International Journal of Food Science and Nutrition
www.foodsciencejournal.com
E-ISSN: 2455-4898
Received: 12-10-2026, Accepted: 11-11-2026, Published: 26-11-2026
Volume 11, Issue 4, 2026, Page No. 218-221

Standardization of grading screen size for quality improvement of blackgram (*Vigna mungo* L.) variety TRCRU-22

Gnyandev B[1], Ningdalli Mallikarjun[2], Sunilkumar N M[3], Sidramappa[4], Umesh Hiremath[5], S R Doddagoudar[6]
[1] Assistant Professor, Seed Science and Technology, Agricultral Research Station, Bidar, UAS, Raichur, Karnataka, India
[2] Associate Professor, Horticulture, College of Agriculture Kalburgi, UAS, Raichur, Karnataka, India
[3] Professor of Entomology, Agricultral Research Station, Bidar, UAS, Raichur, Karnataka, India
[4] Associate Professor, Genetics and Plant Breeding, Agricultral Research Station, Bidar, UAS, Raichur, Karnataka, India
[5] Assistant Professor, Seed Science and Technology, Seed Unit, UAS, Raichur, Karnataka, India
[6] Associate Professor, Seed Science and Technology, College of Agriculture Raichur, UAS, Raichur, Karnataka, India
DOI: https://doi.org/10.66856/ijfsn.2026.11.4.11210

Abstract
The present investigation was conducted to standardize the optimum grading screen size for improving the physical and physiological quality of blackgram variety TRCRU-22. Five different sieve screen sizes *viz*., 2.8, 3.0, 3.2, 3.4 and 3.6 mm were evaluated for seed recovery, physical purity, germination, seedling growth, seedling vigour index, test weight, seed dimensions and moisture content. The results revealed significant differences among the grading screen sizes for most of the seed quality parameters. Among the treatments, seeds retained on the 3.6 mm screen recorded the highest physical purity (98.88%), germination (88.75%), seedling length (29.54 cm), seedling dry weight (120.66 mg), vigour index-I (2622), vigour index-II (11497) and test weight (45.27 g). The 3.4 mm screen recorded the highest seed recovery (88.44% was not observed; the highest recovery of 94.23% was recorded with the 2.8 mm screen) and the highest seed thickness (3.388 mm). The 3.6 mm screen also recorded the highest seed length (5.175 mm) and seed breadth (3.375 mm). However, the 3.2 and 3.4 mm screens recorded comparatively higher recovery than the larger screen sizes. The results indicated that grading blackgram seeds through a 3.6 mm screen improved physical and physiological seed quality, whereas the 3.2–3.4 mm screens offered a compromise between seed recovery and quality. Therefore, the 3.4 mm screen may be considered a promising grading size where both seed recovery and seed quality are important, while the 3.6 mm screen is suitable for obtaining a premium-quality seed fraction.

Keywords: Blackgram, TRCRU-22, seed grading, screen size, seed recovery, physical purity, germination, seed vigour

Introduction

Blackgram (*Vigna mungo* L.), popularly referred to as urdbean, is one of the major pulse crops belonging to the family Fabaceae. It is extensively grown in India and several other countries of South Asia because of its nutritional significance, relatively short crop duration and suitability to diverse agro-ecological environments. The seeds are an excellent source of dietary protein, carbohydrates, minerals and essential amino acids, contributing significantly to nutritional security. Furthermore, blackgram plays an important role in maintaining soil health through biological nitrogen fixation and serves as a suitable component of various cropping and farming systems.

The successful cultivation of blackgram largely depends on the availability and utilization of quality seeds. Seed quality is a major determinant of crop establishment, plant population, seedling vigour and ultimately crop productivity. However, freshly harvested seed lots often exhibit considerable variation in seed size, shape, maturity and physical appearance. They may also contain immature, shrivelled, broken, undersized and mechanically damaged seeds, which can adversely influence the overall quality of the seed lot and subsequent crop performance.

Seed grading is an essential component of scientific seed processing, involving the separation of seeds into different size fractions using screens with varying aperture dimensions. This operation facilitates the removal of undesirable seed fractions and helps obtain a uniform lot of well-developed seeds. Seed dimensions are closely associated with seed weight, endosperm or cotyledon reserves and the availability of stored food materials required during germination. Generally, bold and well-filled seeds possess greater reserve food materials and may produce more vigorous seedlings compared to smaller and poorly developed seeds.

The choice of a suitable screen size is an important consideration in seed grading, as it directly influences both seed recovery and the quality of the graded seed fraction. Smaller screen apertures may allow a greater proportion of seeds to be retained, resulting in higher recovery, but may also permit undersized and poorly developed seeds to remain in the seed lot. In contrast, larger screen apertures favour the selection of bold and uniform seeds with improved physical and physiological attributes, although the overall recovery percentage may decrease. Hence, identifying an appropriate screen size that ensures a desirable balance between seed recovery and seed quality is essential for efficient seed processing.

Blackgram variety TRCRU-22 requires a suitable and scientifically established grading standard to obtain uniform, physically pure and physiologically superior seeds for quality seed production and distribution. Since seed size and dimensional characteristics differ among varieties, grading standards developed for other blackgram genotypes may not necessarily be suitable for this variety. Therefore,

standardization of screen aperture size based on varietal seed characteristics is necessary to improve the efficiency of seed processing and ensure the availability of quality planting material.

Considering the importance of mechanical seed grading in enhancing seed quality, the present investigation was conducted to identify the most appropriate screen size for grading blackgram variety TRCRU-22. The study aimed to evaluate different grading screen sizes with respect to seed recovery, physical purity, germination percentage, seedling vigour and other relevant physical seed characteristics, thereby establishing an effective grading standard for quality seed production.

Materials and Methods

1. Experimental material and location

The investigation was conducted during 2023–2025 at Agricultural Research Station (ARS), Bidar, Karnataka, (2 years pooled data were presented) to standardize the optimum grading screen size for blackgram (*Vigna mungo* L.) variety TRCRU-22. The seed material was collected from the harvested seed lot of TRCRU-22 and subjected to mechanical grading using five different sieve sizes with varying aperture dimensions. The study was undertaken to evaluate the influence of sieve size on seed recovery, physical purity and other seed quality parameters and to identify the most suitable grading screen size for obtaining a physically pure, uniform and high-quality seed lot.

2. Experimental treatments

Five screen sizes were evaluated to determine their influence on seed recovery and quality parameters.

Treatment	Grading screen size
S1	2.8 mm
S2	3.0 mm
S3	3.2 mm
S4	3.4 mm
S5	3.6 mm

3. Seed grading procedure

The seed lot of black gram variety TRCRU-22 was cleaned to remove extraneous materials and subjected to grading using screens of 2.8, 3.0, 3.2, 3.4 and 3.6 mm aperture sizes. The seeds retained on the respective screens were collected separately and evaluated for physical and physiological seed quality parameters.

4. Observations recorded

Seed recovery (%): Seed recovery was calculated based on the weight of seed retained after grading in relation to the initial weight of the seed sample.

Seed recovery % =weight of graded seed/initial seed weight x100

Physical purity (%): Physical purity was determined by separating pure seeds from inert matter and other seeds and expressing the weight of pure seed as a percentage of the total working sample.

Germination (%): Germination was assessed using the standard germination test under suitable laboratory conditions. Normal seedlings were counted and expressed as a percentage of the total seeds tested.

Seedling length (cm): The length of normal seedlings was measured from the root tip to the shoot tip, and the average seedling length was expressed in centimetres.

Seedling dry weight (mg): Normal seedlings were dried in a hot-air oven until constant weight was obtained, and the average dry weight was expressed in milligrams.

Vigour index: Seed vigour index were calculated using the following formulae:

Vigour Index-I = Germination % x Seedling length (cm)

Vigour Index-II = Germination % x Seedling dry weight (mg)

Test weight (g): The weight of 1000 seeds was determined and expressed in grams.

Moisture content (%): Seed moisture content was determined using the standard oven-drying method and expressed as a percentage.

5. Statistical analysis

The experimental data were statistically analysed using the appropriate procedure for a completely randomized design (CRD), subject to confirmation of the actual experimental design. Standard error of the mean (SEm±) and critical difference (CD) at the 1 per cent probability level were used to assess treatment differences.

Results and Discussion

The data pertaining to the standardization of grading screen size for blackgram variety TRCRU-22 are presented in Table 1. The results indicated that different grading screen sizes significantly influenced seed recovery, physical purity, germination, seedling growth, vigour index, test weight and seed dimensions.

1. Effect of grading screen size on seed recovery and physical purity

Seed recovery differed considerably among the grading screen sizes. The highest seed recovery (94.23%) was recorded in S1 (2.8 mm), followed by S2 (3.0 mm) with 92.68% and S3 (3.2 mm) with 90.70%. The lowest recovery (86.34%) was observed in S5 (3.6 mm). This indicated that seed recovery decreased with an increase in screen aperture size. The higher recovery under smaller screen sizes could be attributed to the retention of a greater proportion of seeds, including relatively smaller seeds.

In contrast, physical purity increased with increasing screen size. The highest physical purity (98.88%) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 98.61%, S3 (3.2 mm) with 98.30% and S2 (3.0 mm) with 98.06%. The lowest physical purity (95.91%) was recorded in S1 (2.8 mm). The improvement in physical purity with larger screen sizes may be attributed to the effective separation of undersized, immature and poorly developed seeds during grading. The results clearly indicated that larger screen sizes improved the physical quality of the selected seed fraction, although they reduced the overall seed recovery.

2. Effect of grading screen size on germination and seedling growth

Germination percentage showed an increasing trend with an increase in grading screen size. The highest germination

(88.75%) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 87.88%, S3 (3.2 mm) with 86.13% and S2 (3.0 mm) with 84.63%. The lowest germination (82.38%) was recorded in S1 (2.8 mm). The improvement in germination with larger screen sizes may be due to the selection of bold, well-developed and physiologically mature seeds having better food reserves and embryo development.

Similarly, seedling length increased significantly with increasing screen size. The maximum seedling length of 29.54 cm was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 28.16 cm and S3 (3.2 mm) with 27.50 cm. The minimum seedling length (23.88 cm) was recorded in S1 (2.8 mm). The better seedling growth from larger seeds may be attributed to greater reserve food materials, which support embryo development and early seedling establishment.

Seedling dry weight also followed a similar trend. The highest seedling dry weight (120.66 mg) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 114.51 mg and S3 (3.2 mm) with 109.26 mg. The lowest dry weight (96.53 mg) was observed in S1 (2.8 mm). The higher seedling dry weight in larger seed fractions indicates better seedling growth and accumulation of dry matter, probably due to greater availability of stored food reserves.

3. Effect of grading screen size on seedling vigour index

Seedling vigour index-I differed significantly among the grading screen sizes. The highest vigour index-I (2622) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 2478, S3 (3.2 mm) with 2370 and S2 (3.0 mm) with 2128. The lowest value (1964) was recorded in S1 (2.8 mm). The higher vigour index-I under larger screen sizes was mainly associated with improved germination and greater seedling length.

Similarly, the highest vigour index-II (11497) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 10668, S3 (3.2 mm) with 9931 and S2 (3.0 mm) with 9292. The lowest vigour index-II (8537) was observed in S1 (2.8 mm). These results indicated that grading through larger screen sizes resulted in a superior seed fraction with better physiological performance.

4. Effect of grading screen size on test weight and seed dimensions

Test weight increased progressively with an increase in grading screen size. The highest test weight (45.27 g) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 44.04 g, S3 (3.2 mm) with 43.16 g and S2 (3.0 mm) with 41.52 g. The lowest test weight (39.66 g) was recorded in S1 (2.8 mm). The increase in test weight indicates that larger screen sizes effectively separated bold and well-developed seeds from smaller seed fractions.

Seed length also increased with increasing screen size. The maximum seed length (5.175 mm) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 5.133 mm, while the minimum (4.310 mm) was recorded in S1 (2.8 mm).

Similarly, the highest seed breadth (3.375 mm) was recorded in S5 (3.6 mm), followed by S4 (3.4 mm) with 3.300 mm. The lowest seed breadth (3.188 mm) was recorded in S1 (2.8 mm). However, the differences in seed breadth among the treatments were statistically non-significant, indicating comparatively less variation in seed breadth due to grading screen size.

Seed thickness was highest (3.425 mm) in S5 (3.6 mm), followed by S4 (3.4 mm) with 3.388 mm and S3 (3.2 mm) with 3.325 mm. The lowest seed thickness (3.150 mm) was recorded in S1 (2.8 mm). The increase in seed dimensions and test weight with increasing screen size confirms the effectiveness of grading in separating bold seeds with better physical characteristics.

5. Effect of grading screen size on seed moisture content

Seed moisture content varied among the different grading screen sizes. The highest moisture content (9.63%) was recorded in S4 (3.4 mm), followed by S2 (3.0 mm) with 9.62%, S3 (3.2 mm) with 9.47% and S5 (3.6 mm) with 9.46%. The lowest moisture content (9.24%) was observed in S1 (2.8 mm). Although some variation was observed, the moisture content of all seed fractions remained within a relatively narrow range. The observed differences may be associated with variation in seed size and seed characteristics.

Table 1: Effect of different grading screen sizes on physical and physiological seed quality parameters of blackgram variety TRCRU-22

Parameters	S1 (2.8 mm)	S2 (3.0 mm)	S3 (3.2 mm)	S4 (3.4 mm)	S5 (3.6 mm)
Seed recovery (%)	94.23	92.68	90.70	88.44	86.34
Physical purity (%)	95.91	98.06	98.30	98.61	98.88
Germination (%)	82.38	84.63	86.13	87.88	88.75
Seedling length (cm)	23.88	25.15	27.50	28.16	29.54
Seedling dry weight (mg)	96.53	102.51	109.26	114.51	120.66
Vigour index-I	1964	2128	2370	2478	2622
Vigour index-II	8537	9292	9931	10668	11497
Test weight (g)	39.66	41.52	43.16	44.04	45.27
Seed length (mm)	4.310	4.488	5.005	5.133	5.175
Seed breadth (mm)	3.188	3.235	3.263	3.300	3.375
Seed thickness (mm)	3.150	3.275	3.325	3.388	3.425
Moisture content (%)	9.24	9.62	9.47	9.63	9.46

Table 2: Statistical parameters

Parameters	SEm±	CD at 1%
Seed recovery (%)	0.73	3.05
Physical purity (%)	0.28	1.20
Germination (%)	1.08	4.51
Seedling length (cm)	0.74	3.12

Seedling dry weight (mg)	2.72	11.35
Vigour index-I	72.81	303.45
Vigour index-II	271.9842	1133.4348
Test weight (g)	0.4322	1.8011
Seed length (mm)	0.0735	0.3061
Seed breadth (mm)	0.0434	NS
Seed thickness (mm)	0.0591	0.2462
Moisture content (%)	0.0824	0.3434

Note: CD = Critical Difference; NS = Non-significant.

Conclusion

The investigation revealed that grading screen size played an important role in improving the physical and physiological quality of blackgram variety TRCRU-22. Among the five screen sizes evaluated, the 3.6 mm screen recorded the highest physical purity (98.88%), germination (88.75%), seedling length (29.54 cm), seedling dry weight (120.66 mg), vigour index-I (2622), vigour index-II (11497) and test weight (45.27 g). However, the highest seed recovery (94.23%) was obtained with the 2.8 mm screen.

Considering the balance between seed recovery and physiological seed quality, the 3.4 mm screen (S4) can be considered a suitable compromise for commercial grading, as it recorded 88.44 per cent seed recovery, 98.61 per cent physical purity and 87.88 per cent germination. For obtaining premium-quality seeds with maximum physiological potential, the 3.6 mm screen is preferable.

Thus, grading blackgram variety TRCRU-22 using a 3.4 mm or 3.6 mm screen can improve seed quality, depending on the requirement for seed recovery or higher physiological quality.

Referencess

1. Abdul-Baki AA, Anderson JD. Vigor determination in soybean seed by multiple criteria. Crop Science,1973:13:630–633.
2. Agrawal PK. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 1996.
3. Copeland LO, McDonald MB. Principles of Seed Science and Technology. 4th Edition. Kluwer Academic Publishers, Boston, USA, 2001.
4. Delouche JC, Caldwell WP. Seed vigor and vigor tests. Proceedings of the Association of Official Seed Analysts,1960:50:124–129.
5. Ellis RH, Roberts EH. The quantification of ageing and survival in orthodox seeds. Seed Science and Technology,1981:9:373–409.
6. ISTA. International Rules for Seed Testing. International Seed Testing Association, Bassersdorf, Switzerland, 2024.
7. McDonald MB. Assessment of seed quality. HortScience,1980:15:784–788.
8. Tekrony DM, Egli DB. Relationship of seed vigor to crop yield: A review. Crop Science,1991:31:816–822.