Influence of seed Size Grading on Physiological Paramaters in Pigeon Pea *cv.* GRG152.

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Abstract

The experiment was initiated during December 2020–21 and 2021–22 at the seed unit, UAS, Raichur, Karnataka, India. ~~–t~~The influence of seed size grading on physiological parameters and for grading different round aperture sieves were used, viz., 3.50 mm, 3.75 mm, 4.00 mm, 4.25 mm, and 4.50 mm. The results revealed that the 3.75 mm sieve recorded higher seed recovery (88.60%) than other sieves with better seed quality parameters like germination (85.44%), physical purity (98.00%), 100 seed weight (10.13 g), seedling vigour index (2662), and pure live seed (83.55%). Hence, during seed processing ~~of~~ Pigeon pea cv., GRG 152 should be size graded with 3.75 mm (R) sieves for more seed recovery with Minimum Seed Certification standard ~~(MSCS)~~ for seed approval by the ~~Govt.~~government of India. This screen size shall be referred to the state seed certification agency/authority for inclusion in the recommended screens for grading ~~of~~ pigeon pea cv., GRG152, in the seed certification program.

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Keywords: Pure l~~L~~ive s~~S~~eed ~~(PLS)~~, ~~Seed~~ seed recovery, seed germination, ~~MSCS~~

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1. Introduction

Pulses are considered one of the most important food legumes globally due to their higher protein content. India ranks first in terms of production, consumption, and acreage of pulses. The major constraint in pulse production is the low productivity unit area^{-1}, which has been focused on the use of poor quality seeds for sowing (Anon, 2023). In India, presently farmers grow more than a dozen of pulses. Among them chickpea, pigeon pea, urd bean, greengram, lentil, field pea, and lathyrus are important.

Pigeon pea is a multipurpose crop providing food, fodder, feed, fuel, functional utility, forest use and fertilizer in context of sustainable agriculture. It is an excellent source of protein (21.7g100g^{-1}), dietary fibres (15.5g100g^{-1}), soluble vitamins, minerals and essential amino acids (Gowda et al., 2015 and Ganiger et al., 2023).

Seed size is one of the important yield components, successful seed production depends on rapid establishment and uniform crop stand in the field.To ensure that, high quality seeds are normally recommended for sowing (Bellaloui et al., 2017, Nikale, 2021 and Ramanadane, 2024). Also, seed size has an effective role on cultivar adaptation to different condition with affecting the seed vigour (Morrison and Xue, 2007, Kumar et al., 2014, Axay et al., 2014, Pozhilarasi et al., 2018, Tabakovic et al., 2020, Pavitra et al., 2021). Among the genetic factors, seed size has a special role in crop production (Pollock and Roos, 1972, Shivakumar et al., 2023). Physical grading of seed based on morphological characters, primarily the seed size is widely used trait for selection of vigorous seed from the lot (Agrawal, 1996, Manikandan and Srimathi, 2014, Arunkumar et al., 2017, Suruti et al., 2019). Studies of Roozrokh et al. (2005) on chickpea showed that large seeds of chickpea had high germination percentage, with more seedling dry weight compare to small seeds. The present method of seed processing using standardized sieve aperture size aims to remove the non-viable seeds so that sound healthy and disease free seed of uniform size are made available for sowing, which give rise to optimum plant population and ultimately resulting higher yield (Kavita and Yogeesha, 2022, Ashok and Guggari, 2022). It is often observed that the seed growers are losing considerable quantity of good seed which is treated as a rejection and considering the huge demand from farmers for certified seed of pigeon pea varieties. During seed processing seed size grading helps in grading the seeds uniformly in to a suitable size as within in the same crop also the seed size varies with the different varieties due to their genetic makeup(Gnyandev et al., 2015, Angadi and Kumar, 2016, Vishwanath and Hunje, 2023, Prachi et al., 2017). So it is very important to grade the seeds properly without compromising the seed quality and also the seed recovery. This graded helps in better crop establishment in the field (Abhishek et al., 2016; Takur et al., 2019). Hence the present study on standardize the optimum sieve aperture size for grading pigeon pea cv., GRG 152 seed was planned and undertaken.

2.Materials and Methods

The experiment was conducted at the Seed Unit, University of Agricultural Sciences, Raichur, Karnataka, India ~~during~~ during the years 2020 and 2021 in ~~the month of~~ December. The experiment was performed month duration. The bulk/unprocessed seeds of pigeon pea cv. GRG 152 harvested from the crop raised at the Seed Unit, seed production plot, UAS, Raichur constituted the seed material for the study. For seed grading, ~~theair~~their cleaner cum grader was used (Cleaner cum grader) having two screens and a fan (aspirator). The ~~bB~~ulk seeds of pigeon peas were size graded using 3.50 mm, 3.75 mm, 4.00 mm, 4.25 mm, and 4.50 perforated metal sieves. The seeds that were retained on each ~~of the~~ sieve and those passed through the sieve were collected separately and the ungraded seeds were treated as control. The seeds of

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Commented [AGD6]: Rephrase to make it clear each grade were tested for seed recovery (%), physical purity (%), 100 seed weight (g), and seed germination (%) as per Anon. (2016), vigor index was worked out (Abdul-Baki and Anderson, 1973) and pure live seed percentage was also worked out.~~Forseed~~For seed germination, 100 seeds ~~each~~ in four replications were tested at constant ~~temperature~~ temperatures of 25±2°C and 90±2% ~~of~~ RH. After 8 days the normal seedlings were counted and expressed as mean seed germination ~~in per cent~~percent as per Anon. (2016).

The Pure live seed percentage was calculated using the following formula:

$$\text{Pure Live Seed (\%)} = \frac{\text{Physical purity (\%) X Germination (\%)}}{100}$$

$$\text{Seed recovery (\%)} = \frac{\text{Weight of seeds retained in each sieve X 100}}{\text{Total weight of seeds}}$$

The experiment was laid out in a completely randomized design with four replications. The results were subject to analysis of variance and expressed at a 1% level of probability (Panse and Sukhatme, 1999).

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3. Results and Discussion

The ~~purpose of grading is to improve the homogeneity of the seed lot~~grading aims to improve the homogeneity of the seed lot grading aims to improve the seed lot by removing the ~~under sized~~under-sized, broken, and shriveled seeds during size grading. The ~~under sized~~undersized seeds are discarded which are believed to include empty, underdeveloped, immature, and low vigorous seeds. ~~Importance~~ The importance of seed size was reported by Menaka and Balamurugan (2008). Seed size is an important ~~physical indicator of seed quality that affects~~indicator of seed quality affecting vegetative growth and is frequently related to yield, market grade factors, and harvest efficiency.

The quantity of seeds retained on each sieve decreases with an increase in sieve size (~~Table1~~Table 1). The seeds retained by the 3.75 mm sieve recorded more seed recovery (%) and also ~~be meeting out~~met the Minimum Seed Certification standard (MSCS) for seed approval by Govt. of India. Similar observations of improved seed recovery and quality have been reported ~~by~~ earlier (Renugadevi et al., 2009 in cluster bean, Tabakovic et al., 2020 in maize, Ganiger et al., 2023 in Bengalgram BGD 103).

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The seed recovery ranged from 53.81 ~~% to~~% to 94.85 % among the size grades. The recovery of larger size seeds (seeds retained in 4.50 mm sieve) was 53.81%whiletherecoveryofmediumsizedseedsretainedin 3.50 mm sieve was 94.85%. The 100 seed weight ranged between 9.56 g and 12.88 g among the size grades and increased with the increase in seed size (Table ~~1and figure1~~1 and Figure 1). Similar results are reported by Sivasubramaniam et al. (2017) in Tephrosia.

The seed germination (%) ~~was~~ ranged from 82.78 to 92.80% and there was a significant difference between the seed germination (%) of different sizes (Table ~~1and~~ 1 and ~~F~~figure 1).~~Increase~~ An increase in seed germination (%) was observed with an increase in seed size. The highest seed germination (%) was observed in 4.50 mm (87.75%). These results are in agreement with our findings of Gunaga et al. (2007) who have recorded higher seed germination and seedling vigour by using ~~bigger sized~~size bigger-sized seeds in *Pongamia pinnata* and *Vateria indica*. Shivakumar et al. (2023) in dhaincha and Arunkumar et al.(2017) in foxtail ~~milet~~millet. In pigeon ~~pea~~peas, 3.50 mm sieve size recorded the highest seed recovery (%) followed by 3.75 mm, even though 3.50 mm recorded the highest seed recovery (%) but with the lowest seed germination (%), but 3.50 mm didn't meet the minimum physical purity seed certification standard even with higher seed recovery compared to 3.75 mm. Hence 3.50 mm sieve size was rejected and 3.75 mm is considered as an optimum sieve size for seed grading of pigeon pea variety GRG 152. Similar results are recorded by Vishwanath et al. (2023) in soyabean and Suruti et al. (2019) in Barnyard millet.

The hundred seed weight was increased with an increase in sieve size (Range 9.56–12.88 g.) and the highest seedling vigour index was observed in sieve size of 4.50 mm (3605) and lowest in ungraded (Figure 1). Seed weight and seedling vigour index were related to the size of the seed and food storage, as the sieve size ~~increases~~increased, the seed size also increased. The larger/bigger seeds generally contain more food ~~in seeds compare to~~than the smaller ones, meanwhile the 100 seed weight was the maximum in ~~large size~~large-size seeds compared to ~~small sizes~~small-size seeds. These results are in confirmative with Willenborg et al. (2005) ~~and~~ Mathur (1982) in oat, and Farhoudi (2010) in safflower. The positive association between the size and weight of seeds was reported by Debchoudhury et al. (1995) in rapeseed, Kumar et al. (2005) in Indian mustard, Angadi and Kumar (2016) in sorghum and Ganiger et al. (2020) in ~~pigeonpea~~pigeon pea.

The ~~per cent~~percent pure live seed increased as the seed size increased from unprocessed to 4.50 mm (70.29 to 92.39) as depicted in ~~F~~figure1.

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4. Conclusions

From the study, it could be inferred that a sieve size of 3.75 mm (Figure 2) was found to be effective, economical, and considered an optimum sieve size for processing of pigeon pea *cv*. GRG 152. Hence, while seed processing of this variety, the seed producers can use a 3.75 mm round grading screen so that they can attain more seed recovery with better seed quality parameters as per the acceptable limits of Indian Minimum Seed Certification standards.

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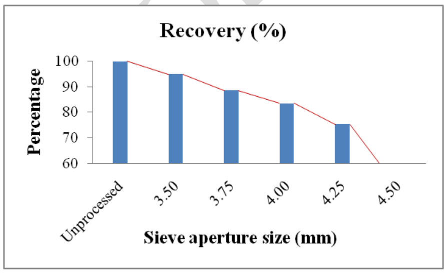
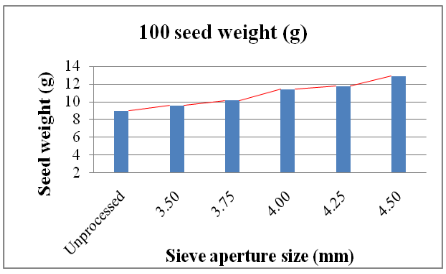
Table 1: Influence of size grading on seed and seedling quality characteristics of Pigeon pea*cv.*GRG 152

Treatments Sieve size (Round shape)	Recovery(%)			Physical purity(%)			Germination (%)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
S_1:Unprocessed	100	100	100	90.97	87.58	89.19	78.00	79.50	78.81
S_2: 3.50 mm	96.03	93.79	94.85	97.25	96.40	96.84	83.25	82.25	82.78
S_3: 3.75 mm	89.31	87.98	88.60	98.27	97.44	98.00	87.25	83.50	85.44
S_4: 4.00 mm	84.52	82.95	83.46	98.49	98.47	98.49	89.00	91.88	90.67
S_5: 4.25 mm	77.31	72.88	75.20	99.29	99.34	99.33	90.00	92.25	91.03
S_6: 4.50 mm	54.84	53.06	53.81	99.72	99.65	99.69	91.50	93.88	92.80
	S	S	S	S	S	S	S	S	S
SEM$\pm$	0.49	0.55	0.25	0.24	0.25	0.17	0.82	0.53	0.50
CD (p=0.01)	1.98	2.25	1.02	0.98	1.01	0.71	3.34	2.14	2.04

Treatments	SVI-I			100 seed weight(g)			PLS (%)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
S_1:Unprocessed	2171	2246	2208	8.96	8.92	8.95	70.96	69.62	70.29
S_2: 3.50 mm	2426	2298	2362	9.656	9.51	9.56	80.85	79.29	80.07
S_3: 3.75 mm	**2742**	**2582**	**2662**	**10.26**	**9.97**	**10.13**	**85.74**	**81.36**	**83.55**
S_4: 4.00 mm	2921	2934	2927	11.96	10.77	11.39	87.66	90.47	89.06
S_5: 4.25 mm	3365	3208	3287	12.08	11.41	11.77	89.36	91.64	90.50
S_6: 4.50 mm	3513	3698	3605	13.67	12.12	12.88	91.24	93.55	92.39
	S	S	S	S	S	S	S	S	S
SEM$\pm$	41.8	39.95	26.27	0.17	0.08	0.09	0.77	0.56	0.54
CD (p=0.01)	170.17	163.63	106.95	0.69	0.32	0.35	3.12	2.27	2.22





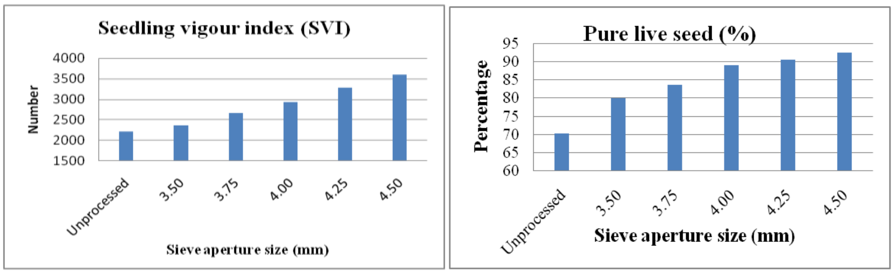


Figure 1: Effect of size grading on (a) seed recovery (%), (b) 100 seed weight, (c) Seedling vigour Index and (d) pure live seed in Pigeon pea cv. GRG 152.

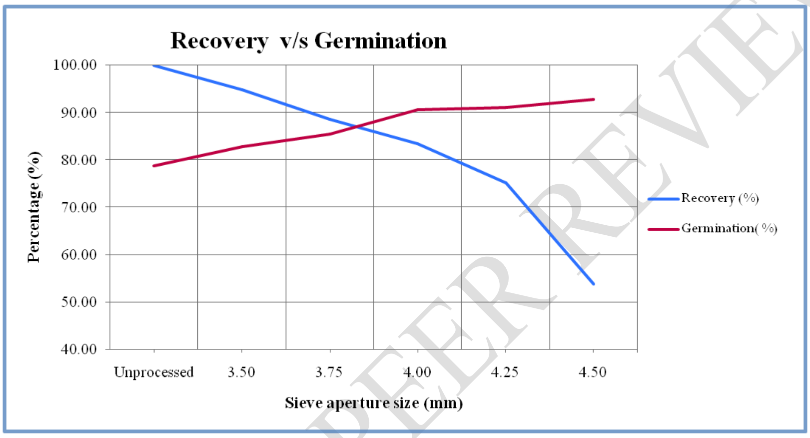


Figure 2: Effect of sieve aperture size distribution curve on recovery percentage and germination percentage of pigeon pea cv. GRG 152.