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Genetic Variability Studies for Yield and Nutritional Quality Traits in Greengram [*Vigna radiata* (L.) Wilczek]

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ABSTRACT

The field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur during *rabi*, 2022-23 to study the genetic variability parameters for ten quantitative traits *viz.*, days to 50% flowering, days to maturity, plant height, branches per plant, clusters per plant, pods per plant, pod length, seeds per pod, test weight and seed yield per plant and three qualitative traits *viz.*, protein content, iron content and zinc content in greengram by utilizing 60 greengram genotypes. Analysis of variance revealed the presence of significant variation for all the traits among the studied genotypes. High genotypic coefficient of variation and high phenotypic coefficient of variation was recorded for pods per plant, iron content and seed yield per plant indicating the presence of high amount of variation for these characters among the studied genotypes. High heritability accompanied with high genetic advance as per cent of mean was observed for the characters *viz.*, plant height, branches per plant, clusters per plant, pods per plant, test weight, zinc content, iron content and seed yield per plant indicating the presence of additive gene action and selection may be effective for these characters.

Key words: *Green gram, PCV, GCV, Yield, Heritability and Genetic advance*

Greengram is one among the pulse crops which is important because of its short duration, adaptation to low water requirement and soil fertility. It is a self-pollinated crop with chromosome number 2n=2x=22 and belongs to leguminaceae family. It is favored for consumption due to its easy digestibility and low production of flatulence (Shil and Bandopadhya, 2007). Greengram occupies an important position due to its high seed protein content (22-24%) and it has the ability to restore soil fertility through symbiotic nitrogen fixation. It is rich in essential amino acids especially lysine, which is deficient in most of the cereal grains. Yield is a complex trait governed by the interaction of many variables, hence, the selection simply based on yield is not effective. The efficiency of selection would increase, if there is knowledge on amount and nature of genetic variation present for the characters among the studied genotypes.

MATERIAL AND METHODS

The experimental material consisted of sixty green gram genotypes that are released from different institutions were grown during *Rabi*, 2022-23 in alpha lattice design in five blocks with three replications at Pulses section, RARS, Lam, Guntur district, Andhra Pradesh. All the genotypes were sown in two rows at 30 cm distance between row to row and 10 cm distance between plant to plant. Days to 50% flowering, days to maturity are recorded on plot basis and remaining all the traits are recorded on five plant basis. The analysis of variance for each character was calculated as per the standard statistical procedure given by Panse and Sukhatme (1978). The phenotypic and genotypic coefficients of variation were calculated by using the formula given by Burton (1952). Heritability in broad sense was computed as the ratio of genetic variance to the total phenotypic variance, which is estimated as per Lush (1940) and expressed as percentage. Genetic advance was calculated based on the formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among the genotypes for all the characters studied, indicating the existence of sufficient variation among the genotypes studied (Table 1). Thus, the analysis of variance revealed ample scope for improvement of the genotypes with regard to the characters studied. The estimates of variability, heritability and genetic advance as per cent of mean were detailed in the Table 2.

Phenotypic and Genotypic Coefficient of variation (PCV & GCV)

It was observed that the estimates of PCV were higher than the GCV indicating the influence of environment on the expression of phenotype rather than the genotype itself. Pods per plant (24.40% & 21.73%), iron content (55.84% and 55.80%) and seed yield per plant (26.72% & 22.87%) recorded high PCV and GCV indicating the presence of more variation for these characters among the studied genotypes. These results were in conformity with the Raturi *et al.* (2015), Pavan *et al.* (2019), Salman *et al.* (2021), Muthuswamy *et al.* (2022) and Varma *et al.* (2022) for pods per plant and seed yield per plant.

Moderate phenotypic and genotypic coefficient of variation was recorded for clusters per plant (19.75% and 17.73%), test weight (15.52% and 13.23%) and zinc content (17.46% and 17.34%). Similar results were reported by Nand *et al.* (2013), Hemavathy *et al.* (2015) and Sharma *et al*. (2018).

Plant height (22.03% and 17.21%) and branches per plant (21.35% and 17.55%) showed high and moderate phenotypic and genotypic coefficient of variation, respectively. Pod length (12.58% and 6.75%) showed moderate phenotypic co efficient of variation and low genotypic co efficient of variation. There is a large difference between PCV and GCV indicating the more influence of environment on expression of this trait, selection for this character may not be effective. These findings of moderate PCV and low GCV were in tune with the results of Rahim *et al.* (2010), Pavan *et al.* (2019).

Low phenotypic and genotypic coefficient of variation was recorded for days to 50% flowering (8.37% and 7.40%), days to maturity (9.47% and 8.56%), seeds per pod (6.81% and 5.32%) and protein content (5.49% and 5.44%) which indicates the presence of less variation for these traits among the genotypes studied.

Heritability and Genetic advance as per cent of mean

High heritability accompanied with high genetic advance as per cent of mean was observed for the characters *viz.*, iron content (99.88% and 94.89%), zinc content (98.61% and 35.48%), clusters per plant (80.61% and 32.89%), pods per plant (79.37% and 39.89%), seed yield per plant (73.28% and 40.34%), test weight (72.63% and 23.22%), branches per plant (67.60% and 29.73%) and plant height (61.04% and 27.70%). High heritability accompanied by high genetic advance indicates that most likely the heritability is due to additive gene action and selection may be effective. Similar results were reported by Salman *et al.* (2021) for plant height, branches per plant, clusters per plant and pods per plant. Similar results were reported by Garg *et al.* (2017) and Muthuswamy *et al.* (2022) for test weight.

Days to 50% flowering (78.20% and 13.49), days to maturity (81.72% and 15.94%) and protein content (98.11% and 11.11%) showed high and moderate heritability and genetic advance, respectively, which revealed the importance of additive gene action in the inheritance of these traits. Further, it indicates that these characters can be improved through simple selection.These results were in conformity with Anuradha *et al.* (2022) for days to 50% flowering and days to maturity.

Seeds per pod (61.16% and 8.58%) showed high heritability and low genetic advance. High heritability accompanied with low genetic advance is indicative of non-additive gene action. The high heritability is being exhibited due to favourable influence of environment rather than genotype and selection for such traits may not be rewarding. These results were in conformity with the findings of Varma *et al.* (2022).

Low heritability accompanied with low genetic advance as per cent of mean was observed for pod length (28.85% and 7.47%). Low heritability accompanied with low genetic advance indicates that the character is highly influenced by environmental effects and selection for this trait would be ineffective. Similar results were reported by Rahim *et al.* (2010), Sabatina *et al.* (2021) and Singh *et al.* (2022).

CONCLUSION

Analysis of variance revealed the presence of significant differences among the genotypes for all the traits studied. The estimates of genetic parameters revealed high phenotypic and genotypic coefficient of variation for pods per plant, iron content and seed yield per plant. High heritability coupled with high genetic advance as per cent of mean was observed for the characters *viz.*, plant height, branches per plant, clusters per plant, pods per plant, test weight, zinc content, iron content and seed yield per plant indicating that most likely the heritability is due to additive gene action and selection may be effective for these traits.

Table 1: Analysis of variance for seed yield and other characters in greengram

Source of variations	D.F	Days to 50% flowering	Days to maturity	Plant height	Branches per plant	Clusters per plant	Pods per plant	Pod length
		Mean sum of squares						
Replications	2	4.5	27.75	96.52	0.96	0.07	0.25	2.44
Treatments (unadjusted)	59	24.67**	101.85**	141.36***	0.90**	1.79**	13.36**	1.20**
Blocks within Replicated (adj)	12	2 .72	6.13	35.12	0.06	0.13	1.68	0.57
Intrablock error	106	2.02	7.17	23.63	0.13	0.13	0.99	0.54

**Significant at 1% level

Source of variations	D.F	Seeds per pod	Test weight	Protein content	Zinc content	Iron content	Seed yield per plant
		Mean sum of squares					
Replications	2	0.08	0.18	0.01	0.12	0.89	1.33
Treatments (unadjusted)	59	1.15**	0.80**	4.72**	54.29**	1692.24**	3.30**
Blocks within Replicated (adj)	12	0.26	0.09	0.02	0.31	0.54	0.33
Intrablock error	106	0.19	0.08	0.03	0.24	0.69	0.36

Table 2: Estimates of variability, heritability and genetic advance as per cent of mean for seed yield and other traits in greengram

S. No.	Character	Coefficient of variation		Heritability in broad sense	Genetic advance as percent of mean
		PCV (%)	GCV (%)		
1	Days to 50% flowering	8.37	7.4	78.2	13.49
2	Days to maturity	9.47	8.56	81.72	15.94
3	Plant height (cm)	22	17.2	61.04	27.7
4	Branches per plant	21.4	17.6	67.6	29.73
5	Clusters per plant	19.8	17.7	80.61	32.89
6	Pods per plant	24.4	21.7	79.37	39.89
7	Pod length (cm)	12.6	6.75	28.85	7.47
8	Seeds per pod	6.81	5.32	61.16	8.58
9	Test weight (g)	15.5	13.2	72.63	23.22
10	Protein content (%)	5.49	5.44	98.11	11.11
11	Zinc content (mg/kg)	17.5	17.3	98.61	35.48
12	Iron content (mg/kg)	55.8	55.8	99.88	94.89
13	Seed yield per plant (g)	26.7	22.9	73.28	40.34

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