Environment and Ecology 40 (4) : 2061—2065, October—December 2022
ISSN 0970-0420

Influence of Size Grading on Seed and Seedling Quality Characteristics of Pigeonpea Variety GRG 811

B.S. Ganiger, Basave Gowda, Umesh Hiremath, Lokesh G.Y. , S. R. Doddagoudar

Received 17 March 2022, Accepted 16 July 2022, Published on 19 October 2022

ABSTRACT

Seed processing is the most important practice of quality seed production in achieving the prescribed physical seed standards wherein seed grading is important practice for better crop establishment and also useful in separation of quality seed in a seed lot. In this context the present study on standardisation of sieve aperture size of round shape for grading using different sieves of 3.75 mm, 4.00 mm, 4.30 mm, 4.50 mm and 4.75 mm size. On the basis of two year data, the results revealed that seed recovery in 3.75 mm sieves was higher than the seeds retained other sieves but the quality of seeds retained in 3.75 mm sieves was higher than the Minimum Seed Certification Standard level for germination. Hence on grading of Pigeonpea cv, GRG 811 could be size graded with 3.75 mm (R) sieves for more seed recovery with Minimum Seed Certification Standard (MSCS) for seed approval by Govt of India.

Keywords Pigeonpea cv, GRG 811, Grading, Sieve aperture size, Seed recovery (%).

B.S. Ganiger*
Assistant Professor (Seed Science and Technology), College of Agriculture, Bheemarayanagudi, University of Agricultural Sciences, Raichur 585287, India

Basave Gowda
Registrar, University of Agricultural Sciences, Bengaluru, Karnataka, India

Umesh Hiremath, S. R. Doddagoudar
Assistant Professor (Seed Science and Technology), National Seed Project (Crops), Seed Unit, University of Agricultural Sciences, Raichur, Karnataka, India

Lokesh G. Y.
Assistant Professor (Genetics and Plant breeding), College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Email: bganiger07@gmail.com
*Corresponding author

INTRODUCTION

Pulses are one of the important food crops globally due to higher protein content. India ranks first in terms production, consumption and acreage of pulses. The major constraint in pulse production is the lower productivity per unit area, which has been focused to the use of poor quality seeds for sowing. In India, presently farmers grow more than a dozen of pulses. Among them chickpea, pigeonpea, urd bean, greengram, lentil, field pea, lathyrus are important.

Pigeonpea is second most important pulse crop of India after chickpea which is well balanced nutritionally. It 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 (21.7g /100 g), dietary fibers (15.5 g /100 g), carbohydrates (62.78 g/100 g) soluble vitamins, minerals and essential amino acids (Gowda *et al.* 2015). The total area under pigeonpea cultivation during 2019-20 was ~48.24 lakh hectares producing around 38.80 lqkh tonnes of pigeonpea with an average national productivity of 804 kg/ha (agricoop.nic.in).

Pigeonpea variety GRG-811 for released for Zone 1 and 2 developed at Agriculture Research Station, Kalaburagi, Karnataka having the yield potential of 19 q ha and superior to released cultivars TS-3R (8%) and Maruti (3.6%). It resistant to Fusarium wilt, moderately resistant to sterility mosaic disease (SMD), matures earlier than Maruti.

Scientific seed production recognizes the importance of seed processing to maintain the physical purity of seeds besides recovery of optimum sized seeds for uniform crop establishment and growth. Seed size is an important parameter of seed vigour as it influences the performance of seed in soil. As per the minimum seed certification standards as mention in the blue book published by central seed committee, they are monitoring the change between 3.25 to 4.00 mm (R). So that different agency using different sizes based on this. Presently using sieve size i.e. 4.00 mm for grading Pigeonpea seed is based on old varieties, this sieve is not matching with any of the high yielding varieties which are under cultivation. Present method of seed processing using standardised sieve aperture size aims to remove the non-viable seeds so that sound healthy disease free seed of uniform size will be available for sowing, which will give rise to optimum plant population and higher yield. It is often observed that the seed growers are loosing considerable quantity of good seed which is treated as a rejection and considering the huge demand from farmers for certified seed of pigeonpea, therefore, there is need to standardize the sieve size for seed grading of pigeonpea varieties. Hence the present study on standardise the optimum sieve aperture size for grading pigeonpea cv, GRG 811 seed was planned and undertaken.

MATERIALS AND METHODS

The experiment was conducted at Seed Unit, University of Agricultural Sciences, Raichur, during the year 2019-20 and 2020-21. The bulk seeds of pigeonpea cv GRG 811 harvested from the crop raised at seed unit, UAS, Raichur during 2019 and 2020 constituted the materials for the study. For grading the seeds "Cleaner cum grader" having two screens and one fan were used. The Seeds retained over each sieve size were collected separately and tested for quality parameters i.e. recovery percentage and physical purity percentage (ISTA 1993), 100 seed weight (ISTA 1999) was expressed in gram. The graded seeds were tested for seed recovery percentage, germination percentage, physical purity percentage, 100 seed weight (g). The pre cleaned seeds of red gram cv GRG 811 were graded with round shape sieve of 3.75 mm, 4.00 mm, 4.30 mm, 4.50 mm and 4.75 mm size.

Size grading : The bulk seeds were graded with round shape aperture sieves of size viz., 3.75 mm, 4.00 mm, 4.30 mm, 4.50 mm and 4.75 mm. The seeds retained on the sieves were analyzed for seed recovery in percentage and for the seed and seedling quality characters.

Seed recovery (%) : The weight of seeds retained in each sieve was recorded and seed recovery was calculated in percentage using the following formula

$$\text{Seed recovery (\%)} = \frac{\text{Wight of seeds retained in each sieve}}{\text{Total wight of seeds}} \times 100$$

100 seed weight (g) : Eight replicates of hundred seeds were drawn from each treatment, weighed in sensitive electronic balance and expressed in milligrams (ISTA 1999).

Germination (%) : Four replicates of hundred seeds were tested using between paper method and kept under the test conditions of 25° ± 1°C and 95° ± 3% relative humidity maintained in a germination room illuminated with fluorescent light. After the test period of seven days the normal seedlings were counted and

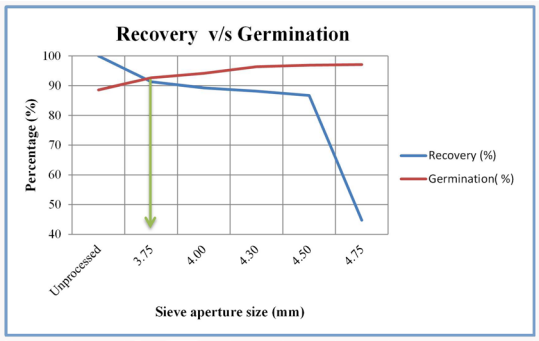

Fig. 1. Effect of sieve size distribution curve on recovery percentage and germination percentage of pigeonpea cv., GRG 811.

the mean values expressed as percentage (ISTA 2013) to the total number of seeds placed for germination.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds placed for germination}} \times 100$$

Seedling vigour index : The Vigour index values were computed, adopting the procedure of Abdul Baki and Anderson (1973) as given below and expressed as whole number.

Seedling vigour index I = Germination (%) × Total seedling length (cm)

Seedling vigour index II = Germination (%) × seedling dry matter (mg)

Pure live seed percentage : Was calculated using following formula :

Pure live seed percentage = Physical purity (%)× Germination (%)/100

The experiment was laid out in a completely randomized design with four replications. The results were subject to analysis of variance and expressed at 1% level of probability. Statistical analysis was done based on the procedure prescribed by Panse and Sukhatme (1999).

RESULTS AND DISCUSSION

The purpose of grading is to improve the homogeneity of the seed lot by removing seeds of the same species with low quality. During size grading, the small seeds are discarded which are believed to include empty, under developed and low vigour seeds. Among the different sieve sizes, highly significant variation was observed for almost all the characters under study. The importance of seed size has been reported by Menaka and Balamurugan (2008).

Grading is one of the important post harvest management techniques that homogenize the seed lot resulting in uniform germination with higher planting value (Suma *et al.* 2014). The results of large scale processing of Pigeonpea cv, GRG 811 seeds are presented in Table 1, indicated that the highest seed recovery percentage was observed in 3.75 (mm) (91.28) and lowest in 4.75 mm (44.76). As the screen size decreased from 4.75 to 3.75 mm, the per cent seed recovery was increased (44.76 to 91.28) (Fig. 1). This is in conformity with the findings of Kumar *et al.* (2014) and Ganiger *et al*. (2020) in red gram cv, TS-3R.

Physical purity recorded significant difference between different sieve size, however highest physical purity percentage was recorded in sieve size 4.75 mm (99.30) followed by 4.50 mm (99.06). Pure live seed percentage has significant difference but highest pure live seed percentage was recorded in 4.75 mm (97.13) followed by 4.5 mm (96.88). Similar observations of improved seed recovery and quality have been reported by many workers (Maruthi 2011 and Ganiger *et al.* 2020).

Germination percentage : Germination percentage in all different sieve sizes was greater than 91 and Germination values increase by increase in seed size and they were in the range of 88.63–97.13% and there were significant differences to standard germination test (Fig. 1). The seeds retained 4.75 mm sieve recorded highest germination (97.13%) followed by 4.50 mm, 4.30 mm and 4.00 mm and 3.75 mm recorded (92.63%) germination percentage which is above the minimum seed certification standards. This is in confirmatory with research findings

Table 1. Influence of size grading on seed and seedling quality characteristics of pigeon pea cv. GRG 811.

Treatments	Recovery(%)			Physical purity(%)			Germination (%)			SVI-I		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
S_1 : Unprocessed	100.00	100.00	100.00	94.10	93.83	93.96	88.00	89.00	88.63	2742	2760	2751
S_2 (3.75mm)	91.80	90.75	91.28	98.06	98.41	98.24	93.00	92.25	92.63	3100	3143	3121
S_3 (4.00mm)	89.80	88.80	89.30	98.16	98.76	98.46	94.00	94.25	94.13	3232	3245	3239
S_4 ((4.30mm)	88.65	87.75	88.20	98.73	98.99	98.86	96.25	96.50	96.38	3424	3496	3460
S_5 (4.50mm)	86.45	87.05	86.75	98.99	99.14	99.06	96.75	97.00	96.88	3481	3619	3550
S_6 (4.75mm)	46.25	43.28	44.76	99.27	99.34	99.30	96.50	97.75	97.13	3568	3793	3681
	S	S	S	S	S	S	S	S	S	S	S	S
SEM ±	0.56	0.45	0.43	0.26	0.19	0.07	1.04	0.74	0.83	98.48	59.56	71.07
CD 1%	2.26	1.82	1.77	1.06	0.76	0.29	4.22	3.01	3.40	400.88	242.67	289.29

Treatments	SVI-II			100 seed weight(g)			PLS (%)		
	2018	2019	Pooled	2018	2019	Pooled	2019	2019	Pooled
S_1 : Unprocessed	82	88	85	9.699	9.276	9.487	83.06	83.49	83.28
S_2 (3.75 mm)	93	95	94	9.460	9.409	9.434	91.20	90.79	90.99
S_3 (4.00 mm)	101	102	101	9.552	9.447	9.500	92.27	93.08	92.68
S_4 (4.30 mm)	104	104	104	9.629	9.733	9.681	95.03	95.53	95.28
S_5 (4.50 mm)	111	113	112	9.657	9.769	9.713	95.77	96.16	95.97
S_6 (4.75 mm)	119	121	120	10.572	10.71	10.642	95.80	97.10	96.45
	S	S	S	S	S	S	S	S	S
SEM ±	2.77	2.17	2.11	0.14	0.14	0.13	1.11	0.62	0.83
CD 1%	11.29	8.85	8.60	0.58	0.57	0.53	4.51	2.62	3.36

of Gunaga *et al.* (2007). The higher germination in large seeds may due to higher amount of food reserves and increased activity of redox enzymes in the seeds helping in breaking down the complex food reserves into simple soluble sugars (Anuradha *et al.* 2009 and Safari *et al.* 2011).

The evaluated seed quality characters of the present study revealed that seed size had positive association with seed weight, The hundred seed weight observed with different sieve size exhibited a reduction with reduction in size of sieve. The highest hundred seed weight was recorded in 4.75 mm (10.572 g) and least in 3.75 mm (9.434 g) sieve size. The positive association of seed size and seed weight was reported by Ganiger *et al.* (2020) redgram cv, TS 3R and Suma *et al.* (2014) in sesame reported that seed size and seed weight was positively related.

Seedling vigour index I and II recorded meagre difference between different sieve size seeds and Seedling vigour index I and II was highest in 4.75 mm and least in unprocessed seeds. But Maruthi (2011) in corn and Ganiger *et al.* (2020) in redgram cv, TS 3R reported that seed size, seed weight and seed quality characters are positively related to each other. All the evaluated vigour parameters exhibited a significant reduction with large, medium, smaller sized seeds. Pollock and Roos (1972) reported that larger seeds possessed more vigour than smaller seeds due to the presence of more of food material. Anuradha *et al*. (2009) in bengalgram also observed that seedling vigour characteristics were positively correlated with seed size and seed weight.

CONCLUSION

Thus, the study inferred that, a sieve size of 3.75 mm (R) registered recovery (91.28%), Physical purity (98.24%), germination (92.63%), 100 seed weight

(9.434 gm), pure live seed (90.99%), SVI-I (3121) and SVI-II (93). These seed quality characteristics are above the minimum seed certification standards and with an additional seed recovery of 2% over the presently using sieve size of 4.00 mm. Hence the Pigeonpea/GRG 811 can be processed using 3.75 mm (R) grading sieve for better seed recovery and quality.

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