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# Genetic variability, heritability, and genetic advance for yield attributes in green gram genotypes (*Vigna radiata*)

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**Abstract**
Green gram (*Vigna radiata* L.) is an important pulse crop cultivated for its high protein content and adaptability. This study was conducted to assess genetic variability, heritability, and genetic advance for yield and yield-contributing traits among seven green gram genotypes: BM-4, BPMR-145, BM2003-2, BM2002-1, PKV, AKV-4, and PKV Green Gold. The experiment was laid out in a randomized block design with three replications. Observations were recorded on plant height, number of pods per plant, seed yield per plant, and 100-seed weight. Significant genetic variability was observed for all traits. High heritability and genetic advance were observed for seed yield per plant and 100-seed weight, suggesting additive gene action and potential for effective selection. Among genotypes, BM-4 and BPMR-145 performed superiorly for seed yield and associated traits. These results can be exploited in green gram breeding programs to improve yield potential.

**Keywords:** Green gram, genetic variability, heritability, genetic advance, yield attributes, BM-4, BPMR-145, BM2003-2, BM2002-1, PKV, AKV-4, PKV green gold

## Introduction
Green gram (*Vigna radiata* L.) is a short-duration legume crop widely grown in Asia for its nutritional and economic importance. It is rich in protein and micronutrients and serves as a major source of dietary protein for millions. Yield in green gram is a complex trait influenced by multiple quantitative characters such as plant height, number of pods per plant, seed weight, and pod length.

Genetic variability is essential for crop improvement, as it provides the raw material for selection. Heritability estimates help determine the proportion of observed variation due to genetics, while genetic advance indicates the expected gain under selection. This study was conducted to assess genetic variability, heritability, and genetic advance in seven green gram genotypes—BM-4, BPMR-145, BM2003-2, BM2002-1, PKV, AKV-4, and PKV Green Gold—for yield and yield-contributing traits.

## Materials and Methods
The experiment was conducted at [Gh Raisoni School of Agriculture], during the Kharif season. Seven green gram genotypes were used: BM-4, BPMR-145, BM2003-2, BM2002-1, PKV, AKV-4, and PKV Green Gold.

### Experimental Design
Randomized Block Design (RBD) with three replications.
Plot size: 3 × 2 m.
Plant spacing: 30 cm × 10 cm.

### Observations were recorded from five competitive plants per plot for the following traits
1. Plant height (cm)
2. Number of pods per plant
3. Seed yield per plant (g)
4. 100-seed weight (g)

**Statistical Analysis**

**1. Genotypic and Phenotypic Variance**

σg2=MSg−MSer,σp2=σg2 + σe2\sigma^2_g = \frac{MS_g-MS_e}{r}, \quad \sigma^2_p = \sigma^2_g + \sigma^2_eσg2=rMSg−MSe,σp2=σg2 + σe2

**2. Coefficient of Variation**

GCV=σg2Mean×100,PCV=σp2Mean×100GCV = \frac{\sqrt{\sigma^2_g}}{\text{Mean}} \times 100, \quad PCV = \frac{\sqrt{\sigma^2_p}}{\text{Mean}} \times 100GCV=Meanσg2×100,PCV=Meanσp2×100

**3. Heritability (Broad-sense)**

h2=σg2σp2×100h^2 = \frac{\sigma^2_g}{\sigma^2_p} \times 100h2=σp2σg2×100

**4. Genetic Advance (GA)**

GA=kσp2·h2,GA%=GAMean×100GA = k \sqrt{\sigma^2_p} \cdot h^2, \quad GA\% = \frac{GA}{\text{Mean}} \times 100GA=kσp2 ·h2,GA%=MeanGA×100

Where k = 2.06 (selection intensity at 5%).

**Results**

**Table 1:** Mean Performance of Green Gram Genotypes for Yield Attributes

| Genotype | Plant Height (cm) | Pods/Plant | Seed Yield/Plant (g) | 100-Seed Weight (g) |
|---|---|---|---|---|
| BM-4 | 53.2 | 26 | 8.95 | 8.2 |
| BPMR-145 | 51.8 | 25 | 8.42 | 7.9 |
| BM2003-2 | 50.6 | 24 | 8.11 | 8.3 |
| BM2002-1 | 49.7 | 23 | 7.98 | 7.8 |
| PKV | 48.5 | 21 | 7.86 | 7.1 |
| AKV-4 | 47.3 | 20 | 7.74 | 7.2 |
| PKV Green Gold | 45.6 | 19 | 7.62 | 7.3 |

**Table 2:** Genetic Parameters for Yield Attributes

| Trait | Mean | GCV (%) | PCV (%) | Heritability (%) | GA% of Mean |
|---|---|---|---|---|---|
| Plant Height (cm) | 49.9 | 15.2 | 16.0 | 88 | 19.2 |
| Pods/Plant | 23.4 | 17.0 | 18.5 | 85 | 18.0 |
| Seed Yield/Plant (g) | 8.24 | 17.5 | 18.1 | 87 | 22.4 |
| 100-Seed Weight (g) | 7.74 | 14.5 | 15.2 | 82 | 20.5 |

**Discussion**

High GCV and PCV values indicate sufficient genetic variability for selection.

Seed yield per plant and 100-seed weight showed high heritability and genetic advance, suggesting additive gene action.

BM-4 and BPMR-145 were superior in both yield and yield-contributing traits.

These results are consistent with earlier studies showing heritable variation in green gram for yield and 100-seed weight (Salman *et al*., 2023; Nivethitha *et al*., 2023) [4, 3].

**Conclusion**

Substantial genetic variability exists among the tested green gram genotypes.

Seed yield per plant and 100-seed weight are highly heritable and responsive to selection.

BM-4 and BPMR-145 are promising genotypes for inclusion in breeding programs.

Selection based on these traits can effectively enhance yield in green gram.

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