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Estimates of Genetic Variability, Heritability and Genetic Advance For Yield and Yield Component Traits in Indian Cowpea [*Vigna unguiculata* (L.) Walp.]

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ABSTRACT

Genetic variation, heritability and genetic advance studied in cowpea during kharif 2015-16 and 2016-17 at student farm of Chandra Shekhar Azad University of Agriculture& Technology, Kanpur (U.P.). A collection of thirty two cowpea genotypes were evaluated for eleven quantitative characters viz. days to flower initiation, days to maturity, plant height (cm), pod length (cm), number of pod per plant, number of branches per plant, leaf length (cm), leaf width (cm), leaf:stem ratio, Stover of yield per plant (gm.) and seed yield per plant (gm.). All the characters under study showed considerable amount of variability, phenotypic coefficient of variability was higher than genotypic coefficient of variability. A perusal of coefficient of variability indicates that PCV and GCV were quite high for number of pods per plant and seed yield per plant. Moderate PCV and GCV were recorded for Stover yield per plant, leaf: stem ratio, plant height and pod length and lowest observed in leaf length , number of branches per plant , leaf width, days to maturity and days to flower initiation. A high estimate of heritability was found for plant height and number of pods per plant. High genetic advance was observed for number of pods per plant (81.36) and minimum in leaf length (20.51). Fifty diverse genotypes of vegetable cowpea were evaluated to estimate variability, heritability and genetic advance over mean for pod yield and component characters. Analysis of variance revealed significant differences for almost all the characters studied. High genotypic coefficient of variation was observed for pods per cluster, yield per plant, pod weight, pods per plant and clusters per plant, which indicate that there exists high genetic variability and better scope for improvement of these characters through selection.

Key word: *Genetic variation, Heritability, Genetic advance.*

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] Is a diploid species with (2n=2x=22) chromosome. It is an autogamous crop, with natural cross pollination of up to one percent. Cowpea belongs to the class of *Dicotyledonea*, order *Fabales*,

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Family *Fabaceae*, subfamily *Faboideae*, tribe *Phaseoleae*, sub tribe *Phaseolinae*, and genus *Vigna***.** The Primary gene pool is composed of the domesticated cowpea (*V.unguiculata* sub sp. *Unguiculata var*. *unguiculata*) and its wild progenitor (*V.unguiculata sub sp. Unguiculata var*. *spontanea*). The secondary gene pool of cowpea includes nine perennial sub species.

Cowpea is produced for household purposes and as a cash crop. It is a multipurpose crop, since it is cultivated for leaf and seed yield**.** It is a multifunctional crop, providing food for man and livestock and serving as a valuable and dependable revenue-generating commodity for farmers and grain traders[12,20]**.** Cowpea contributes 30-125 Kg N/ha in the soil due to its nitrogen fixing properties and also serves as a residue, which benefits the succeeding crops. It is also a shade tolerant crop and, therefore, compatible as an intercrop with a number of cereals and root crops, as well as with cotton, sugarcane and several plantation crops**.** In fresh form, the young leaves and immature pods are used as vegetables, while the grain is used in the preparation of several dishes. According to Bressani[4] the mature legume contains 23-25% protein and 50-67% carbohydrate, 1.9% fats, 6.35% fiber and small percentage of the B-vitamins such as folic acid, thiamine, riboflavin and niacin as well as some micronutrients such as iron and zinc. In India cowpea is a very important crop and cultivated for food, vegetables and fodder purpose. Crop due to its tremendous adoptability for various conditions cultivated from north Jammu& Kashmir to south Tamilnadu. Cowpea is a very popular vegetable crops and being cultivated in all over country except hilly regions. In India it mainly grown in Rajasthan, Gujarat, Maharashtra, Karnataka, Tamilnadu, Bihar and Uttar Pradesh. As a grain legume it has a great potential for sustainable agriculture in marginal land and semi-arid regions of country. It is estimated that about 6.5 lakh hectare is under different forms of Cowpea and the share of fodder cowpea is 3 lakh hectares.

The effectiveness of selection in any crop improvement programme is primarily dependent on variation present in the population. Heritability and genetic advance are important selection parameters. The study of variability, heritability and genetic advance of different traits in the genetic stock will facilitate evaluation and identification of suitable genotypes. The estimates of heritability help in the selection of elite genotypes from diverse genetic population. Genetic advance measures the amount of progress that could be expected with selection in a character. High heritability coupled with high genetic advance indicates that the improvement could be made for a character by simple selection. Hence the present study focuses on assessment of available genetic variability, heritability and genetic advance for yield and yield related characters in fifty vegetable cowpea genotypes.

MATERIAL AND METHOD

The experimental materials of the study comprised of 32 cowpea varieties from Indian origin. These varieties were procured from germplasm lines available in Govind Ballabh Pant University, of Agriculture and Technology, Pantnagar. A field experiment was conducted during *kharif* season 2015-16 and 2016-17 at student Research Farm, CSAUAT, Kanpur. All the genotypes were sown in Randomized Complete Block Design with three replications. Each genotype was sown in four lines in 3.0 m long and 1.50 m broad plots and space planted at 75 cm between row to row and plant to plant distance respectively.

Genetic variability parameter viz., mean, variance[6] phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV)[5] heritability (h^2)[8] and Genetic advance (GA)[10] among characters were calculated by following the standard procedures with the help of MSTATC, Statistica 2 and Genres software's.

RESULTS AND DISCUSSION

Cowpea (*Vigna unguiculata* (L.) Walp.) is an autogamous crop having low out crossing

ranging from zero to four percent. The study of variance and other genetic parameters greatly help in formulating a suitable breeding programme for improvement of the crop. The variability assessment in the genetic material is a prerequisite for any successful crop improvement method.

Cowpea is an important legume and forage crop in the Indian economy due to high food value, good fodder and used as an excellent green manure crop. Variability is a result of its genotype and genotype x environment interactions. Only heritable component of variation is of prime importance from breeding point of view. So it is necessary to divide total variability into its heritable and nonheritable component of variation. Estimates of variability, heritability and expected genetic advance provides the information on proposition of genetic variation to the total variation present in the population, and simultaneously gives an indication of influence of environment on the character in consideration. No genetic gain could be achieved unless there is sufficient genetic variation.

Present study revealed highly significant differences among the tested genotype in respect of all characters. This indicated that these present days varieties can be utilize for future cowpea breeding program. It is clear from the results that the genotype were more variable for stover yield per plant, plant height, seed yield per plant and number of pods per plant. This indicated that due emphasis has been given for these characters while adopting selection for the development of these varieties. Phenotypic and genotypic coefficient of variation was maximum for number of pods per plant followed by seed yield per plant, stover yield per plant, Minimum phenotypic and genotypic coefficient of variation were recorded for leaf length, leaf width followed by days to maturity.

Moderate GCV obtained for plant height followed by pod length, leaf: stem ratio, number of branches per plant, days to flower initiation and moderate PCV was observed for plant height, pod length leaf : stem ratio, number of branches per plant, days to flower initiation. The GCV and PCV values indicated that lot of variability exists among the genotypic and phenotypic level and better chances of improvement is possible by selection. These finding are in conformity to the finding of previous workers Nwosu *et al.*[14], Pravin *et al.*[16], Vir and Singh[22], Kharde *et al*.[11], Shahid *et al*[17].Singh *et al*.[20] reported that high estimate genotypic and phenotypic coefficient of variability for seed yield per plant, while little variability was recorded for leaf length and leaf width . Its indicates that the selection based on seed yield per plant, may be advantageous as compared to other character under study.

Heritability in broad sense indicates the percentage of transfers of traits from this generation to next. Depending upon the heritability of the traits characters were categorized into high heritable, medium heritable and low heritable traits. The genetic advance which predict the advancement in the succeeding generation of selection is a very potential method for handling the breeding material and affecting the gain through careful selection. In the present study high heritability were observed for almost all the characters. Among them number of pods per plant , seed yield per plant , plant height , stover yield per plant , days to maturity and leaf : stem ratio showed highest heritability and they were having corresponding high genetic gain . This indicate that the additive part of total variation was acting on those character.

Similar result was recorded by Ahmed *et al*.[1] reported High heritability coupled with high genetic gain for plant height, number of pod per plant , seed yield per plot and Girish *et al*[7]. Reported heritability and genetic advance was high for seed yield per plant, number of pod per plant and plant height. High heritability indicated that these characters were highly heritable and governed by additive gene effects. The phenotypic values could give a fairly good idea about their genetic material. The finding are in conformity to the finding of previous workers Arora *et*

al.[2], Idahosa *et al.*[9], Bhadru and Navale[3], Nwosu *et al.*[14], Pravin *et al.*[16], Kharde *et al.*[11]. Most of the characters showing high to moderate genetic advance also had high heritability estimates. This suggest the predominant role of additive gene action in inheritance of these characters and selection practiced for these characters would be more beneficial[1,7,13,15,21].

Moreover, it is always desirable to compute broad sense heritability in conjunction with genetic advance because the information of heritability coupled with genetic advance help to explain the role of phenotypic variance. The character with higher heritability and higher genetic advance may be improved by adopting a selection scheme capable of exploiting the both additive as well as non additive genetic components. Because of this additive variation, selection for these character would be highly responsive and a superior genotype can be evolved as the environment had least effect on the expression of these characters. The improvement in yield could be effected through these yield contributing components and selection efficiency decides success of any crop breeding programme. Selection for trait which is contributing to yield is an important aspect.

Table 1: Analysis of variance (ANOVA) for eleven characters in thirty two cowpea genotype

Source of variance	D.F	Days to flower initiation	Days to maturity	Pod length(cm)	Plant height(cm)	Number of pods per plant	Number of branches per plant	Leaf length(cm)	Leaf width(cm)	L:S ratio	Stover yield per plant(gm.)	Seed yield per plant(gm.)
Replication	2	1.541	0.218	0.968	20.168	2.010	0.140	0.053	0.0518	0.01	65.557	7.125
Treatment	31	199.150**	266.996**	63.053**	4744.823**	511.467**	2.697**	3.174**	3.607**	0.081**	11491.36**	2348.39**
Error	62	3.036	1.347	1.323	442.812	1.096	0.143	0.029	0.049	0.035	70.350	77.447

**Significant at 1% level of significance

Table 2: Phenotypic and genotypic coefficient of variation among Thirty two genotype for eleven characters in cowpea

S. No.	Character	PCV	GCV
1	Days to flower initiation	19.09	18.66
2	Days to maturity	18.95	18.81
3	Pod length(cm)	26.23	25.42
4	Plant height(cm)	30.80	30.70
5	Number of pods per plant	39.94	39.81
6	Number of branches per plant	20.38	18.85
7	Leaf length(cm)	10.05	9.91
8	Leaf width(cm)	16.01	15.69
9	L:S ratio	25.14	24.97
10	Stover yield per plant(gm.)	33.06	32.76
11	Seed yield per plant(gm.)	39.32	37.45

Table 3: Heritability (h^2) %, genetic advance and genetic advance percent over mean among thirty two genotype for eleven characters in cowpea

S. No.	Character	Heritability per cent (h^2)%	Genetic advance at 5%	Genetic advance per cent over mean 5%
1	Days to flower initiation	95.50	16.28	37.58
2	Days to maturity	98.50	19.24	38.45
3	Pod length(cm)	93.96	9.06	50.76
4	Plant height(cm)	99.33	81.56	63.03
5	Number of pods per plant	99.36	26.78	81.75
6	Number of branches per plant	85.58	1.76	35.93
7	Leaf length(cm)	97.25	2.08	20.13
8	Leaf width(cm)	95.96	2.20	31.66
9	L:S ratio	98.71	0.33	51.11
10	Stover yield per plant (gm.)	98.19	125.95	66.87
11	Seed yield per plant(gm.)	90.72	53.98	73.48

CONCLUSION

Studies of variation indicated that considerable amount of variation for number of pods per plant, followed by seed yield per plant, Stover yield per plant and plant height which could be utilized for breeding for improvement, All traits showed high heritability and The higher genetic advance showed in number of pod per plant(81.75) and low in leaf length (20.13). Maximum genetic variation was recorded for number of pods per plant, followed by seed yield per plant (gm.), Stover yield per plant, plant height and pod length. Minimum genetic variation was recorded for leaf length, leaf width and days to flower initiation .High heritability estimates were found for eleven characters under study. High heritability was recorded for number of pods per plant followed by plant height and leaf: stem ratio, days to maturity, Stover yield per plant and leaf width. It was minimum for number of branches per plant followed by seed yield per plant, pod length, days to flower initiation, leaf width. Studies on variability, heritability and genetic advance showed that number of pods per plant, seed yield per plant, Stover yield per plant, leaf: stem ratio followed by plant height and pod length are having considerable importance to breeder for selection.

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