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Effect of seed size on growth, reproductive and yield traits of soybean (*Glycine max* L.)

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Abstract

A field experiment was conducted during *kharif* 2025 at the Experimental field of Seed Technology Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to quantify the response of soybean to seed-size and varietal background. Three varieties, namely PDKV Amba, Suvarna Soya and JS-335, were evaluated with three seed-size classes of 4.0, 3.60 and 3.20 mm in a factorial randomized block design (FRBD) with three replications. Seed size significantly affected field emergence, plant height, branching, pods plant⁻¹, seed yield plant⁻¹, seed yield and harvest index. PDKV Amba exhibited the highest values for plant height (52.50 cm), branches plant⁻¹ (6.05), no. pods plant⁻¹ (42.44), seed yield plant⁻¹ (19.92 g), seed yield (18.10 q ha⁻¹) and harvest index (32.85%). The 4.0-mm seed size produced the highest field emergence (83.22%), plant height (52.38 cm), branches plant⁻¹ (6.23), pods plant⁻¹ (44.66), seed yield plant⁻¹ (19.89 g), seed yield (18.89 q ha⁻¹) and harvest index (33.45%). The effect on 100-seed weight was non-significant for varieties and seed sizes. The interaction effect of varieties with seed-size was significant only for no. pods plant⁻¹. On the basis of the observed treatment means, PDKV Amba and the 4.0-mm seed fraction showed the most consistent performance under the experimental conditions. These findings support the importance of seed grading as a component of soybean crop establishment and productivity, although multi-season and multi-location validation is required before wider recommendation.

Keywords: Soybean, seed size, seed grading, field emergence, yield attributes, seed yield

Introduction

Soybean (*Glycine max* L.) is an important legume and oilseed crop whose seed is valued for protein and edible oil. Its commercial importance is associated with broad adaptation, multiple uses and its role in diversified production systems. As a legume, soybean can contribute to soil nitrogen economy through biological nitrogen fixation. Nevertheless, realized productivity is determined by the interaction of genotype, seed quality, environment and crop management. Rapid and uniform establishment is a fundamental requirement for productive soybean stands. Seed physical and physiological quality therefore represent an important component of crop performance. Seed size is a readily measurable physical attribute and is commonly considered during seed grading. Differences among seed-size classes may be accompanied by differences in stored reserves and seedling vigour, potentially affecting establishment and early plant development. The effect of seed size may extend beyond emergence to vegetative development, reproductive growth and final seed production. However, the magnitude of this response may vary with genotype and growing conditions. Evaluation of seed-size classes under a defined production environment is consequently useful for developing practical seed-selection recommendations. The present investigation was undertaken to assess three soybean varieties across three seed-size classes and to determine their effects on field emergence, plant growth, yield attributes, seed yield and harvest index under the conditions prevailing at Akola during *kharif* 2025.

Materials and Methods

The experiment was conducted during *kharif* 2025 at the Research Farm of the Seed Technology Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Treatments

were evaluated in a factorial randomized block design with three replications in plot size of 32.4×9 m with following factors.

Table 1: Treatment Details

Factor A	:	Varieties
		V ₁ - PDKV Amba
		V ₂ - Suvarna soya
		V ₃ - JS 335
Factor B	:	Seed size
		S ₁ - 4.00mm
		S ₂ - 3.60mm
		S ₃ - 3.20mm

Field emergence was expressed as the percentage of emerged seedlings relative to the number of seeds sown. At harvest, plant height was measured on five representative plants from the base to the tip of the youngest fully opened leaf. Primary branches and pods plant⁻¹ were recorded from the same sampled plants. Seed yield plant⁻¹ was recorded from the sampled plants, while plot yield was determined after harvesting, drying and threshing and expressed as q ha⁻¹. One-hundred-seed weight was measured using an analytical balance after drying. Harvest index was calculated as economic yield divided by biological yield and expressed as a percentage.

The reported SE (m±) and critical difference (CD) at 5% were used to interpret treatment comparisons. Differences exceeding the corresponding CD were regarded as statistically significant at the 5% level; values designated NS in the source tables were treated as non-significant.

Results and Discussion

The results demonstrate that both varietal background and seed-size class influenced important components of soybean establishment and productivity. Interpretation of significance is based strictly on the reported CD values.

Among varieties, PDKV Amba recorded the greatest plant height (52.50 cm) and number of branches per plant (6.05). Its field emergence (76.33%) was numerically higher than that of Suvarna Soya (74.11%) and JS-335 (74.33%). Thus, the evidence supports a varietal advantage in plant height

and branching, but not a statistically established advantage in field emergence. The superior growth of PDKV Amba might be attributed to its better genetic potential, establishment and efficient utilization of growth resources. Seed size produced a clear response in establishment and vegetative growth. The 4.0-mm seed size recorded 83.22% field emergence, compared with 75.88% and 65.77% for the 3.60 mm and 3.20 mm seed sizes respectively. The same treatment also produced the greatest plant height (52.38 cm) and number of branches per plant (6.23), indicating superior early crop performance associated with the larger seed class. This pattern is biologically compatible with the greater food reserves in larger seeds, resulting in better germination, seedling establishment and vegetative growth, as reported by Jasim, E.A. and Esho, K.B. (2022), Xu *et al.* (2022) and Wang *et al.* (2025) [3, 4, 5]. PDKV Amba produced the highest pods plant⁻¹ (42.44), seed yield plant⁻¹ (19.92 g), seed yield (18.10 q ha⁻¹) and harvest index (32.85%). The reported CDs indicate significant varietal differences for these traits. In contrast, 100-seed weight ranged narrowly from 10.78 to 10.81 g and was reported as non-significant. The higher productivity of PDKV Amba was therefore associated primarily with its reproductive performance and total yield rather than a statistically demonstrable difference in 100 seed weight. The 4.0 mm seed size was superior for pods plant⁻¹ (44.66), seed yield plant⁻¹ (19.89 g), seed yield (18.89 q ha⁻¹) and harvest index (33.45%). Although 100 seed weight was numerically highest with 4.0mm (11.58 g), the effect was explicitly reported as non-significant. Accordingly, the numerical maximum should not be presented as a statistically confirmed treatment effect. These results are in close agreement with the findings of Bianchi *et al.* (2022), Hua *et al.* (2025) [1, 2]. The interaction of varieties with seed size was significant only for number of pods per plant. Interactions for field emergence, plant height, branching, seed yield per plant, seed yield, 100 seed weight and harvest index were reported as non-significant. This indicates that pod production showed some genotype-specific response to seed size, whereas the principal trends in growth and yield were comparatively consistent across the tested varieties.

Table 2: Mean performance of soybean varieties and seed-size classes for growth traits

Treatment	Field emergence (%)	Plant height (cm)	Number of Branches per plant
V ₁ – PDKV Amba	76.33	52.50	6.05
V ₂ – Suvarna Soya	74.11	48.59	5.66
V ₃ – JS-335	74.33	50.15	5.62
SE(m) ±	0.85	0.40	0.11
CD at 5%	2.55	1.21	0.33
S ₁ – 4.0 mm	83.22	52.38	6.23
S ₂ – 3.6 mm	75.88	51.27	5.96
S ₃ – 3.2 mm	65.77	47.68	5.14
SE(m) ±	0.85	0.40	0.11
CD at 5%	2.55	1.21	0.33
Interaction SE(m) ±	1.47	0.70	0.19
Interaction CD at 5%	NS	NS	NS

Table 3: Mean performance of soybean varieties and seed-size classes for reproductive and yield traits

Treatment	Number of pods per plant	Seed yield per plant(g)	Seed yield (q ha ⁻¹)	100-seed weight (g)	Harvest index (%)
V ₁ – PDKV Amba	42.44	19.92	18.10	10.81	33.74
V ₂ – Suvarna Soya	41.00	17.15	14.88	10.78	31.44
V ₃ – JS-335	40.55	18.85	15.28	10.79	30.24
SE(m) ±	0.75	0.55	0.34	0.29	0.42
CD at 5%	2.25	1.64	1.02	0.86	1.27
S ₁ – 4.0 mm	44.66	19.89	18.89	11.58	34.94

S2 – 3.6 mm	41.88	18.41	16.57	10.56	32.37
S3 – 3.2 mm	37.44	17.62	12.79	10.24	28.12
SE(m) ±	0.75	0.55	0.34	0.29	0.42
CD at 5%	2.25	1.64	1.02	NS	1.27
Interaction SE(m) ±	1.29	0.95	0.59	0.50	0.73
Interaction CD at 5%	3.89	NS	NS	NS	NS

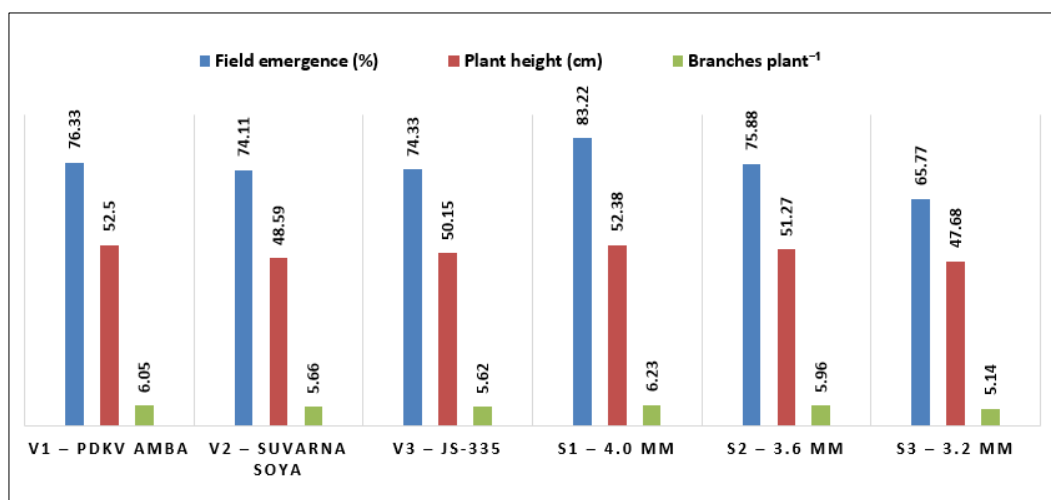


Fig 1: Mean performance of soybean varieties and seed-size classes for growth traits

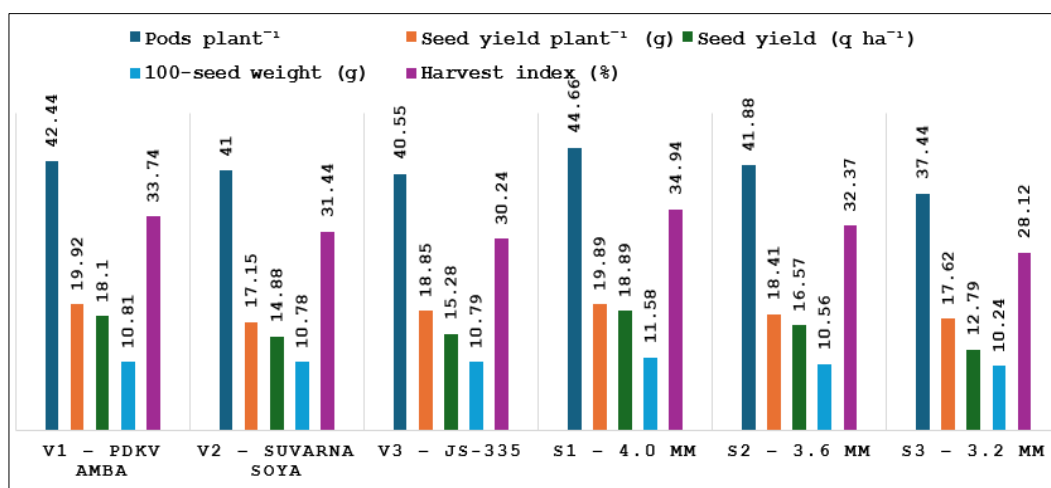


Fig 2: Mean performance of soybean varieties and seed-size classes for reproductive and yield traits

Conclusion: The experiment showed that soybean performance was affected by both variety and seed size under the conditions of *kharif* 2025 at Akola. PDKV Amba recorded the strongest overall varietal performance, whereas the 4.0 mm seed class produced the highest field emergence, vegetative growth, pod production, seed yield per plant, seed yield and harvest index. The interaction effect of variety with seed size was significant only for number of pods per plant, while 100 seed weight was not significantly affected by either factor. The results suggest that a well-graded 4.0 mm seed fraction, particularly when used with PDKV Amba, may be advantageous for crop establishment and productivity. Because the study represents a single season and location, broader recommendation should await validation across environments and additional soybean genotypes.

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• **Conflicts of Interest:** There are no conflicts among authors

References

1. Bianchi MC, Vilela NJD, Carvalho ER, Pires RMO, Santos HO, Bruzi AT. Soybean seed size: how does it affect crop development and physiological seed quality? *Journal of Seed Science*. 2022;44:e202244010.
2. Hua J, Zhu Y, Li R, Wu Z, Xu Y, Sun S, *et al*. Small- and medium-sized seeds are more conducive to achieving high soybean yield due to outstanding seedling survival and yield formation characteristics. *Journal of Integrative Agriculture*. 2025.
3. Jasim EA, Esho KB. Effect of seed size on seedling vigor and seed yield in vegetable seed production: a review. *European Journal of Agricultural and Rural Education (EJARE)*. 2022;3(5):1-8.
4. Wang X, Sun J, Yi Z, Dong S. Effects of seed size on soybean performance: germination, growth, stress resistance, photosynthesis, and yield. 2025.
5. Xu C, Wu T, Yuan S, Sun S, Han T, Song W, *et al*. Can soybean cultivars with larger seed size produce more protein, lipids, and seed yield? A meta-analysis. *Foods*. 2022;11(24):405.