SHORT COMMUNICATION

Heritability and genetic advance as indices for yield and yield components selection in Cowpea (*Vignaunguiculata* L. Walp)

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Abstract

The present investigation was undertaken using six generations *viz*., P_1, P_2, F_1, F_2, BC_1 and BC_2 derived from two crosses namely GDVC-2 x LC-1 and GC-6 x LC-1. The material was evaluated in a Randomized Block Design with two replications. The characters studied were days to 50 % flowering, days to maturity, plant height (cm), number of branches per plant, number of pods per plant, number of seeds per pod, pod length (cm), 100 seed weight (gm), harvest index (%), seed yield per plant (gm). Moderate to high narrow sense heritability and broad sense heritability coupled with high genetic advance were observed in both the crosses for seed yield per plant, harvest index, number of pods per plant and plant height indicating that, heritability was due to additive gene effects and selection in early generation may be effective.

Keywords: Broad Sense, Genetic advance, Heritability, Narrow sense, Selection.

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Introduction

Cowpea [*Vigna unguiculata* L.Walp] (2n=22) is a leguminous crop in the order Fabaceae. It is mainly grown in tropical and subtropical regions in the world for vegetable and grains and to lesser extent as a fodder crop. It can respond well to drought as well to excessive rainfall up to some extent. Now a days, it is gaining importance due to its multi-purpose uses *i.e*., food, feed, vegetable, fodder and green manure. It is green tender plants and leaves are used for feeding domestic animals as green fodder. Being a leguminous crop, it is also used for improving the soil fertility. Knowledge of gene action in plant breeding helps in selection of parents for use in the hybridization programmes in choice of appropriate breeding procedure for the genetic improvement of various quantitative characters like yield and yield contributing components and in estimation of some other genetic parameters. Heritability and genetic advance are useful in predicting result and effects of selection of desired plants.

Materials and Methods

The experimental materials comprised of six generations *viz.,* P_1, P_2, F_1, F_2, BC_1 and BC_2 of each of the two crosses *viz.,* GDVC-2 x LC-1 and GC-6 x LC-1 were used to analysis of ten characters. Each of two different cowpea crosses were sown in Randomized Block Design with two replications. Each plot consisted of two row of P_1, P_2, F_1, BC_1 and BC_2 and eight rows of F_2. Five plants are selected from each generation, except $F_{2,}$ from which twenty plants are selected. Each row was of 5.0 meter long. The row to row and plant to plant distance was kept as 45 cm and 30 cm, respectively. The other recommended practices were followed to raise the crop successfully.

The broad sense heritability in percent was calculated by using formula suggested by Wright (1935) and the narrow sense heritability was calculated as suggested by Warner (1952). Genetic advance (G.A.) as percent of mean was estimated according to Johnson *et al*. (1955).

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Result and Discussion

To find out the amount of variations between generation means for various characters, the analysis of variance for randomized block design was done for each character. The results of analysis of variances between crosses showed highly significant differences for all the characters. The results of analysis of variances between generation within crosses revealed that mean sum of square for treatments were highly significant for all character in both the crosses except days to 50 % flowering and pod length in the cross, GC-6 x LC-1. This indicated existence of sufficient variations for effective selection for all the characters in the material under study (Table 1).

Estimation of heritability serves as a useful guide to the breeder for selection. The breeder can appreciate the proportion of variation that is due to genotypic (broad sense heritability) or additive (narrow sense heritability) effects. That is, the heritable portion of variation in the first case, and the portion of genetic variation that is fixable in pure lines in the later case. If heritability of a character is very high, selection for the character should be fairly easy because there would be a close correspondence between the genotype and phenotype due to relatively smaller contribution of the environment to phenotype. But for

Table 1: Analysis of variance (Mean sum squares) of generation means for ten characters in Cowpea.

Sources	*d.f.*	*DF*	*DM*	*PH*	*NBPP*	*NPPP*	*NSPP*	*PL*	*TW*	*HI*	*SYPP*
Analysis of variance between crosses											
Replication	1	0.04	0.17	0.96	0.01	1.94	0.67	0.02	0.08	10.58	3.47
Treatment	12	11.06**	93.59**	374.09**	4.18**	25.69**	5.64**	2.49**	2.7**	67.64**	19.93**
Error	12	0.19	0.2	8.69	0.15	1.63	0.62	0.07	0.03	6.24	1.41
Analysis of variance between generations within cross											
GCVC-2 x LC-1											
Replication	1	0.18	0.001	30.7	0.07	0.006	0.08	0.001	0.04	1.91	1.10
Treatment	5	16.28**	169.6**	602.23**	6.64**	46.96**	4.63*	2.23**	1.12**	26.47	31.93**
Error	5	0.20	0.22	49.01	0.28	2.25	0.90	0.05	0.04	8.73	0.62
GC-6 x LC -1											
Replication	1	0.00083	0.44	7.05	0.12	3.03	0.20	0.0052	0.024	17.52	5.41
Treatment	5	0.092	20.3*	213.8**	3.26**	14.25*	7.25**	0.25	3.32**	38.34*	7.15*
Error	5	0.21	0.38	8.29	0.032	1.38	0.41	0.07	0.023	3.73	1.66

*, **significance at 5% and 1 % respectively

DF = Days to 50% flowering; DM = Days to maturity; PH = Plant height (cm)
NBPP = Number of branches per plant; NPP = Number of pod per plant; NSPP = Number of seeds per pod
PL= Pod length(cm); TW = Test weight (g); HI = Harvest index (%)
SYPP = Seed yield per plant (g)

Table 2: Estimates of heritability's and genetic advance for ten characters in two crosses of Cowpea.

		GDVC-2 x LC-1			*GC-6 x LC-1*		
		Heritability (%)		*Genetic*	*Heritability (%)*		*Genetic*
Sr. No.	*Characters*	*NS*	*BS*	*Advance*	*NS*	*BS*	*Advance*
1	Days to 50 % flowering	62.07	84.05	3.27	43.93	75.92	3.02
2	Days to maturity	59.68	75.8	15.77	52.58	77.99	3.8
3	Plant height (cm)	41.77	61.14	8.36	60.64	75.33	18.72
4	Number of branches per plant	58.99	89.71	4.45	71.05	83.69	3.92
5	Number of pod per plant	63.95	77.14	8.68	65.96	94.14	12.06
6	Number of seeds per pod	65.41	76.42	1.65	60.96	68.95	2.23
7	Pod length (cm)	52.16	72.14	2.08	68.9	86.29	3.44
8	100 seed weight	55.43	63.55	1.10	59.54	65.20	0.96
9	Harvest index (%)	49.96	96.32	8.59	54.62	75.35	11.30
10	Seed yield per plant (g)	58.03	87.13	7.17	75.46	88.35	7.02

Where, NS = Narrow Sense Heritability; BS = Broad Sense Heritability;

a character with low heritability, selection may be considerably difficult or virtually impractical due to the masking effect of the environment on genotypic effects. Thus, estimates of heritability are useful in predicting the transmission of characters from the parents to their offspring.

In the cross, GDVC-2 x LC-1 the broad sense heritability ranged from 96.32 (harvest index) to 61.14 (plant height) presented in Table 2. Highest broad sense heritability was exhibited by harvest index (96.32) followed by number of branches per plant (89.71), seed yield per plant (87.13), days to 50 % flowering (84.05), number of pods per plant (77.14), number of seeds per pod (76.42), days to maturity (75.8), pod length (72.14), 100 seed weight (63.55) and plant height (61.14). The narrow sense heritability varied from 41.77 (plant height) to 65.41 (number of seeds per pod). The highest narrow sense heritability was recorded by number of seeds per pod (65.41) followed by number of pods per plant (63.95), days to 50 % flowering (62.07), days to maturity (59.68), number of branches per plant (58.99), seed yield per plant (58.03), 100 seed weight (55.43), pod length (52.16), harvest index (49.96) and plant height (41.77). Genetic advance for the cross, GDVC-2 x LC-1 was ranged from 1.10 (100 seed weight) to 15.77 (days to maturity). Days to maturity (15.55), number of pod per plant (8.68), harvest index (8.59), plant height (8.36) and seed yield (7.17) recorded maximum genetic advance.

The results of heritability and genetic advance are presented in Table 2. Broad sense heritability ranged from 65.20 (100 seed weight) to 94.14 (number of pod par plant). Highest broad sense heritability was recorded by number of pods per plant (94.14) followed by seed yield per plant (88.35), pod length (86.29), days to maturity (77.99), day to 50 % flowering (75.92), harvest index (75.35), plant height (75.33), number of seeds per pod (68.95) and 100 seed weight (65.20). The narrow sense heritability varied from 43.93 (days to 50 % flowering) to seed yield per plant (75.46). Maximum narrow sense heritability was reported by seed yield per plant (75.46) followed by number of branches (71.05), pod length (68.9), number of pods per plant (65.96), number of seeds per pod (60.96), plant height (60.64), 100 seed weight (59.54) and harvest index (54.62). Genetic advance for the cross GC-6 x LC-1 was ranged from 0.96 (100 seed weight) to 18.72 (plant height). Plant height (18.72), number of pods per plant (12.06), harvest index (11.50) and seed yield per plant (7.02) recorded higher genetic advance.

In crop improvement, only genetic component of variation is important since that component is transmitted to the next generation. Heritability indicates the effectiveness with which the selection of genotypes could be based on phenotypic performance. This could be achieved through determining heritability and genetic gain under selection. The success of selection is then governed by the degree to which the desired character is transmitted to the offspring's of the selected parents. Moderate to high narrow sense heritability and broad sense heritability coupled with high genetic advance were observed in both the crosses for seed yield per plant, harvest index, number of pods per plant and plant height indicated that heritabilities weredue to additive gene effects and selection in early generation may be effective. The findings are similar to the findings of different scientists *viz*., Bhandari and Verma (2008), Khanpara *et al*., (2016), Pathak *et al*., (2017), Meenatchi, T., (2019) and Verma *et al*., (2019).

Conclusion

Moderate to high narrow sense heritability and broad sense heritability coupled with high genetic advance were observed in both the crosses for seed yield per plant, harvest index, number of pods per plant and plant height indicated that, heritability was due to additive gene effects and hence pedigree method of breeding will be a rewarding one to improve the trait under investigation. Low narrow sense heritability and high broad sense heritability indicated that this character is under influence of environment, so selection for these traits is ineffective.

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