2	DPP 9414	100	132	7.2	4.2	44.20	16.4	33.60	1.8	4.8	19.8
3	DPP 9415-1	80	126	7.0	3.2	37.50	15.0	32.40	1.8	7.6	32.4
4	DPP 13	95	132	6.6	2.6	47.14	17.2	27.00	1.4	8.0	21.0
5	DPP 13-1	93	126	6.4	2.5	45.00	14.0	73.00	1.0	5.6	23.1
6	DPP 13-2	93	139	6.3	3.0	43.50	16.5	65.80	1.0	5.4	13.5
7	DPP 19	94	126	6.8	3.5	45.00	18.0	42.40	1.8	4.4	12.6
8	DPP 25G	94	147	6.4	3.6	42.00	15.0	17.40	1.0	4.0	15.0
9	DPP 54	99	126	6.5	3.2	42.00	20.0	51.60	1.2	4.8	15.0
10	DPP 62	94	126	7.4	4.2	50.00	20.0	37.00	1.6	9.2	36.0
11	DPP 80	94	126	6.1	4.2	43.00	16.0	22.4	1.0	3.2	10.2
12	DPP 89	87	126	8.1	3.6	46.67	18.0	47.20	1.2	8.8	50.0
13	DPP100	102	126	6.7	3.5	40.00	18.0	21.20	1.2	6.8	31.8
14	DPP102	94	139	5.3	3.0	42.00	16.5	77.4	1.2	3.6	9.69
15	DPP-102-1	94	126	5.8	4.0	40.00	18.0	51.6	1.2	3.6	10.8
16	DPP 107	94	132	5.7	3.5	43.50	15.4	71.20	1.0	7.0	21.0
17	DPP 107-1	99	139	6.8	3.6	42.00	16.0	44.40	1.0	5.4	17.1
18	DPP 120	94	132	7.0	4.0	43.00	16.4	73.00	1.4	8.0	25.2
19	DPP 127W	102	132	5.5	3.0	41.00	16.0	46.40	1.2	2.4	7.2
20	DPP 362	94	126	6.5	2.8	46.67	20.0	17.60	1.0	8.0	22.5
21	EC 381854	93	126	4.2	2.3	40.00	17.0	37.40	1.0	5.0	12.0
22	EC 381855	91	126	5.5	3.0	41.20	18.0	44.40	1.4	2.0	7.2
23	EC 381856	90	126	7.0	3.5	42.00	16.4	38.80	1.2	3.2	10.8
24	EC 381857	94	126	6.5	3.2	40.00	19.0	33.40	1.0	5.6	16.2
25	EC 381858	93	126	6.4	3.0	50.00	20.0	20.20	1.4	4.8	15.6
26	EC 381860	98	126	7.5	3.1	43.50	18.0	20.40	1.0	5.6	22.8
27	EC 381865	93	126	6.4	3.0	45.00	17.0	32.80	1.2	6.0	21.0
28	EC 381856-1	93	126	5.9	2.7	38.00	19.0	30.60	1.0	7.2	16.2
29	EC 381866	89	126	5.8	2.6	40.00	17.0	21.00	1.0	2.4	8.4
30	NDVP 9	93	130	7.5	4.5	45.00	18.5	25.20	1.0	6.2	30.9
31	NDVP 10A	93	126	8.5	6.0	44.50	20.0	40.20	1.0	3.2	17.4
32	NDVP 10B	94	132	6.6	2.4	40.00	13.5	26.80	1.0	4.4	13.2
33	NDVP 250	103	132	8.3	4.0	42.86	16.2	35.20	1.4	8.4	28.2
34	VP 8005	71	126	9.3	4.4	45.45	20.2	35.80	1.0	4.8	44.4
35	Green Pearl	99	132	8.4	5.5	50.00	15.4	47.60	1.2	4.0	27.6
36	KT 8	101	126	7.5	4.7	41.67	19.0	41.00	1.2	4.8	15.0
37	GC 477	98	126	7.6	4.2	40.00	20.0	46.60	1.6	10.4	43.2
38	Arka Ajit	89	126	8.9	4.0	42.00	18.0	36.20	1.4	6.8	30.0
39	KS 245	98	147	7.1	3.5	43.00	16.5	46.80	1.2	4.0	12.0
40	MA-6	65	126	7.1	4.2	40.00	19.0	23.00	1.0	3.2	15.0

Contd.

Table 2. (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
41	C-400A	94	147	7.0	3.6	42.00	17.5	18.4	1.2	2.0	6.0
42	Arkel	73	126	6.7	3.8	41.57	20.0	31.8	1.0	8.0	31.8
43	FC 2	98	126	6.5	3.6	42.00	18.0	40.0	1.6	9.2	31.8
44	JI 2432	67	126	9.1	5.6	58.33	18.0	22.4	1.0	4.4	34.8
45	KS 268	103	147	6.8	3.4	46.00	16.5	36.8	1.4	8.8	36.0
46	PB 29B	93	126	6.4	4.8	41.67	16.0	32.2	1.0	6.0	22.8
47	S 143	94	126	6.0	3.2	40.00	18.0	31.8	1.4	6.0	19.2
48	JI 2431	97	126	6.8	3.0	47.00	17.0	32.6	1.0	4.4	21.6
49	JI 1766	103	147	6.9	3.1	45.50	16.0	35.2	1.2	7.6	27.0
50	C 96	80	126	7.2	3.0	42.00	18.0	36.0	1.2	7.2	22.8
51	JI 2439	71	126	6.9	3.6	37.78	18.0	22.6	1.0	5.0	15.0
52	JI 2436	73	126	6.6	1.6	37.50	16.5	33.8	2.0	12.1	46.2
53	JP Afila	98	132	6.0	2.4	38.00	15.7	23.2	1.4	6.0	22.2
54	Acacia	98	132	5.8	2.5	42.00	14.8	89.8	1.2	9.6	33.6
55	JP Plufela	99	126	5.6	2.7	40.00	18.0	59.0	1.2	14.0	63.6
56	JP 501-Ak	109	147	5.3	2.0	38.00	16.0	61.6	1.8	5.0	12.0
57	JP 20	98	147	6.1	3.0	40.00	16.1	38.6	1.0	5.0	18.0
58	JP 15	111	147	6.4	2.2	35.50	16.0	61.0	1.2	6.0	12.0
59	JP 141	103	132	6.5	2.6	37.00	15.0	64.6	2.0	6.6	9.9
60	JP 825	90	126	5.7	2.8	38.57	19.0	66.4	1.4	6.8	20.4
61	T 10V	98	132	5.6	2.1	35.00	16.5	74.2	1.4	5.4	10.8
62	Green Arran	100	147	5.2	2.3	34.50	16.0	43.4	1.0	2.0	6.0
63	JP 625	107	147	5.1	1.8	33.33	15.2	48.00	1.2	5.0	9.0
64	JM 1	99	147	6.2	2.7	40.00	16.5	36.80	1.0	4.4	15.0
65	Lincoln (Bilaspur)	108	147	6.3	3.0	41.67	16.2	51.80	1.2	7.6	21.0
66	Bonneville	82	147	7.3	4.1	42.50	17.0	59.20	1.0	12.4	36.0
67	PM2	99	126	6.4	3.0	41.57	16.2	32.33	1.0	4.8	20.4
68	SL 82	99	126	5.7	2.2	38.00	16.0	28.40	1.6	5.6	14.4
69	PMR 4	101	147	6.0	2.8	40.00	16.5	33.60	1.0	6.8	18.0
70	VL 7	102	126	6.3	2.0	40.00	20.2	18.60	1.0	5.0	23.7
71	PMR 10	102	126	6.2	3.2	42.00	20.2	40.60	1.4	14.4	67.8
72	Pb 29G	93	126	6.0	3.6	37.77	19.0	29.20	1.4	5.0	15.0
73	Pb 88	98	126	6.6	3.3	39.50	19.0	32.00	1.0	5.6	19.8
74	PMR 21	93	126	6.0	3.8	36.84	19.0	37.80	1.0	4.0	15.6
75	Triton RS 497	70	126	6.1	3.7	41.50	20.0	38.60	1.2	5.2	20.1
	CHECKS										
C1	Palam Priya	100.2	128.40	7.6	3.6	46.67	18.4	34.6	1.8	12.0	63.6
C2	VL 8	92.6	126.50	7.0	3.6	46.90	18.0	48.4	1.4	9.6	48.6
C3	VL 3	100.4	132.0	6.7	4.2	50.00	14.4	38.0	1.8	6.4	28.2
C4	Azad Pea 1	95.6	126.0	7.6	4.6	40.00	19.0	45.0	1.2	9.2	49.2
C5	Lincoln	95.4	126.0	7.1	4.0	45.00	16.2	31.0	1.2	7.2	39.6
CD1	Between two check means	4.34	7.03	0.55	0.43	4.45	1.90	8.02	0.25	2.58	16.93
CD2	Between two means in same block	9.70	15.72	1.23	0.96	9.96	4.24	17.76	0.55	5.77	37.86
CD3	Between two means in different blocks	10.63	17.22	1.35	1.05	10.91	4.65	19.46	0.60	6.32	41.47
CD4	Between test culture and check mean	8.23	13.34	1.05	0.81	8.45	3.60	15.07	0.47	4.89	32.12

Significant at P=0.

entries (75 test cultures and 5 checks). Significant variability among different genotypes for various horticultural traits in peas has been reported earlier also by Ramesh *et al.* (2002), Kumar and Jain (2003), Sharma *et al.* (2003) and Singh *et al.* (2003).

The checks varied for number of branches per plant. Palam Priya and VL 3 showed significantly higher values (1.8) for this trait, while Azad P-1 and Lincoln both had significantly lowest number of branches per plant (1.2).

The progenies or test cultures exhibited significant mean squares for four traits namely, days to first flowering, pod length, seeds per pod and plant height. Single degree freedom analysis for checks *vs.* test cultures showed significant mean squares for all the traits studied

except for days to first flowering, shelling percentage and total soluble solids. Thus, it revealed that there were significant differences between the checks and the test culture genotypes for almost all the traits.

The mean values among the test cultures ranged from 65 days (Matar Ageta-6) to 111 days (JP 15) for days to first flowering, 126 days (in 45 test cultures) to 147 (in 14 test cultures) for days to first picking, 6.0 (C 4000A and Green Arran) to 67.8g (PMR 100) for pod yield per plant, 2.0 (C 400 A and Green Arran) to 14.4 (PMR 100) for number of pods per plant, 4.2cm (EC 381854) to 9.35cm (VP 8005) for pod length, 1.6 (JI 2436) to 6.0 (NDVP 10 A) for seeds per pod, 33.33 (JP 625) to 58.33 % (JI 2432) for shelling percentage, 13.5 (NDVP 10 B) to 20.2% (PMR 10, VP 8001 and VL 7) for TSS and 17.40 (DPP 25 G) to 89.8 cm (Acacia) for plant height. These results further corroborate the findings of Sureja and Sharma (2000), Kumar and Jain (2003), Sharma *et al.* (2003) and Singh and Dhillon (2004) for majority of the horticultural traits.

On the basis of present study, the test culture PMR 10 was found to be the highest yielder (67.8g) followed by JP Plufela (63.6g) and DPP 89 (50.0g), though they were late maturing. Matar Ageta-6, JI 2432, Triton RS 497, JI 2436, JI 2439, VP 8005 and Arkel were found to be early maturing genotypes, of which JI 2432, VP 8005, JI 2436 and Arkel were also found to be promising with respect to high yield, pod length, total soluble solids and shelling percentage.

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