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Standardization of sieve size for grading of little millet cv.CO (Samai) 4

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Abstract

Seed grading is an important practice for better crop and also useful in separation of quality seeds in a seed lot. The aim of grading is to improve the uniformity of the seed lot by removing seeds of the same species with low quality. The present study was carried out to find out the optimum sieve size for size grading of seeds of little millet cv.CO (Samai) 4. The effect of seed size on physiological parameters were evaluated using BSS 12×12, BSS 14×14 and BSS 16×16 wire mesh sieves along with control. The little millet seeds graded with BSS 14×14 recorded higher seed recovery (72.4%) than other sieves used with required germination (82%), 1000 seed weight (3.8g), root length (13.03 cm), shoot length (10.67 cm), dry matter production (0.035 g/10 seedlings) and vigour index (1873). Hence, seeds of little millet cv.CO (Samai) 4 could be size graded using BSS 14×14 sieve for more seed recovery with required seed quality standards as compared to BSS 12×12, BSS 16×16 and ungraded seeds.

Keywords: Little millet, sieves, seed recovery, vigour, seed quality

Introduction

Minor millets are claimed to be the future foods for better health and nutrition security. For a successful crop production, the utility of good quality seeds is very important, which increase the yield by 15-20%. Seed size is one of the important key factor for crop improvement. Due to various seed production environment and cultural practices, the seeds may differ by size, weight, colour and density. To eliminate non seed materials, other foreign seeds and low quality seeds of same species, grading act as an integral part of seed production and enhancing the planting value. Studies pertaining to seed grading based on seed size in relation to seed quality characters are warranted as amount of food reserve in seed is the basic requirement for its future expression as germination, and final establishment at field. In addition to obtain uniform seed size within a variety, size grading is inevitable. Jerlin and Vadivelu (2004) [11] reported that larger seeds having higher seeding survival, growth and establishment. When there is an increased investment in seed size results in decreases investments to other functions. Seed size is one of the components of seed quality which affects the performance of crop. (Ojo, 2000; Adebisi, 2004 and Adebisi *et al.*, 2011) [17, 2]. The importance of seed size grading in improving physi-cal and physiological quality of the seeds was re-ported by Suresha *et al.*, (2007) [28] in soapnut; Bicer, (2009) [3] in chickpea; Menaka and Balamurugan, (2008) [15] in amaranthus; Jerlin *et al.*, (2010) [12] in jute; Sadeghi *et al.*, (2011) [23] in safflower; Udhaya *et al.*, (2016) [29] in sunnhemp; Ragupathi, (2017) [20] in proso millet; Sivasubramaniam *et al.*, (2017) in tephrosia and Pozhilarasi *et al.*, (2018) [19] in amaranthus. Therefore, the present study was made in little millet to findout optimum sieve size for grading and its effect on sowing quality of seeds.

Materials and Methods

The study was conducted with little millet seeds obtained from the Department of millets, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study. The experiment was conducted at the department of seed science and technology, AC&RI, Madurai. The pre-cleaned seeds were size graded with BSS 12x12 and BSS 14x14 wire mesh sieves (Fig.1). The seeds retained and passed in each sieve were subjected to the following quality estimation along the ungraded bulk (control).

Seed recovery (%)

The seeds retained by sieves were weighted and the seeds recovery percent was worked out using following formula and expressed in per cent.

$$\text{Seed recovery (\%)} = \frac{\text{Weight of seeds retained passed by the sieve}}{\text{Weight of the ungraded seeds}} \times 100$$

Thousand seed weight

The seeds retained in each of the sieves were weighed and expressed as respective percentage of total quantity of seeds processed. The following determination were made on the above size grades as well as the control (ungraded) viz., 1000 seed weight (International Seed Testing Association, 1999) was determined by recording the mean of eight replications and expressed in gram.

Germination

Germination test was carried out in quadruplicate using 100 seeds each in rolled paper towel method (ISTA, 1999) [10] in a germination room maintained at $25 \pm 1^\circ\text{C}$ temperature and $96 \pm 2\%$ relative humidity (RH) with diffused light during the day. On tenth day of germination test, number of normal seedlings were counted and the average was expressed as percent.

Root length

Ten normal seedlings were selected randomly from the germination test and root length was measured from tip of primary root to base of shoot and mean root length was expressed in cm.

Shoot length

Ten normal seedlings chosen for measurement of root length were used for measurement of shoot length. It was measured from tip of primary leaf to base of shoot and mean shoot length was expressed in cm.

Seedling dry matter production

Ten normal seedlings chosen earlier for measuring shoot and

root lengths were used to determine seedling dry weight. The seedlings kept in paper cover and dried under shade for 24 h and then in a hot air oven at $85 \pm 1^\circ\text{C}$ for 24 hours. The average weight was expressed in gram per ten seedlings.

Vigour index

Seedling vigour index was computed by adopting the following formula as suggested by Abdul-Baki and Anderson (1973) and was expressed in whole number.

$$\text{Vigour index} = \text{Germination percentage} \times \text{Total seedling length in centimeter}$$

Statistical analysis

The data obtained from experiments were analyzed by the 'F' test for significance by following Completely Randomized Design. Wherever necessary, the percent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical significance. (Gomez and Gomez, 1984) [8].

Experimental Results**Seed recovery, 1000 seed weight, Germination**

Seed recovery was significantly influenced by size grades. The seeds retained by BSS 14 x 14 sieves recorded the highest seed recovery of 72.4 per cent and the lowest seed recovery was in BSS 16 x 16 passed with 1.8 per cent. The seed recovery in the BSS 12 X 12 along with BSS 14 x 14 was found to be the highest with 91.1 per cent while, seed recovery of BSS 14 x 14 along with BSS 16 x 16 was 79.5 per cent (Table 1). Among the treatments, maximum 1000 seed weight of 3.83 g was obtained in BSS 12 x 12 retained which was followed by BSS 14 x 14 retained with 3.45 g. The minimum 1000 seed weight of 3.12 g was recorded in BSS 16 x 16 passed. Significant differences in germination were found among the different size grades of seeds. Seeds retained by BSS 14 x 14 recorded the highest germination of 82 per cent followed by BSS 12 x 12 retained seeds with 78 per cent. The seeds passed through BSS 16 x 16 sieve recorded the lowest germination of 68 per cent.

Table 1: Influence of size grading on seed and seedling quality characteristics of little millet cv. CO (Samai) 4

Seed grades	Seed recovery (%)	1000 seed weight (g)	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling dry matter production (g 10 seedlings ⁻¹)	Vigour Index
Bulk	-	3.41	76 (60.66)	12.43	9.32	0.021	1653
BSS 12 x 12 retained	18.7 (25.10)	3.45	78 (62.02)	12.86	9.98	0.026	1849
BSS 14 x 14 retained	72.4 (58.05)	3.83	82 (64.89)	13.03	10.67	0.035	1873
BSS 16 x 16 retained	7.1 (15.34)	3.27	74 (59.34)	11.27	8.82	0.018	1487
BSS 16 x 16 passed	1.8 (5.73)	3.12	68 (55.55)	9.54	6.09	0.012	1063
Mean	25 (30.00)	3.52	75.6 (60.66)	11.8	8.97	0.022	1572
SEd	0.32	0.06	1.83	0.18	0.100	0.0007	30.47
CD (P=0.05)	0.79**	0.16**	4.23**	0.43**	0.23**	0.0016**	70.26**



Fig 1: Different sieves used for grading seeds of little millet cv. CO (Samai) 4

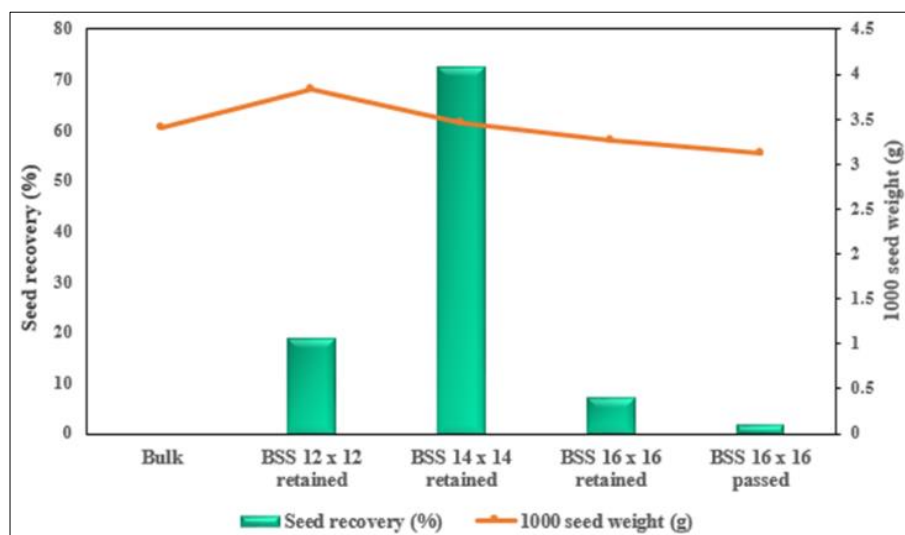


Fig 2: Influence of size grading on seed recovery (%) and 1000 seed weight (g) in little millet cv. CO (Samai) 4

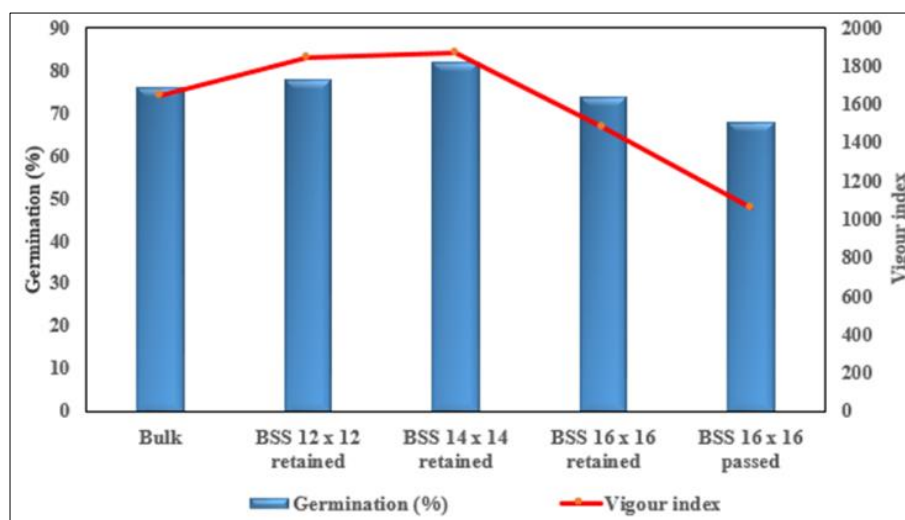


Fig 3: Influence of size grading on germination (%) and vigour index in little millet cv. CO (Samai) 4

Root length, Shoot length, Seedling dry matter production, Vigour index

The root length was significantly influenced by seed size grades. The seeds retained on BSS 14 x 14 sieve produced the longest roots of 13.03 cm and was followed by BSS 12 x 12 retained with 12.86 cm. The shortest root length was produced by BSS 16 x 16 passed seeds with 9.54 cm. Significant differences were observed among the size grades for shoot length of seedlings. Seeds retained on BSS 14x14 sieve recorded the longest shoot of 10.67 cm and was followed BSS 12 x 12 retained sieve retained seeds (9.98 cm). Seeds passed through BSS 16 x 16 registered the shortest

shoot of 6.09 cm. Size grades had significant influence on dry matter production of the seedlings. Among the size grades, seedlings of BSS 14 x 14 retained seeds registered the highest seedling dry matter production of 0.035 g followed by BSS 12 x 12 retained seeds with 0.026 g. The seedlings of BSS 16 x 16 passed seeds recorded the lowest seedling dry matter production of 0.012 g. Vigour index showed significant differences due to the size grades. Seeds retained by BSS 14 x 14 sieve recorded the highest vigour index with 1873 and was followed by BSS 12 x 12 retained seeds (1849). Seeds passed through BSS 16 x 16 recorded the lowest vigour index of 1063.

Discussion

There are various factors, which influence the seed yield and other economic characters. Seed size is one of the important factors deciding the seed quality. Seeds produced under variable climatic conditions may result in variation in seed size or grade and ultimately affecting germination as well as subsequent plant vigour and seed production. The importance of seed size on the quality has been reported by many authors in several crops (Ramesh, 1996; Gabriel *et al.*, 1997; Geethanjali *et al.*, 2003; Chakravarthy, 2004) [21, 6, 7, 4]. Grading is one of the important post-harvest management techniques that homogenizes the seed lot resulting in uniform germination with higher planting value (Srimathi, 1997) [26]. Saeed (1966) [24] opined that seed size influenced the phases of germination in terms of early emergence, speed of emergence and seedling growth in addition to seed germination.

In the present study, bulk seeds of little millet cv. CO (Samai) 4 were graded using BSS 12 x 12, BSS 14 x 14 and BSS 16 x 16 sieves and the seeds retained on all the sieves and passed on BSS 16 x 16 sieves were tested for seed quality parameters along with ungraded bulk. The results revealed that the recovery of seeds was the highest with 72.4% in BSS 14 x 14 sieve, while it was lowest with 1.8 per cent in BSS 12 x 12 passed fraction. The 1000 seed weight was also higher with the corresponding increase in seed size. The seeds retained by BSS 14 x 14 and BSS 12 x 12 sieves recorded higher weight (3.45 g, and 3.83 g respectively) (Fig.2) than those seeds passed through BSS 16 x 16 sieve with 3.12 g. Kalavathi (1996) [13] reported a positive association between size and weight of seeds in *seena*. The results were in conformity with Nachimuthu (1997) [16] in *gingelly*.

Improved physical and physiological quality of graded seeds as reported in maize had contributed for the higher germination percentage in large and medium size seed (Silva *et al.*, 1979) [25]. The germination capacity increased progressively with increasing seed size. The larger seeds retained on BSS 14 x 14 recorded higher germination (82%) followed by the seeds retained on BSS 12 x 12 and bulk (78 and 76% respectively) (Fig.3). The higher germination of larger seeds might be due to the higher amount of food reserves and increased activity of redox-enzyme in the seeds helping in faster breakdown of the complex food reserve materials into simple soluble sugars as suggested by Gurbanov (1970) [9]. The results are in conformity with the findings of Kawade *et al.* (1987) [14] in pearl millet and Weimarck (1975) [30] in triticale seeds.

The other seed quality parameters like seedling growth and vigour index were also endorsed the superiority of large size seeds retained on BSS 14 x 14 and BSS 12 x 12 sieves (Fig.3). The relative high vigour associated with large sized seeds could be ascribed to well matured embryo and adequate nutrient reserves, which contributed towards its physiological stamina and vigour factor residing in it (Pollock and Roos, 1972) [18]. In addition to the greater quantity of storage materials and food reserves available in larger seeds, the seedling fresh weight, seedling mitochondrial protein, mitochondrial and biochemical activity, respiration rate and energy (ATP) production were also reported to be positively correlated with seed weight, and hence larger seeds had greater vigour and growth potential than the smaller seeds. Similar findings were also reported by Ries and Everson (1973) [22] and Farahani *et al.* (2011) [5] in wheat. The vigour index of large and medium sized seeds were significantly superior to small seeds. This may be due to differences in

their seed weight, germination potential, seedling length and stored food reserves (Styer *et al.*, 1980) [27]. The results thus clearly brought out the usefulness of grading little millet cv. CO (Samai) 4 seeds with BSS 14 x 14 wire mesh sieve for obtaining better quality seeds with maximum recovery (72.4%) and higher seed quality with minimum rejection.

Conclusion

Seed production under variable environmental conditions may result in differences in seed size, weight and density, which ultimately affect the germination as well as subsequent plant vigour and production. In the present study, bulk seeds of little millet cv. CO (Samai) 4 were graded using BSS 12 x 12, BSS 14 x 14 and BSS 16 x 16 sieves and the seeds retained on all the sieves and passed on BSS 16 x 16 sieves were tested for seed quality parameters along with ungraded bulk. The results revealed that the recovery of seeds was the highest with 72.4 per cent in BSS 14 x 14 sieve, while it was lowest with 1.8 per cent in BSS 12 x 12 passed fraction.

The seeds retained by BSS 14 x 14 and BSS 12 x 12 sieves recorded higher 1000 seed weight (3.45 g, and 3.83 g) than those seeds passed through BSS 16 x 16 sieve with 3.12 g. The larger seeds retained on BSS 14 x 14 recorded higher germination (82%) followed by the seeds retained on BSS 12 x 12 and bulk (78 and 76%). The other seed quality parameters like seedling growth and vigour index were also endorsed the superiority of large size seeds retained on BSS 14 x 14 and BSS 12 x 12 sieves. Therefore, grading little millet cv. CO (Samai) 4 seeds with BSS 14 x 14 wire mesh sieve resulted in maximum seed recovery and higher seed quality with minimum rejection.

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