Assessment of Genetic Variability, Correlation and Path Coefficient Analysis for Yield and Yield Attributing Traits in Field Pea (*Pisum sativum* var. *arvense* L.)

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Abstract: ***Genetic variability, correlation and path coefficient analysis were studied in a set of 21 genotypes of Field pea (Pisum sativum var. arvense L.) grown at field experimentation center of Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. The experiment was conducted during Rabi 2020-21 in a randomized block design with three replications. Observations on five randomly selected plants in each genotype from each replication were recorded for twelve quantitative traits. Analysis of variance revealed that significant genotypic differences for all the characters under study and a wide range of variation was apparent for all the characters. High genotypic and phenotypic variances were observed for plant height (cm), days to maturity and days to fifty percent pod setting. The genotypic coefficient of variation was highest for plant height (cm) followed by biological yield (gm), number of primary branches and number of pods per plant. Heritability with high genetic advance was observed for plant height (cm) followed by biological yield (gm) and number of primary branches. Correlation analysis revealed that grain yield was positively and significantly correlated with biological yield (gm), days to maturity, plant height (cm), and number of days to fifty percent pod setting. Pod length (cm) had negative association with grain yield (gm). Path coefficient analysis indicated highest positive direct effect for biological yield (gm), harvest index and fifty percent flowering on grain yield. Days to maturity and plant height have direct negative effect on grain yield (gm).***

Keywords: Genetic variability, heritability, genetic advance, correlation analysis, path coefficient

1. Introduction

Pea (*Pisum sativum* L.) is a leguminous plant of sub family papilionoidea and belongs to the general class of Dicotyledons. Pea consists of chromosome number 2n=14. Pea is a popular pulse crop and is second most important food legume of the world. Pea is native of south Western Asia and is widely grown in temperate countries. It is essentially a cold weather crop and can withstand light frost. Two types of peas are generally cultivated, i.e. one is Field Pea (*Pisum sativum* L. var *arvense)* and the other one is Garden Pea (*Pisum sativum* L. var *hortense*). Field pea is generally used as pulse crop and Garden Pea as vegetable. It is a winter crop and grown as mixed /inter crop with Wheat and Barley.

Pea germinates in a hypogeal fashion with the cotyledon remaining below the ground surface. Plant is semi-erect, but when a support is available it has a tendency to climb with their tendril. Pea is a self-pollinated crop. The attempt for the improvement and extent of potential gain achieved in this crop has been very much limited as compared to the other crops. Low production in peas is primarily due to poor productivity potentials of the present varieties

Pea is highly nutritive and it contains relatively higher protein content (20-25%), starch (20-50%), sugars (4-10%), fat (06 to 1.5 %), cellulose (2-10%), minerals (4%), water (9-15%) in their seed. Pulses are rich in lysine but deficient in Sulphur containing amino acids like methionine and cysteine.

In India, the cultivation of Pea is about 0.76 million hectares with a total production of 0.84 million tonnes with a productivity of 1100 kg/ha (Annual report, 2019). Low production in peas is primarily due to poor productivity potentials of the present varieties. Therefore, understanding of yield and its component attributes is very much essential for improving the genetic potential of crop plants. The development of high yielding varieties with good processing quality is of immense importance. Therefore, understanding of yield and its component attributes is very much essential for improving the genetic potential of crop plants. The development of high yielding varieties with good processing quality is of immense importance.

2. Background of the Research

For crop improvement, variability is prime requirement in any crop. Therefore, assessing the extent of genetic variation present in breeding material, a knowledge of genetic parameters such as genotypic coefficient of variability, heritability and expected genetic advance are required in genetic improvement of crop yield. A dependent character is the resultant effect of a number of quantitative characters. The study of association between pairs of these characters and yield provides basis for the further breeding plans. In order to have a clear picture of the direct and indirect effect relationship need to be studied through path coefficient analysis.

Heritability (bs) is a good genetic parameter of the transmission of the characters from parents to their off-springs (Falconer, 1981), whereas the genetic advance is the measure of genetic gain under selection. Thus, genetic advance denotes the improvement in the mean phenotypic value of the selected population. Heritability estimates along with genetic advance are more beneficial in yield improvement that can be made in a crop by selecting elite genotypes for various yield related characters.

The estimation of the correlation analysis is usually helps in finding out the phenotypic yield characters which are closely associated with seed yield of individual genotype. Estimation of correlation coefficient analysis among the yield contributing variables are useful during selection and would maximize yield in the shortest period of time. Correlation coefficient between a pair of characters is either positive or negative and high or low. This value indicates the relative importance of characters on which greater emphasis should be made during selection for yield. However, as a number of variables in the correlation study increase, the direct and indirect association between yield and a particular component character becomes complex. The selection efficiency is based on the association between yield traits that can be enhanced by ascertaining direct and indirect effects of component traits over the expression of seed yield per plant using path coefficient analysis. Wright (1921) gave description and a technique of path coefficient analysis, which provides an effective measure of direct and indirect association of characters contributing to seed yield. It determines the cause and effect relationship and has been found useful in partitioning the correlation coefficient into its direct and indirect effects contributing to yield. Dewey and Lu (1959) first applied the technique of path coefficient analysis in a plant breeding program.

3. Materials and Methods

Twenty one genotypes of Pea (*Pisum sativum*var. *avense* L.) were evaluated for different component analysis during *Rabi* 2020-21 at Experimental Research Farm, SHUATS. Genetic variability, Correlation and Path coefficient studies were carried out to understand the importance of one character/trait over other, influencing pod yield. The experimental material was sourced from IIHR, Bangalore and IIVR, Varanasi. The experiment was laid out in completely Randomized Block Design with twenty one treatments and three replications. The observations were recorded on five plants selected at random treatment in each replication.The observations were recorded for twelve quantitative characters viz., days to fifty percent flowering, days to fifty percent pod setting, plant height(cm), number of branches per plant, number of pods per plant, number of seeds for pod, pod length(cm), number of days to maturity, biological yield(gm), seed index, harvest index and seed yield per plant. Observations were recorded in the field at the appropriate developmental stages of plant growth and morphological characters.

The mean values of five randomly selected observational plants for twelve different characters were used for statistical analysis. The following statistical parameters were calculated for presentation of data on different quantitative attributes:

1) Analysis of Variance (**Fisher, 1936**)
2) Genetic variability (**Burton, 1952**)
    a) Genotypic Coefficient of Variation (**GCV**)
    b) Phenotypic Coefficient of Variation (**PCV**)
3) Heritability (broad sense) **(Burton and Devane,1953)**
4) Genetic advance **(Johnson *et al.* 1955)**
5) Genotypic and phenotypic correlation **(AI Jibouri *et al.*, 1958**)
6) Path coefficient Analysis **(Dewey and Lu.,1959)**

4. Results and Discussion

Genetic Variability:
The analysis of variance (Table 1) revealed that highly significant differences among genotypes for all the characters under investigation indicating the presence of considerable amount of variability in the experimental material. Naturally there is ample scope for improving different characters including seed yield, provided material is subjected to judicious selection pressure. A wide range of phenotypic variation was observed in respect of plant height, days to maturity, days to fifty percent pod setting and days to fifty percent flowering.

These findings corroborated with number of workers for different characters like wide range of variability for plant height (Singh, 1985, Singh *et al.*, 1993, Singh *et al.*, 1996, Tiwari *et al.*, 2001 and Tyagi and Shrivastava, 2002), for pod yield and other traits (Singh *et al.*, 1995) and for all other characters (Partap *et al.*, 1992). Tyagi *et al.* (1997) observed significant differences for all attributes except pod length and harvest index. The same trend was also observed by Kumar *et al.* (1998).The variation was low in respect of number of primary branches, number of seeds per pod and pod length. Similar results were also reported for seeds per pod (Singh *et al.*, 1993) and for pod length (Tyagi *et al.*, 1997).

Components of variance
The genotypic and phenotypic components of variability were high for plant height, days to maturity, number of days to fifty percent pod setting and days to 50%flowering (Table 2). Similar findings were also reported by different workers. Singh *et al.*, (1993) found greatest genotypic variability for plant height. Sureja and Shanna (2000) observed considerable genetic variability for yield component characters.

Moderate estimates of the genotypic and phenotypic variances were observed for harvest index and biological yield. Low estimates of genotypic and phenotypic variances were observed for number of primary branches per plant, number of seeds per pod, pod length and number of pods per plant. Similar results were obtained for seeds per pod (Singh *et al.*, 1993) and for pod length (Tyagi *et al.*, 1997).

Coefficient of variation
A better index for measuring the genetic variability is genetic coefficient of variation as described by Burton (1952) to compare the genetic variability present in different characters.

The highest genotypic and phenotypic coefficient of variation was observed for plant height, indicating that selection of this character will be much more effective.

However, number of primary branches per plant, number of pods per plant, pod length, grain yield per plant and harvest index exhibited moderate values of genotypic and phenotypic coefficient of variation, whereas, days to maturity, number of seeds per pod, days to fifty percent flowering and days to fifty percent pod setting had lower values suggesting that these characters are more influenced by environment and therefore the selection of these characters will not be much effective.

In the present study the differences between PCV and GCV was relatively low for most of the characters, suggesting that improvement by phenotypic selection is possible. This finding was also supported by Koria and Singh (1988) who reported by low genetic coefficient of variation for seeds per pod and shelling percentage. Kumar *et al.* (1997) observed high GCV and PCV for partitioning index, straw yield and biological yield. A number of workers have reported high values of PCV and GCV for plant height (Tyagi *et al.*, 1997, Kumar *et al.*, 1998and Vikas and Singh, 1999).

It is not possible to determine the amount of variability which is heritable, with the help of genetic coefficient of variation alone. Burton (1952) also suggested that genetic coefficient of variation together with heritability estimates would give a better idea about the amount of genetic advance to be expected from selection.

Heritability (Broad sense) and genetic advance

An insight into the magnitude of variability present in a crop species is of at most importance as it provides the basis for the effective selection.

In crop improvement, only the genetic components of variation are important since only these components are important in transitions to the next generation. Heritability indicates the effectiveness with which selection of genotypes could be based on phenotypic performance. This could be achieved through the estimates of heritability and genetic gain under selection.

The heritability estimates were quiet high for the characters viz., days to 50% flowering, days to maturity, plant height and days to maturity. These findings are in agreement with the results obtained for plant height (Singh, 1985, Tyagi *et al.*, 1997, Kumar *et al.*, 1998 and Vikas and Singh, 1999), for days to maturity and plant height (Singh *et al.*, 1993), for all characters (Singh, 1995) for days to 50% flowering (Gupta *et al.*,. 1998). Sharma *et al.* (2003) observed high heritability for all the traits except days to maturity.

The traits viz., plant height, days to 50% flowering, pods per plant and days to maturity displayed high to moderate heritability estimates along with high to moderate GCV indicating their reliability for selection of genotypes.

Shift in gene frequency towards superior side under selection pressure is termed as genetic advance and is generally expressed as percentage of mean (Genetic gain). Johnson *et al.* (1955) found it more useful to estimate heritability values together with genetic advance in predicting the ultimate choice of the best genotype by selection. However, high genetic gain along with high heritability showed most effective condition for selection.

In present investigation, high heritability estimates coupled with high genetic advance was observed for plant height. This result confirmed the finding of Vikas *et al.* (1996), Kumar *et al.* (1997) and (1998), Vikas and Singh (1999), Mahanta *et al.* (2001). High heritability coupled with moderate genetic advance was recorded for days to 50% flowering, pod length, number of pods per plant, number of seeds per pod and harvest index. High heritability with low genetic advance was observed for days to fifty percent pod setting, days to maturity and seed index.

The overall discussion on variability parameters revealed that the characters plant height, days to 50% flowering and days to maturity shown substantial to high genetic variability in the genotypes studied. This variability was due to moderate to high differences in the genetic makeup of genotypes and ·were controlled by additive gene effects. Further, the above mentioned characters also exhibited higher genetic gain revealing response to selection. Therefore, selection practiced on these characters would lead to an improvement.

Correlation Coefficient Analysis

In breeding crops for higher yield, it is imperative to obtain information regarding the interrelationship of different plant characters with yield and among themselves, since it facilitates the quicker assessment of high yielding genotypes in selection programme. Estimation of any phenotypic correlation coefficient is not sufficient to fully evaluate the association between characters as it is the result of interaction between the genotype and environment. The real association could be known only through genotypic correlation which eliminates the environmental influence. Hence, in the present investigation the genotypic and phenotypic correlation coefficients were worked out between grain yield and other component characters.

Present results indicate that the values of genotypic correlation were slightly higher than their phenotypic correlation (Table 4). This indicated that though there was a high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment.

Grain yield per plant showed positive and highly significant correlation with days to maturity, plant height, and number of pods per plant, number of primary branches per plant at both genotypic and phenotypic levels.

A number of workers also reported similar genotypic and phenotypic association for different characters with grain yield like days to maturity(Singh, 1985, Tyagi and Shrivastava, 2002), plant height (Singh, 1985,Singh and Malik, 1994, Sharma *et al.,1997,* Tyagi *et al.*, 1997, Kumar *et* aL1998, Sharma and Kalia, 1998), Tiwari *et al.,* 2001, Tyagi and Shrivastava,2002), number of primary branches per plant (Singh, 1985, Shrivastava and Singh, 1989, Mahanata *et al.*, 2001 and Singh *et al.*, 2002), pod length (Singh and Malik, 1994, Shanna *et al.*, 1997,Kumar *et al.*, 1998, Shanna and Kalia, 1998, Shinde *et al.*, 1998 and

Shanna *et al.*, 2003). However, grain yield per plant was non-significantly and negatively correlated with pod length.

If the genetic correlation is high, the two characters can be regarded as being substantially the same and if there are no special circumstances affecting the heritability of the intensity of selection, it will make difference in which environment the selection is carried out.

In the present investigation of inter relationship, it can be presumed that for improving grain yield in field pea an ideal plant type would be tall with early maturity, more number of pods, more number of branches and high pod length. Hence, these characters could be utilized as selection criteria for improving grain yield.

Path Coefficient Analysis

In correlation programme when less variables are considered correlation study can serve the purpose. However, when the number of variables increases the situation becomes complex. For overcoming this complexity, path analysis (Wright, 1921 and Dewey and Lu, 1959) is valuable in the sense that through this technique it becomes possible to judge relative contribution of various component characters to seed yield in term of direct and indirect effects. The analysis of correlation coefficient together with information on path analysis helps considerably in identification of suitable characters for proper weightage to be given during selection. To achieve a clear cut picture of interrelationship of various component characters with yield, direct and indirect effects were calculated using path coefficient analysis at genotypic level.

In the present investigation, the highest positive direct effect on grain yield was recorded for biological yield followed by days to maturity, plant height, days to fifty percent pod setting and number of primary branches. Similar results have been reported by Singh (1986) for number of primary branches per plant, Shah *et al.* (1992) for plant height, Verma (1993) for days to maturity, biological yield and seeds per pod.

An important consideration for formulating the path diagram is that all the important causal factors affecting the grain yield are included. Since, yield is a very complex character being affected by so many factors, it might not be feasible to include all the characters. Under these circumstances, provision is made for a residual path which will take care of all such factors excluded. In the study the residual effect at genotypic level was 0.182 which suggested that there might be few more component traits responsible to influence the grain yield per plant than those studied for the improvement of the grain yield.

Emphasis should be made on yield contributing characters which are influencing it directly or indirectly. In the present study overall picture of path analysis revealed that for improving grain yield in field pea, weightage in selection should be given to more number of pods, more seed weight, more branches and more seeds per pod.

Table 1: Analysis of variance for 12 characters in 21 genotypes of Pea

S. No	Character	Mean Sum of Squares		
		Replication (d.f=2)	Treatment (d.f=20)	Error (d.f=40)
01	Days to 50% flowering	0.683	178.854 ***	0.949
02	Days to 50% pod setting	4.429 **	246.871 ***	0.829
03	Plant height (cm)	53.907	2026.068 ***	26.401
04	Number of Primary Branches	0.004	0.420 ***	0.003
05	Pod length (cm)	0.007	8.699 ***	0.112
06	Number of pods per plant	0.439	24.046 ***	1.686
07	Number of seeds per pod	0.041	3.058 ***	0.222
08	Days to maturity	1.254	574.730 ***	1.071
09	Biological Yield (gms)	3.176	179.157 ***	1.806
10	Harvest Index (%)	5.133	121.862 ***	2.839
11	Seed Index (gms)	0.463	9.486 ***	0.359
12	Grain Yield Per Plant (gms)	0.692 **	9.324 ***	0.132

** Significance at 1 % level of significance *** Significance at 0.1% level of significance

Table 2: Mean, Range, GCV, PCV, Heritability, Genetic advance and Genetic advance as (%) of Mean

S. No	Character	Mean	Range		GCV	PCV	h^2 (bs) (%)	GA	GA as % mean
			Lowest	Highest					
1	Days to 50% flowering	49.73	40.00	68.00	15.485	15.609	98.4	15.738	31.647
2	Days to 50% pod setting	85.10	71.00	101.00	10.642	10.696	99	18.562	21.813
3	Plant height (cm)	75.85	49.27	125.87	34.04	34.707	96.2	52.162	68.773
4	Number of primary branches	1.26	1.00	2.00	29.574	29.903	97.8	0.759	60.251
5	Pod length (cm)	8.48	4.77	10.40	19.951	20.338	96.2	3.419	40.318
6	Number of pods per plant	10.53	6.37	18.33	25.93	28.714	81.6	5.079	48.237
7	Number of seeds per pod	6.80	4.87	8.47	14.305	15.898	81	1.802	26.516
8	Days to maturity	115.75	99.33	138.00	11.947	11.98	99.4	28.407	24.542
9	Biological yield (gm)	23.45	13.58	36.21	32.787	33.884	97	15.602	66.533
10	Harvest index (%)	29.32	19.31	47.70	21.482	22.237	93.3	12.535	42.751
11	Seed Index (gm)	23.48	21.00	28.00	7.43	7.856	89.4	3.398	14.475
12	Grain yield per plant (gm)	6.62	4.34	10.03	26.453	27.017	95.9	3.53	53.353

Table 3: Phenotypic correlation coefficient for yield contributing traits of Field Pea

	Days to 50% flowering	Days to 50% pod setting	Plant height	Number of Primary Branches	Pod length	Number of pods per plant	Number of seeds per pod	Days to maturity	Biological Yield	Harvest Index	Seed Index	Grain yield per plant
Days to 50% flowering	1	0.9234 ***	0.8059 ***	0.4183 ***	-0.5690 ***	0.4408 ***	-0.3988 **	0.8889 ***	0.5787 ***	-0.1258	-0.2224	0.532**
Days to 50% pod setting		1	0.7234 ***	0.6197 ***	-0.4458 ***	0.4647 ***	-0.3004*	0.8982 ***	0.6324 ***	-0.1696	-0.1473	0.561**
Plant height			1	0.3313 **	-0.6189 ***	0.6218 ***	-0.2674*	0.8113 ***	0.7961 ***	-0.3727 **	-0.2611 *	0.609**
Number of Primary Branches				1	-0.1375	0.4957 ***	-0.1024	0.5791 ***	0.5672 ***	-0.1928	0.0394	0.546**
Pod length					1	-0.5964 ***	0.6470 ***	-0.6091 ***	-0.4124 ***	0.2816 *	0.6321 ***	-0.19
Number of pods per plant						1	-0.2704*	0.6166 ***	0.4974 ***	-0.2043	-0.4051 ***	0.403**
Number of seeds per pod							1	-0.3111 *	-0.1389	0.2282	0.4796 ***	0.0817
Days to maturity								1	0.7320 ***	-0.2586 *	-0.3550 **	0.631**
Biological Yield									1	-0.5813 ***	-0.1285	0.750**
Harvest Index										1	0.2344	0.0563
Seed Index											1	0.0645
Grain yield per plant												1

Table 4: Genotypic correlation coefficient for yield contributing traits of Field Pea

	Days to 50% flowering	Days to 50% pod setting	Plant height	Number of Primary Branches	Pod length	Number of pods per plant	Number of seeds per pod	Days to maturity	Biological Yield	Harvest Index	Seed Index	Grain yield per plant
Days to 50% flowering	1	0.932**	0.825**	0.430**	-0.584**	0.501**	-0.457**	0.901**	0.595**	-0.129	-0.2442	0.553**
Days to 50% pod setting		1	0.743**	0.629**	-0.460**	0.518**	-0.339**	0.906**	0.643**	-0.1686	-0.1589	0.579**
Plant height			1	0.340**	-0.643**	0.648**	-0.313*	0.828**	0.801**	-0.388**	-0.279*	0.611**
Number of Primary Branches				1	-0.1365	0.537**	-0.1247	0.586**	0.572**	-0.1952	0.0324	0.560**
Pod length					1	-0.679**	0.677**	-0.624**	-0.424**	0.298*	0.690**	-0.1934
Number of pods per plant						1	-0.361**	0.682**	0.522**	-0.258*	-0.446**	0.398**
Number of seeds per pod							1	-0.357**	-0.1624	0.254*	0.530**	0.0801
Days to maturity								1	0.741**	-0.266*	-0.377**	0.644**
Biological Yield									1	-0.589**	-0.1457	0.761**
Harvest Index										1	0.269*	0.0335
Seed Index											1	0.0648
Grain yield per plant												1

Table 5: Phenotypic path coefficient analysis showing direct and indirect effect of twelve characters on yield contributing traits of Field Pea

	Days to 50% flowering	Days to 50% pod setting	Plant height	Number of Primary Branches	Pod length	Number of pods per plant	Number of seeds per pod	Days to maturity	Biological Yield	Harvest Index	Seed Index	Grain yield per plant
Days to 50% flowering	**0.3744**	0.3457	0.3017	0.1566	-0.213	0.165	-0.1493	0.3328	0.2167	-0.0471	-0.0833	0.532**
Days to 50% pod setting	-0.3412	**-0.3695**	-0.2673	-0.229	0.1647	-0.1717	0.111	-0.3319	-0.2337	0.0627	0.0544	0.561**
Plant height	-0.1683	-0.151	**-0.2088**	-0.0692	0.1292	-0.1298	0.0558	-0.1694	-0.1662	0.0778	0.0545	0.609**
Number of Primary Branches	0.0231	0.0342	0.0183	**0.0552**	-0.0076	0.0274	-0.0056	0.032	0.0313	-0.0106	0.0022	0.546**
Pod length	-0.0623	-0.0488	-0.0678	-0.0151	**0.1095**	-0.0653	0.0708	-0.0667	-0.0452	0.0308	0.0692	-0.19

Number of pods per plant	0.0238	0.0251	0.0336	0.0268	-0.0322	**0.0541**	-0.0146	0.0333	0.0269	-0.011	-0.0219	0.403**
Number of seeds per pod	-0.0209	-0.0157	-0.014	-0.0054	0.0339	-0.0142	**0.0524**	-0.0163	-0.0073	0.012	0.0251	0.0817
Days to maturity	0.0191	0.0193	0.0174	0.0124	-0.0131	0.0132	-0.0067	**0.0215**	0.0157	-0.0056	-0.0076	0.631**
Biological Yield	0.7698	0.8412	1.059	0.7545	-0.5486	0.6616	-0.1848	0.9737	**1.3302**	-0.7732	-0.1709	0.750**
Harvest Index	-0.0914	-0.1233	-0.2709	-0.1402	0.2047	-0.1485	0.1659	-0.188	-0.4226	**0.727**	0.1704	0.0563
Seed Index	0.0062	0.0041	0.0072	-0.0011	-0.0175	0.0112	-0.0133	0.0098	0.0036	-0.0065	**-0.0277**	0.0645
Grain yield per plant	0.5323	0.5613	0.6085	0.5457	-0.19	0.4031	0.0817	0.6308	0.7495	0.0563	0.0645	**1**
Partial R^2	0.1993	-0.2074	-0.127	0.0301	-0.0208	0.0218	0.0043	0.0135	0.997	0.0409	-0.0018	

Table 6: Genotypic path coefficient analysis showing direct and indirect effect of twelve characters on yield contributing traits of Field Pea

	Days to 50% flowering	Days to 50% pod setting	Plant height	Number of Primary Branches	Pod length	Number of pods per plant	Number of seeds per pod	Days to maturity	Biological Yield	Harvest Index	Seed Index	Grain yield per plant
Days to 50% flowering	**0.7795**	0.7268	0.6431	0.3351	-0.4554	0.3909	-0.3565	0.7027	0.4639	-0.1006	-0.1904	0.553**
Days to 50% pod setting	-0.4886	**-0.524**	-0.3893	-0.3296	0.2408	-0.2714	0.1775	-0.4749	-0.3368	0.0883	0.0833	0.579**
Plant height	-0.3274	-0.2948	**-0.3969**	-0.1349	0.2553	-0.2572	0.124	-0.3284	-0.3178	0.1538	0.1108	0.611**
Number of Primary Branches	0.0257	0.0376	0.0203	**0.0597**	-0.0081	0.032	-0.0074	0.035	0.0341	-0.0117	0.0019	0.560**
Pod length	-0.0756	-0.0594	-0.0832	-0.0177	**0.1293**	-0.0879	0.0875	-0.0807	-0.0548	0.0385	0.0892	-0.1934
Number of pods per plant	0.0765	0.079	0.0989	0.0819	-0.1037	**0.1526**	-0.0551	0.104	0.0797	-0.0393	-0.0681	0.398**
Number of seeds per pod	-0.069	-0.0511	-0.0471	-0.0188	0.1021	-0.0544	**0.1508**	-0.0539	-0.0245	0.0383	0.08	0.0801
Days to maturity	-0.1562	-0.1571	-0.1434	-0.1016	0.1082	-0.1181	0.0619	**-0.1733**	-0.1284	0.0461	0.0653	0.644**
Biological Yield	0.8564	0.9249	1.1525	0.8229	-0.6101	0.7517	-0.2337	1.0661	**1.4391**	-0.8475	-0.2096	0.761**
Harvest Index	-0.089	-0.1163	-0.2673	-0.1347	0.2055	-0.1777	0.175	-0.1835	-0.4062	**0.6898**	0.1854	0.0335
Seed Index	0.0203	0.0132	0.0232	-0.0027	-0.0573	0.0371	-0.0441	0.0313	0.0121	-0.0223	**-0.0831**	0.0648
Grain yield per plant	0.5527	0.5787	0.6107	0.5597	-0.1934	0.3977	0.0801	0.6443	0.7605	0.0335	0.0648	**1**
Partial R^2	0.4309	-0.3033	-0.2424	0.0334	-0.025	0.0607	0.0121	-0.1116	1.0944	0.0231	-0.0054	

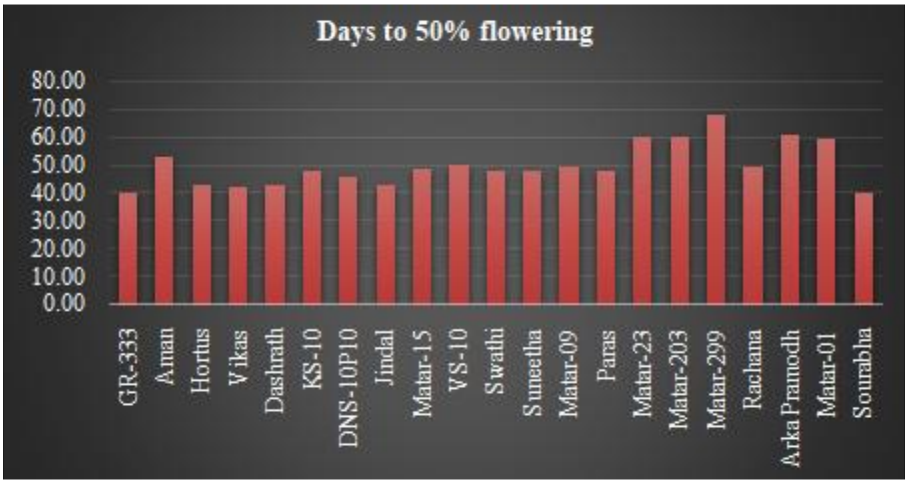

Figure 1: Graph between number of days to fifty percent flowering and genotypes

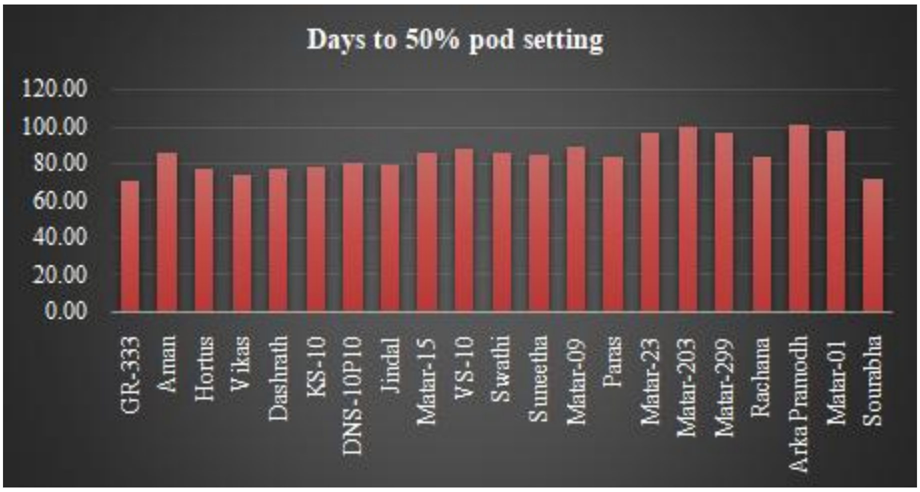

Figure 2: Graph between number of days to fifty percent pod setting and genotypes

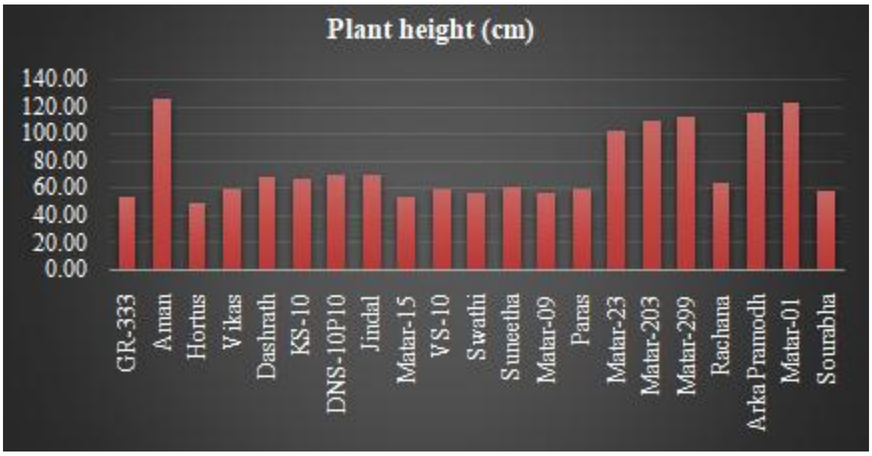

Figure 3: Graph between plant height and genotypes

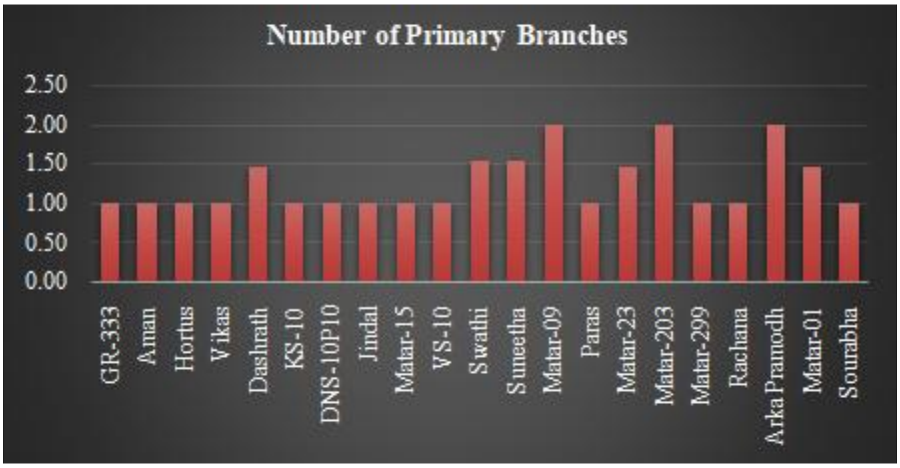

Figure 4: Graph between number of primary branches and genotypes

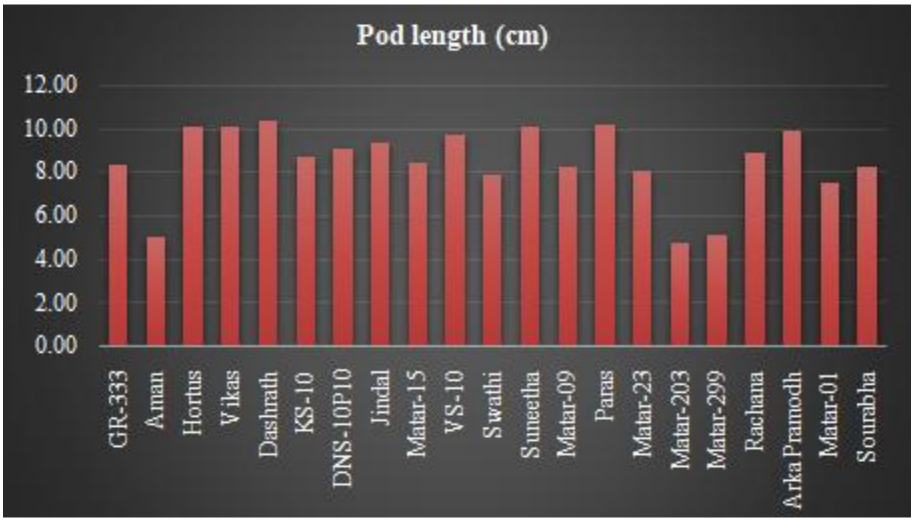

Figure 5: Graph between pod length and genotypes

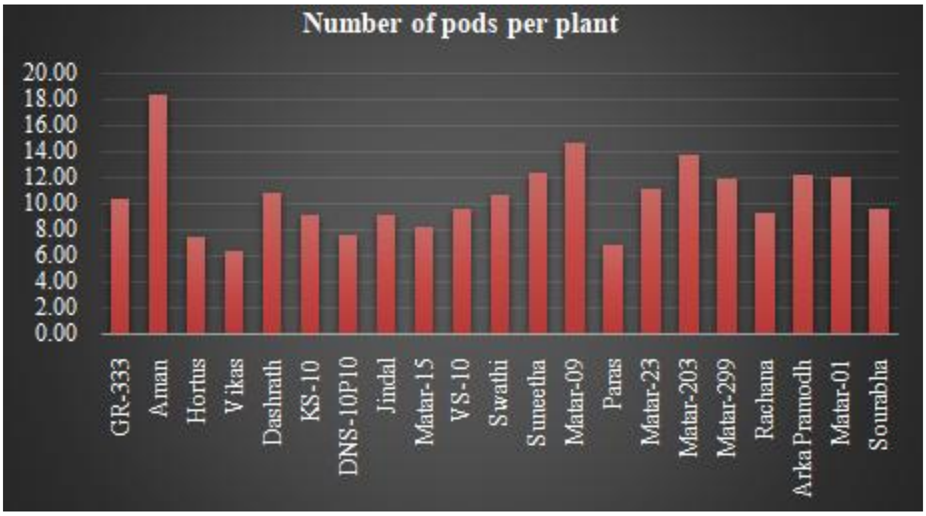

Figure 6: Graph between number of pods per plant and genotypes

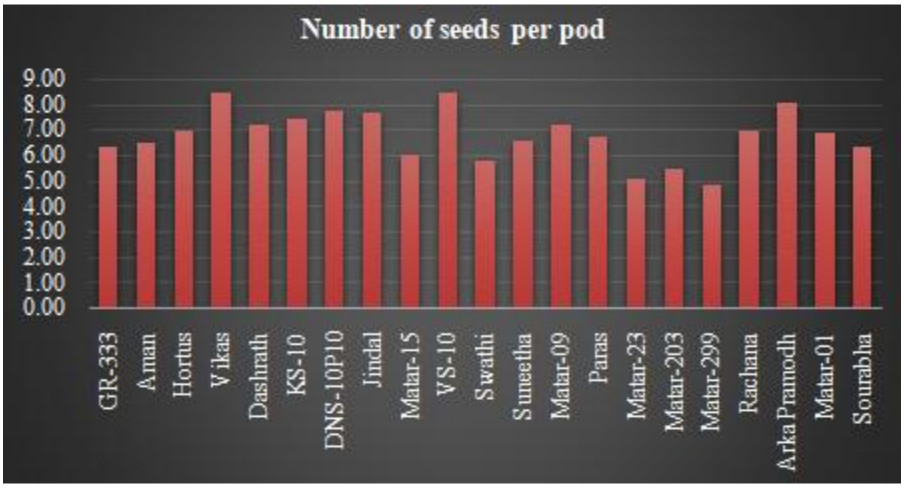

Figure 7: Graph between number of seeds per plant and genotypes

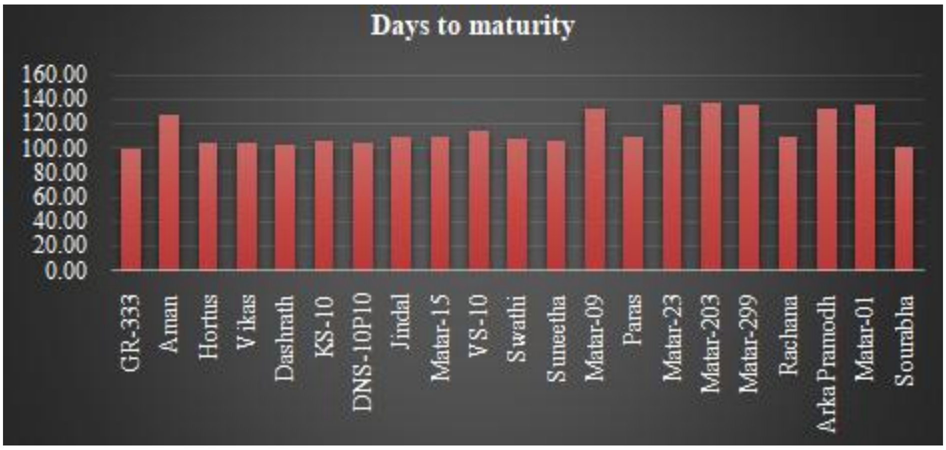

Figure 8: Graph between days to maturity and genotypes

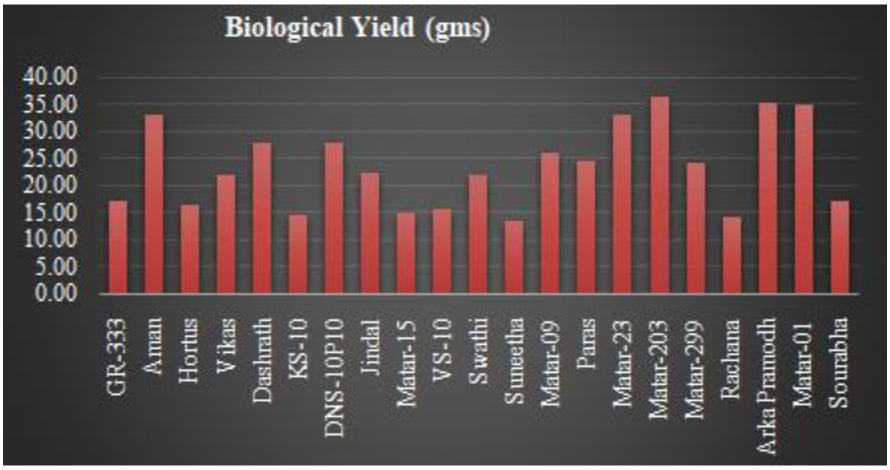

Figure 9: Graph between biological yield and genotypes

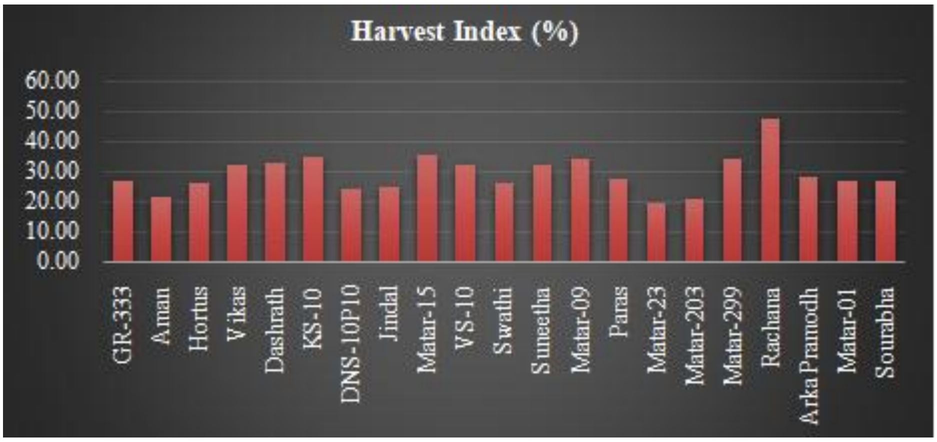

Figure 10: Graph between harvest index and genotypes

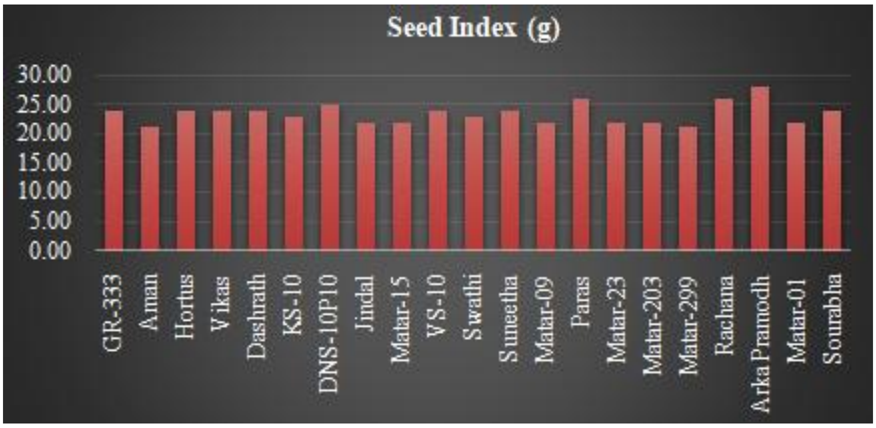

Figure 11: Graph between Seed index and genotypes

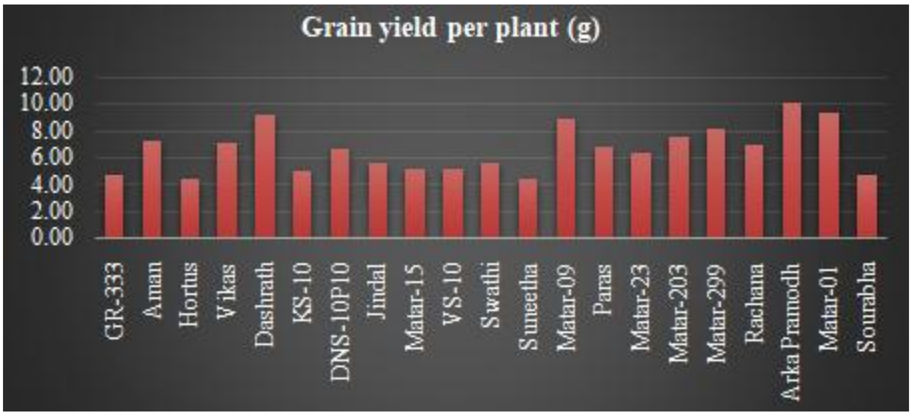

Figure 12: Graph between grain yield per plant and genotypes

5. Conclusion

The analysis of variance for all the characters showed significant differences among genotypes studied, indicating sufficient amount of variability present in the material. The genotypic and phenotypic variances were higher for plant height, days to maturity, days to fifty percent pod setting and days to fifty percent flowering.

The highest genotypic coefficient of variation was observed for plant height followed by biological yield and number of branches per plant, thereby indicating considerable amount of variability in the material for these characters. High heritability estimates (broad sense) were found for days to maturity, plant height, days to fifty percent pod setting and biological yield, indicating that these characters were less influenced by the environment and direct selection for these traits would be effective for further improvement in these characters. High heritability estimates coupled with high genetic advance as per cent of mean was recorded for plant height indicating the predominance of additive gene action for this trait.

Estimates of correlation coefficients revealed that in general genotypic correlations were higher than their phenotypic counterpart. Highly significant and positive correlations were observed for grain yield per plant with days to maturity, plant height, biological yield, number of primary branches per plant. Considering above relationships an ideal plant type in field pea can be considered having more number of pods, more number of seeds per pod and more number of branches per plant with increased plant height.

Path coefficient analysis revealed that characters; days to 50% flowering, days to 50% pod setting, plant height, number of primary branches, number of pods per plant, days to maturity and biological yield have positive direct effect on seed yield per plant at genotypic and phenotypic levels.

From the present investigation it is concluded that among 21 genotypes of Field Pea, Arka pramodh, Matar-01. Dashrath, Matar-09, Matar-209 and Matar-203was found to be superior in grain yield over the check followed by Matar-01 which may be recommended for large scale cultivation, after following proper procedure of testing.

6. Future Scope/ Suggestions

Hence utmost importance should be given to the above referred characters during selection for increased seed yield per plant. Based on these findings, it could be suggested that in breeding programme aiming to improve grain yield in Field Pea, more weightage should be given mainly to early maturity, plant height, number of primary branches, and number of pods per plant, number of seeds per pod and harvest index.

Conflict of Interest

The Author (s) declare (s) that there is no conflict of interest.

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