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Phenotypic stability in late season garden pea

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Abstract

Stability parameters along with *per se* performance of 7 varieties/lines of mid season pea varieties were worked out for seven yield related characters in three environments under late sown conditions. Highly significant differences were observed among the genotypes for yield/plot, days to 50% flowering, pod length, pod breadth, seed number/pod, 100-green seed weight and shelling percentage. However, non significant G x E (linear) interaction for all the characters and highly significant pooled deviation for all the traits except pod breadth indicated preponderance of nonlinear component of G x E interaction. KS-225 was the best performer, stable and suitable for favourable environments under late sown conditions for green pod yield and suitable for unfavourable environments for pod length and pod breadth. DRP-3 was the earliest in flowering, stable and suitable for favourable environments. KS-226 was better performing, stable and suitable for unfavourable environments regarding pod breadth and seed number/pod. VL-3 and JP-83 were better performers, stable and suitable for unfavourable environments regarding seed number/ pod.

Key words: Garden pea, *Pisum sativum,* G x E interaction, environment, late season, stability, pod yield

Introduction

Garden pea (*Pisum sativum* L.) is one of the most important leguminous vegetables grown in plateau region of Bihar. The availability of green pods in the market late in the season *i.e.*, in February-March would be possible only by growing the varieties suitable for late sowing *i.e.*, the end of November and successful development of flowers and pods under late season conditions. With this objective in mind, the present study was undertaken to identify stable and high yielding garden pea varieties/lines suitable for late sowing through stability analysis.

Materials and methods

Seven improved lines/varieties of garden pea (Table 3) were sown at the end of November as a late sown crop during 1994-95, 1995-96 and 1997-98. Experiment on each environment (year) was conducted in a randomised block design with three replications. The plot size was 3 x 2 m with a spacing of 30 x 10 cm. Data on days to 50% flowering and green pod yield were recorded on plot basis and randomly selected 10 pods from each replication were used for recording pod length, pod breadth, seed number/pod, 100-green seed weight and shelling percentage. The data were analysed for stability parameters based on Eberhart and Russel (1966) model.

Results and discussion

The analysis of variance of pooled data (Table 1) revealed high and significant differences among the genotypes tested in all the environments for all the attributes studied. However, stability analysis of variance of mean data suggested significant differences among the genotypes for days to 50% flowering, pod length, pod breadth, seed number/pod and 100green seed weight (Table 2). Significant differences among the genotypes were also observed for days to 50% flowering and 100-green seed weight by Krishna Prasad *et al.* (1994 a,b) and for pod length and seed number/pod by Gupta *et al.* (1998) in stability analysis of pea genotypes. The environment + (genotype x environment) interactions were significant for all the characters when tested against pooled error, which satisfied the requirement of stability analysis *i.e.*, the genotypes interacted considerably with the environments in the expression of the characters studied. Highly significant mean squares due to environment (linear) for all the characters indicated considerable differences among the environments and their predominant effects on the characters studied. This was due to variations in weather conditions during different years and locations. The linear components of genotype x environment interactions were non significant, when tested against pooled deviation for all the characters, which indicated that the genotypes responded non-linearly to the change in environment. The mean sum of squares for pooled deviation was significant/highly significant against pooled error for all the characters, which confirmed the role of unpredictable component towards the differences in stability of the genotypes. However, for unpredictable traits, prediction can still be made on considering stability parameters of individual genotypes (Singh *et al.,* 1991).

KS-225 recorded the maximum green pod yield (5.2 kg) and highly significant bi values > 1 and near zero s^2di value which indicated its high stability and adaptation to specific favourable environments for yield (Table 3). This coroborate with the Eberhart and Russel (1966) suggestion for an ideal variety.

The genotype DRP-3 took the least number of days (60.8) for flowering and recorded bi value > 1 and very low s^2di (-0.27) value which indicated its high stability and adaptation to specific favourable environments. KS-225 recorded the maximum pod length (9.2 cm) with bi value = -1 and zero s^2di value which suggested its high stability and adaptation under unfavourable environments. KS-226 though recorded higher pod length value (9.1 cm) than general mean (8.1 cm) but with highly significant s^2di value indicated its instability for pod length. KS-225 and KS-226 recorded the maximum pod breadth (1.4 cm), less than unity bi value and zero s^2di value which indicated their high stability and adaptation to unfavourable environments. KS-226

Table 1. Stability analysis of variance of pooled data for seven characters in peas

Sources	df	Mean sum of squares						
		Green pod yield/plot	Days to 50% flowering	Pod length	Pod breadth	Seed number per pod	100-green seed weight	Shelling percentage
Varieties	6	4.34**	110.56**	4.53**	0.037**	6.75**	290.26**	201.83**
Locations	2	95.42**	57.62**	5.53**	0.446**	0.47	295.68**	331.20**
Varieties x Locations	12	1.62*	34.95**	0.01	0.034**	0.59**	74.19**	255.22**
Error	42	0.71	1.52	0.09	0.006	0.17	1188	17.63

Table 2. Stability analysis of variance of mean data for seven characters in peas

Sources	df	Mean sum of squares						
		Green pod yield/plot	Days to 50% flowering	Pod length	Pod breadth	Seed number per pod	100-green seed weight	Shelling percentage
Genotypes	6	1.44	36.85*	1.81**	0.012**	2.25**	96.75*	67.27
Environment + (Var x Env.)	14	5.00**	12.73**	0.26**	0.011**	0.19*	35.28**	88.69**
Environment (L)	1	53.10**	38.41**	1.86**	0.121*	0.30*	197.11**	211.39**
Variety x Environment (L)	1	2.14	16.52	0.14	0.004	0.17	24.59	13.40
Pooled deviation	7	0.58**	5.81	0.14**	0.001	0.19**	21.32**	135.69**
Pooled error	42	0.23	0.50	0.03	0.002	0.05	4.62	5.87

Table 3. Stability parameters for yield and its contributing factors in peas

Genotype	Greenpod yield/plot			Days to 50% flowering			Pod length		
	X	bi	s^2 di	X	bi	s^2 di	X	bi	s^2 di
DRP-3	3.9	0.90	-0.22	60.8	2.00	-0.27	7.7	1.21	0.04
VL-3	4.3	0.47*	0.55	63.4	0.12*	0.65	7.8	1.18	-0.01
Jp-83	4.7	1.50	0.78*	71.4	-0.48*	0.79	7.9	1.32	-0.03
KS-226	3.5	0.64	-0.09	63.7	4.12**	9.95*	9.1	1.69	0.49**
KS-225	5.2	1.75**	0.02	67.0	1.58**	11.81**	9.2	-0.56**	-0.01
Bonneville	3.8	1.34	1.53**	65.0	-0.98*	12.26	7.6	1.33	0.22**
HC-30+36	3.2	0.41*	-0.13	62.3	0.63*	1.95*	7.1	0.83**	0.10*
G. Mean	4.1	-	-	64.8	-	-	8.1	-	-
SE (bi)	-	0.28	-	-	1.03	-	-	0.74	-

Genotype	Pod breadth			Seed number/ pod			100-green seed wt.			Shelling percentage		
	X	bi	s^2 di	X	bi	s^2 di	X	bi	s^2 di	X	bi	s^2 di
DRP-3	1.30	1.35	0.001	5.9	3.46**	0.30*	34.9	-0.38*	-2.31	55.3	0.90*	39.76**
VL-3	1.20	0.92	-0.001	6.5	0.56*	0.12	34.4	0.53*	-0.80	56.7	1.56*	-5.87
Jp-83	1.30	1.36	-0.002	6.4	-0.98*	-0.04	38.6	0.33*	-4.37	54.2	0.06*	44.78**
KS-226	1.40	0.40*	-0.002	6.9	0.77**	-0.05	41.6	1.71	34.16	51.2	1.10*	60.13**
KS-225	1.40	0.57	-0.001	6.5	-1.62*	0.68**	50.3	0.83**	31.63**	55.9	0.99*	1.24
Bonneville	1.30	1.83**	0.004	4.9	1.08*	-0.03	43.4	1.69	61.93**	54.3	0.36*	3.87
HC-30+36	1.20	0.57	-0.002	4.6	3.74**	-0.06	36.3	2.28	-3.37	66.2	2.02*	764.78**
G. Mean	1.30	-	-	5.9	-	-	39.9	-	-	56.2	-	-
SE (bi)	-	0.29	-	-	2.11	-	-	0.87	-	-	2.12	-

*significant at 5% level, ** significant at 1 % level

(6.9), VL-3 (6.5) and JP-83 (6.4) recorded higher seed number/ pod than the general mean (5.9), significant bi value < 1 and very low s^2di values which indicated their high stability and adaptation to poor management conditions for seed number/pod. KS-225 (50.3 g), Bonneville (43.4 g) and KS-226 (41.6 g) though recorded 100-green seed weight higher than general mean (39.9 g) but their performance regarding this character was unpredictable as they showed highly significant/non significant and very high s^2di values.

HC 30+36 though recorded the maximum value (66.2) of shelling percentage but its performance for this trait was unpredictable as it showed highly significant and very high s^2di value.

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