



Assessment of variability, heritability and genetic advance for yield and nutritional traits in greengram [*Vigna radiata* (L.) Wilczek]

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ABSTRACT

The present study was undertaken to assess the magnitude of genetic variability, heritability, and genetic advance for seed yield and its associated traits in 45 greengram genotypes during *rabi*, 2024-25 at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. The analysis of variance revealed significant differences among the genotypes for all characters studied, suggesting the presence of considerable genetic variation. High heritability coupled with high genetic advance was observed for seed yield per plant, iron content, zinc content, vitamin C content, pods per plant, and branches per plant, indicating the predominance of additive gene action and the scope for effective selection. These results emphasize the potential for genetic improvement through direct selection in greengram breeding programs.

Keywords: Genetic Advance Heritability, Greengram, GCV and PCV

Greengram (*Vigna radiata* L. Wilczek) is a vital pulse crop known for its high protein content and short duration, contributing significantly to nutritional security and sustainable agriculture. India is the largest producer and consumer of greengram. It is primarily grown during the *kharif* and summer seasons. The crop is well-adapted to arid and semi-arid regions and is often included in crop rotations due to its quick maturity and low input requirement. Despite its importance, the productivity of greengram remains low due to various biotic and abiotic stresses, limited genetic variability and low harvest index. Hence, there is a growing need to explore and utilize genetic diversity improved agronomic practices and advanced breeding approaches to enhance yield potential and resilience of this vital legume. For the success of any breeding programme, understanding the nature and magnitude of genetic variability, heritability, and genetic advance is critical. High heritability along with high genetic advance suggests the prevalence of additive gene action, which can be exploited through selection. Hence, the present study aims to estimate these parameters in a set of diverse greengram genotypes.

MATERIAL AND METHODS

The experiment material consisted of forty-five greengram genotypes and were evaluated in a

field trial during *Rabi*, 2024-25 in alpha lattice design in five blocks with three replications at RARS, Lam, Guntur, Andhra Pradesh. Observations were recorded on 14 quantitative and nutritional traits. Standard statistical procedures were used to compute the phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense (h^2), and genetic advance as per cent of mean (GAM). Days to 50% flowering, days to maturity were recorded on plot basis and remaining all the traits were 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 categorized and 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. The estimates of variability, heritability and genetic advance as per cent of mean were detailed in the Table 2. Genetic variability revealed significant genotypic

Table 1. Analysis of variance for seed yield and other characters in greengram (*Vigna radiata* (L.) Wilczek)

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
Replications	2	1.236	1.119	10.762	0.028	0.345	1.379	0.314
Treatments (unadjusted)	44	30.343**	17.323**	42.978**	0.802**	1.817**	19.227**	1.071**
Blocks within Replicated (adj)	12	7.462	2.235	2.626	0.012	0.15	0.715	0.621
Intrablock error	76	4.011	1.784	3.918	0.012	0.13	0.992	0.289

Source of variations	D.F	Seeds per pod	Test weight	Protein content	Zinc content	Iron content	Vitamin C	Seed yield per plant
		Mean sum of squares						
Replications	2	2.193**	0.212	329.66	5.357	45.365	28.014	0.043
Treatments (unadjusted)	44	2.749**	0.347**	1442.651**	364.506**	7996.283**	2539.034**	1.688**
Blocks within Replicated (adj)	12	0.591	0.089	92.721	1.18	15.089	14.195	0.031
Intrablock error	76	0.431	0.089	144.728	2.297	18.712	11.297	0.03

differences were observed for all the traits indicating ample variability. High PCV and GCV values were recorded for traits like seed yield per plant, vitamin C, zinc and iron content, which suggest considerable scope for selection. These results were in conformity with the Kumawat *et al.* (2022), Priyanka *et al.* (2023) and Jain *et al.* (2024) for seed yield per plant, Sunayana *et al.* (2018) for iron content. Moderate genotypic and phenotypic coefficients of variation were recorded for plant height, clusters per plant. These results were in conformity with Muthuswamy

et al. (2022), Varma *et al.* (2022) for plant height, Harsh and Priyal (2023), Priyanka *et al.* (2023) and Thonta (2023) for clusters per plant.

Low phenotypic and genotypic coefficients of variation were recorded for days to 50% flowering and days to maturity. These results were in conformity with Priyanka *et al.* (2023) for days to 50% flowering, Thonta (2023) and Jain *et al.* (2024) for days to maturity. The narrow difference between PCV and GCV for most of the traits indicated that environmental influence was minimal.

Table 2. Estimates of variability, heritability and genetic advance as per cent of mean for seed yield and other traits in greengram (*Vigna radiata* (L.) Wilczek)

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense) (%)	Genetic advance as % of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1	Days to 50% flowering	42.28	37.33	50	8.45	7.01	68.64	11.96
2	Days to maturity	67.27	65	73	3.92	3.38	74.38	6.01
3	Plant height (cm)	24.69	17.6	36	16.67	14.61	76.87	26.39
4	Branches per plant	1.58	1	3.9	33.15	32.41	95.57	65.27
5	Clusters per plant	4.5	3	6.27	18.48	16.65	81.2	30.91
6	Pods per plant	10.4	5.4	17.07	25.58	23.71	85.96	45.29
7	Pod length (cm)	6.09	5.09	7.87	12.17	8.38	47.42	11.89
8	Seeds per pod	9.9	7.6	12.4	11.09	8.88	64.18	14.66
9	Test weight (g)	3.15	2.59	4.55	13.3	9.32	49.09	13.45
10	Protein content (mg/kg)	22.18	19.23	26.81	10.83	9.38	74.93	16.72
11	Zinc content (mg/kg)	22.54	10.18	61.23	49.21	48.75	98.13	99.48
12	Iron content (mg/kg)	78.72	20.55	218.3	65.74	65.51	99.3	98.47
13	Vitamin C (mg/100g)	68.68	30.76	138.47	42.55	42.27	98.68	86.49
14	Seed yield per plant (g)	2.21	1.18	5.24	34.58	33.68	94.86	67.58

PCV- Phenotypic Coefficient of Variation

GCV- Genotypic Coefficient of Variation

High heritability (>75%) and high genetic advance were observed for seed yield per plant (94.86%, 67.58%), zinc content (98.13%, 99.48%), iron content (99.30%, 98.47%), vitamin C content (98.68%, 86.49%), pods per plant (85.96%, 45.29%), clusters per plant (81.2%, 30.91%), branches per plant (95.57%, 65.27%) and plant height (76.87%, 26.39%). This implies strong additive gene effects and suggests that these traits are amenable to improvement through selection. These results were in conformity with Sunayana *et al.* (2018) for iron and zinc content, Jain *et al.* (2024) for plant height, branches per plant, pods per plant and clusters per pod.

Moderate heritability with moderate genetic advance was observed for pod length (47.42%, 11.89%) and test weight (49.09%, 13.45%), indicating environmental influence and a moderate response to selection. Similar results were also reported by Salman *et al.* (2023). Traits like days to maturity (74.38%, 6.01%) and days to 50% flowering (68.64%, 11.96%) exhibited high to moderate heritability but low genetic advance, suggesting non-additive gene effects or strong environmental influence, making selection less effective for these traits.

CONCLUSION

The study revealed that traits like seed yield, branches per plant, clusters per plant, pods per plant, zinc content, iron content, and vitamin C content showed high heritability and genetic advance, indicating the predominance of additive gene action and potential for improvement through selection. Traits with moderate to low genetic advance despite high heritability may require different breeding strategies such as hybridization followed by selection. Seed Yield per Plant showed highest heritability and a very high genetic advance, suggesting it is a reliable selection index. Nutritional Traits like iron, zinc, and vitamin C content had extremely high heritability and genetic advance, indicating that biofortification efforts can be successful through simple selection. Yield Components such as branches per plant and pods per plant also showed promising genetic parameters suitable for improvement. These findings provide valuable insights for greengram improvement programs aiming for higher productivity and nutritional quality.

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