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STUDIES ON SEED QUALITY PARAMETERS IN DIFFERENT GENOTYPES OF GREEN GRAM UNDER GOAN CONDITIONS

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ABSTRACT

The present investigation was conducted to study different seed quality parameters in ten genotypes of green gram (*Vigna radiata* L.) under goan conditions. The present investigation revealed that significant differences were observed among genotypes of all traits studied, including germination percentage, shoot length (cm), root length (cm), total seedling length (cm), total fresh weight (gm), Seedling dry weight (gm), vigour Index I and Vigour Index II. The genotype TM 96-2 recorded significantly highest vigour Index I (3884.99) followed by shoot length (22.17 cm), root length (19.14 cm) and total seedling length (41.32 cm). whereas, genotype Sarthi recorded significantly highest germination percentage (98.25 %) and for other characters like shoot length (21.71 cm), root length (14.27), total seedling length (35.97 cm), seedling dry weight (0.26 gm) it recorded the second position among all the ten genotypes of green gram. The genotype GM-4 recorded significantly highest Vigour index II (26.30) and Seedling dry weight (0.32 gm). The lowest germination percentage was recorded in genotype Nawal (76.25 %). The results indicated that there is a existence of considerable genetic variability among all the tested ten genotypes, suggesting potential for selection and improvement of seed quality traits in mungbean breeding programs.

Keywords **:** Green Gram, Seed quality, different genotypes, vigour.

Introduction

Green gram (*Vigna radiata* L. Wilczek), commonly known as mungbean, is one of the most important pulse crops cultivated in tropical and subtropical regions of the world. It is widely grown in Asia, particularly in India, which is the largest producer and consumer of pulses. Green gram is valued for its high nutritional quality, short duration, and adaptability to diverse cropping systems. The seeds contain about 20–25% protein, carbohydrates, vitamins, and essential minerals, making it an important component of human diet and sustainable agriculture. In India, green gram plays a significant role in enhancing soil fertility due to its ability to fix atmospheric nitrogen through symbiotic association with *Rhizobium*. Because of its short duration (60–70 days), it is commonly grown in kharif, rabi, and summer seasons as a main crop, intercrop, or catch crop. The crop also contributes to crop diversification and improves soil health in pulse-based cropping systems.

Seed quality is a critical factor determining successful crop establishment and productivity. High-quality seeds ensure better germination, vigorous seedlings, uniform crop stand, and higher yield potential. Seed quality is determined by several parameters such as germination percentage, seedling length, seedling dry weight, vigour index, speed of germination, and electrical conductivity. These parameters are influenced by genetic factors, environmental conditions, seed maturity and post-harvest management practices. Genotypic variability plays an important role in determining seed quality traits. Different genotypes exhibit considerable variation in germination, seedling growth, vigour and other physiological characteristics. Evaluation of seed

quality parameters among different genotypes helps in identifying superior genotypes suitable for cultivation and seed production programs.

In the coastal agro-climatic conditions of Goa, pulses including green gram are gaining importance due to their suitability in rice-fallow and mixed cropping systems. However, the warm and humid climate of the region may influence seed development, maturation and seed quality parameters. Therefore, evaluation of seed quality traits in different genotypes under local environmental conditions is essential to identify genotypes with superior seed quality and adaptability. Hence, the present study entitled "Studies on Seed Quality Parameters in Different Genotypes of Green gram under Goan conditions" was undertaken to evaluate the variability in seed quality parameters among different genotypes and to identify superior genotypes suitable for seed production and cultivation under the agro-climatic conditions of Goa.

Materials and Methods

The laboratory experiments were conducted in the Department of Agricultural Botany, Goa College of Agriculture, Ela Farm, Old Goa, Goa 403 402 , during 2025-26. Different ten mung bean (*Vigna radiata* L.) genotypes were used in this study to evaluate seed physiological parameters. The experiment was laid out in a Completely Randomized Design (CRD) with four replications. The following physiological parameters were studied in laboratory condition.

Germination Percentage (%): The germination test was conducted using four replications of 100 seeds from each sample in roll towel papers as per procedure described by ISTA (2010). At the end of 7th day numbers of normal seedlings were counted and germination percentage was calculated by using the formula: Germination (%) = (Number of germinated seeds / Total number of seeds sown) × 100

Shoot Length (cm): Shoot length was measured from the base of the stem to the tip of the primary leaf using a scale. The average shoot length was calculated for each replication.

Root Length (cm): The root length of ten randomly selected seedlings from each replication was measured from the root tip to the base of the stem and the average was recorded in centimetres.

Total Seedling length (cm) : The total seedling length (cm) were measured from the tip of the primary leaf to the root tip using scale. The average ten seedlings, total seedling length was recorded in centimetres.

Seedling Fresh Weight (g) : The ten seedlings used for length measurements were used for measurement of seedling fresh weight (g) using a precision balance.

Seedling Dry Weight (g): The ten seedlings used for length measurements were dried in a hot air oven at 80°C for 24 hours and then weighed using a precision balance.

Seed Vigor Index-I (SVI-I) and Seed Vigour Index II was calculated as:

SVI-I = Germination (%) × Mean seedling length (cm) and

Seed Vigor Index-II (SVI-II) was calculated as: SVI-II = Germination (%) × Seedling dry weight (g). The vigour index was calculated as per the formula given by Abdul Baki and Anderson (1973).

Statistical Analysis

The experimental data collected for seed physiological traits germination percentage, root length (cm), shoot length (cm), total seedling length (cm), Seedling fresh weight (gm), seedling dry weight (gm), and vigour index length and vigour index mass were subjected to statistical analysis by adopting the procedure described by Panse and Sukhatme (1985). The experimental design used for analysis was a Completely Randomized Design (CRD) with four replications. The significance of treatment effects was tested at 5% probability levels.

All calculations were performed using standard statistical procedures with the help of OPSTAT software (developed by CCS HAU, Hisar). The interpretation of the results was done based on the significance of mean squares for the genotypes from the ANOVA table.

Results and Discussion

The analysis of variance (Table 1) revealed highly significant differences ($p < 0.01$) among all the mungbean genotypes for all seed physiological traits studied: germination percentage, root length, shoot length, total seedling length, seeding fresh weight, seedling dry weight, and Vigour index I and Vigour Index II. This indicates substantial genetic variability among the genotypes for these traits, which is essential for selection and breeding programs.

Germination percentage: Germination play very important role in planting value and it is important seed quality parameters. Germination is a complex critical character under marginal environmental conditions. It is one of the important criteria for determining the physiological aspect of seed and gives an idea about the ability of seed to produce normal and healthy

seedling under the field conditions. During seed germination, various stored substrates are reactivated, repaired, transformed into new building materials necessary for the initial growth of embryo, its subsequent growth and seedling establishment in its natural habitat (Koller and Hadas, 1982). There was significant difference among the genotypes for standard germination. The germination percentage of mungbean genotypes varied significantly from 76.25 % (Nawal) to 98.25 % (Sarthi) (Table 2).

The average germination percentage was 91.08%. The significantly highest germination was observed in genotypes Sarthi (98.25%) which was at par with Taiwan (97.75 %) followed by Sarthi 336 (97.25 %), BM 2003-2 (96.25 %) and Dapoli Moog No.1 (95.25 %) may be attributed to superior genetic makeup and better physiological seed conditions. The lowest germination was recorded in Nawal (76.25%) could be due to poor seed storage conditions or lower inherent seed viability. The variability observed in seed germination could also be influenced by environmental factors during seed production, harvesting, drying and storage. Similar findings of genetic and environmental influence on germination have been reported by Tzortzakis (2009), Krishnappa *et al.* (2001) in finger millet and Sarkar *et al.* (2015) in okra.

Shoot length (cm)

The analysis of shoot length revealed significant differences among genotypes. The highest shoot length was recorded in T10 – TM 96-2 (22.17 cm), which was statistically at par with T7– Sarthi (21.71 cm) followed by T1 – Phule Suvarna (21.61 cm), T8 – Sarthi 336 (20.50 cm) and T2 - Nawal (20.48 cm). The lowest shoot length was recorded in T3 – Dapoli Moog No.1 (15.38 cm), which was significantly inferior to all other treatments. The average shoot length was (19.70 cm).

Shoot length is an indicator of genotypes to have ability of earliness in germination. More shoot length implies earliness of the genotype in respect of germination and probably also of flowering and fruiting. Variability in shoot length of green gram genotypes has also been reported by Dubey and Syed (2025).

Root length (cm) - Root length of seedlings implies genetic potentiality of seedling to establish itself in resource (soil moisture) rich delphic atmosphere. Higher seedling root length means there will be more ability of seedlings (further plants) to survive in moisture stress conditions. The analyzed data on root length indicated significant difference among green gram genotype. The average root length was (13.61 cm). The maximum root length was recorded in T10 – TM 96-2 (19.14 cm), which was significantly superior to all other treatments. The lowest root length was observed in T8 – Sarthi 336 (11.84 cm), T5- BM 2002-1 (11.61 cm) and T2 - Nawal (11.48 cm), which were at par among themselves and significantly inferior to the higher-performing treatments.

The root length and shoot length are vital for early seedling establishment and nutrient uptake. Longer roots and shoots suggesting their potential for better field performance. Although, root length is a character not directly related to pod yield but it has importance in stress tolerance. The genotypes with higher root length can better withstand water stress conditions in rainfed hills. In this way, root length has indirect effect on plant growth and pod yield of green gram. Variability in root length of green gram genotypes corresponding to present investigation has also been realized by Dubey and Syed (2025).

Total seedling length (cm) - The overall seedling length is function of root and shoots length. It indicates growth rate and growth habit of the genotypes. Seedling length has direct correlation with seed vigour during the germination process, the seed which produce taller seedling are considered to be more vigorous than those which produce shorter seedling.

The total seedling length showed significant variation among genotypes. The highest seedling length was recorded in T10 – TM 96-2 (41.32 cm), which was significantly superior to all other treatments. The genotypes T7 – Sarthi (35.97 cm), T1 – Phule suvarna (35.13 cm), T4 – GM 4 (33.81 cm), T6 – BM 2003-2 (33.11 cm), T8 - Sarthi 336 (32.34 cm) and T2 - Nawal (31.95 cm) were statistically at par with each other, exhibiting moderate seedling length. The lowest values were observed in T5 – BM 2002-1 (28.88 cm), which were significantly inferior to the rest of the treatments. Shorter seedling growth in other genotypes might reflect lower metabolic activity or seed vigour whereas higher seedling growth suggesting their potential for better field establishment. Increasing trend of seedling length in the genotypes was accompanied with good germination capacity of the seeds. Variable results on variability in the seedling length of different crops have been reported by different workers; in pea genotypes increasing seedling length reported by Panwar et al. (2020) and Tiwari et al. (2014) in cluster bean.

Seedling fresh weight (gm)

Seedling fresh weight differed significantly among genotypes. The significantly highest fresh weight was recorded in T8 – Sarthi 336 (6.09 g), which

was statistically at par with T4 – GM 4 (5.82 g) and both were significantly superior to all other treatments. The lowest fresh weight was recorded in T10 - Taiwan 96-2 (3.16 g) and T3 - Dapoli Moog No.1 (2.81 g), which were at par and significantly inferior to the rest of the treatments. And these results are similarly find out by Ansari *et al*. (2017) and Anita Kumari et al (2020) in cluster bean.

Seedling dry weight (gm) - Seedling dry weight is a measure of total accumulation of dry matter in the seedlings. Since, the dry matter is estimated in laboratory condition at very initial stage of life cycle when photosynthetic system has not been activated. Therefore the level of dry matter content in seedlings at this stage is directly related to food reserves of the seeds. Seedling dry weight is an important attribute which determines vigour of the seedling. Bolder seeds produce healthy seedling and have more dry weight than that of the small seeds. Plants grown in the favourable conditions produce healthy and bold seeds which in turn resulted in higher dry weight. Seedling dry weight is an important character as it is directly correlated to seed vigour. Seed lot having higher seedling dry weight considered to have higher vigour (Raturi, 2013).The analysed data on seedling dry weight as depicted in Table 2 indicate a wide range of variability from 0.16 g to 0.32 g.

Seedling dry weight showed significant variation among the genotypes. The highest dry weight was recorded in T4 - GM-4 (0.32 g), which was significantly superior to all other treatments. The genotypes T7- Sarthi (0.26 g) and T8 - Sarthi 336 (0.25 g) were at par with each other and formed the next superior group. The lowest dry weight was recorded in T1- Phule suvarna (0.19 g) and T3-Dapoli Moog No.1 (0.16 g), which were at par and significantly inferior to the rest of the treatments. Similar type of results was reported by Dubey and Syed (2025).

In other crops, in pea a wide range of variability in seedling dry weight have also been reported by Kumar (2007) from 0.42 g to 1.13 g; Pant (2008) from 0.45 g to 0.95 g and Prasad (2009) from 0.72 g to 1.06 g.

Vigour Index I - Seedling vigour index–I is related to the size factor of seedlings. Vigour is a qualitative term encompassing the sum of those properties of the seed which determine the potential level of activity and performance of seed or seed lot during germination and seedling emergence. All genotypes included in this experiment, exhibited significant variation in vigour index I ranging from 2436.50 to 3884.99 (Table 2).

Vigour Index I differed significantly among genotypes. The highest vigour index was recorded in T10–TM 96-2 (3884.99), which was significantly superior to all other treatments and which was at par with genotypes T7- Sarthi (3534.83). The lowest vigour index was recorded in T2–Nawal (2436.58), which was significantly inferior to the remaining treatments.

Vigour Index II - The seedling vigour index-II is a parameter related to weight factor of the seedlings. Seed vigour index-mass is another important parameter which determines the performance of seeds in fields conditions which is attributed to germination and seedling dry weight. There was significant variation in seedling vigour index-II across the ten genotypes ranging from 15.24 to 26.30.

Vigour Index II showed significant variation among the genotypes. The significantly highest vigour index mass was recorded in T4 – GM 4 (26.30), which was statistically at par with T7 – Sarthi (25.28) and T8 - Sarthi 336 (24.59), forming the top-performing group. The genotypes T6 – BM 2003-2 (21.40), T9 - Taiwan (19.80), T5 – BM 2002-1 (18.96), and T10 – TM 96-2 (18.57) were at par with each other and exhibited moderate vigour index mass. The lowest vigour index mass was recorded in T3 – Dapoli Moog No. 1 (15.24), which was significantly inferior to all other treatments. The higher values of seedling vigour index I and seedling vigour index II are attributed to longer seedlings and higher dry matter accumulation, which are direct indicators of seed quality. Similar results are akin to the findings of Dubey and Syed (2025). Also these indices were positively correlated with germination %, shoot/root length, and dry weight, confirming the findings of Kumar et al. (1989) in mungbean and Krishnappa et al. (2001) in finger millet.

Conclusion

An overview of the experimental results of present investigation indicated a wide spectrum of variation in seed quality parameter among all the ten genotypes of green gram. The present study revealed the ten mungbean genotypes for seed physiological parameters such as germination percentage, root length, shoot length, total seedling length, seedling fresh weight, seedling dry weight, seedling vigour indices (SVI-I and SVI-II). Among all the genotypes, TM 96-2 and Sarthi consistently exhibited superior performance across most parameters, indicating its potential as a promising genotype for seed quality improvement. Conversely, Nawal variety showed the lowest values in key traits, highlighting the need for enhancement in its seed quality attributes. The

observed variation suggests that seed physiological traits are largely influenced by genotypic differences and can be effectively used as selection criteria in mungbean breeding programs. High-vigour genotypes such as TM 96-2 and Sarthi can serve as valuable genetic resources for developing improved varieties with better field emergence and seedling establishment. These findings contribute valuable information for mung bean improvement efforts and can support the selection of high-performing genotypes for cultivation under diverse agro-climatic conditions. In addition to, these promising genotypes can be recommended for further evaluation in field trials and potential inclusion in seed production programs to enhance green gram productivity.

Table 1 : ANOVA for different seed physiological parameters of mungbean genotypes

Source of variation	d.f.	Germination (%)	Shoot length (cm)	Root length (cm)	Total Seedling length (cm)	Seedling fresh weight (10 seedling)gm	Seedling Dry weight (10 seedling)gm	Vigour Index I	Vigour Index II
Genotypes	9	243.16**	17.88**	19.76**	51.81**	4.91**	0.008**	752358.33**	65.18**
Error	30	8.34	2.81	2.20	6.86	0.27	0.0001	78156.04	4.46
SE(m)		1.44	0.84	0.74	1.31	0.26	0.01	139.78	1.05
SE(d)		2.04	1.19	1.04	1.85	0.36	0.015	197.68	1.49
C.D.		4.19	2.43	2.15	3.803	0.76	0.03	405.67	3.07
C.V.		3.17	8.52	10.90	7.86	12.24	9.52	9.20	10.43

*significant at 5 % probability ** significant at 1 % probability

Table 2 : Mean performance of different green gram (*Vigna radiata* L.) genotypes for seed quality parameters under laboratory condition.

Genotypes	Germination (%)	Shoot length (cm)	Root length (cm)	Total Seedling length (cm)	Seedling fresh weight (10 seedling)gm	Seedling Dry weight (10 seedling) gm	Vigour Index I	Vigour Index II
T1- Phule Suvarna	83.50	21.61	13.24	35.13	3.67	0.19	2937.65	15.85
T2- Nawal	76.25	20.48	11.48	31.95	4.84	0.22	2436.58	16.76
T3- Dapoli Moog No.1	95.25	15.38	13.84	29.22	2.81	0.16	2781.43	15.24
T4- GM 4	82.00	19.38	14.43	33.81	5.82	0.32	2776.23	26.30
T5- BM 2002-1	90.25	17.26	11.61	28.88	4.08	0.21	2606.68	18.96
T6- BM 2003-2	96.25	19.50	13.61	33.11	3.67	0.22	3180.39	21.40
T7- Sarthi	98.25	21.71	14.27	35.97	4.92	0.26	3534.83	25.28
T8- Sarthi 336	97.25	20.50	11.84	32.34	6.09	0.25	3149.31	24.59
T9- Taiwan	97.75	19.03	12.68	31.70	3.58	0.20	3099.39	19.80
T10- TM 96-2	94.00	22.17	19.14	41.32	3.16	0.20	3884.99	18.57
Mean	91.08	19.70	13.61	33.34	4.26	0.22	3038.74	20.28
SE(m)	1.44	0.84	0.74	1.31	0.26	0.01	139.78	1.05
C.D. @ 5%	4.19	2.43	2.15	3.80	0.76	0.03	405.67	3.07
C.V.	3.17	8.52	10.90	7.86	12.24	9.52	9.20	10.43

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