

## Standardization of sieve size for grading of barnyard millet (*Echinochloa frumentacea* L.) MDU-1

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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 barnyard millet (*Echinochloa frumentacea* L.) MDU1. The effect of seed size on physiological parameters were evaluated using BSS 10×10, BSS12×12 and BSS14×14 wire mesh sieves along with control. The barnyard millet seeds graded with BSS12×12 recorded higher seed recovery (76.67%) than other sieves used with required germination (92%), 1000 seed weight (3.9g), root length (14.1cm), shoot length (8.45cm), dry matter production (0.027g/10 seedlings) and vigour index (1983). Hence, seeds of barnyard millet MDU1 could be size graded using BSS12×12 sieve for more seed recovery with required seed quality standards as compared to BSS 10×10, BSS14×14 and ungraded seeds.

**Keywords:** Barnyard millet, Sieves, Seed recovery, Vigour, Seed quality

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## 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) reported that larger seeds having higher seeding survival, growth and establishment. When there is an increased investment in seed size results in de-

creases 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). The importance of seed size grading in improving physical and physiological quality of the seeds was reported by Suresha *et al.*, (2007) in soapnut; Bicer, (2009) in chickpea; Menaka and Balamurugan, (2008) in amaranthus; Jerlin *et al.*, (2010) in jute; Sadeghi *et al.*, (2011) in safflower; Udhaya *et al.*, (2016) in sunnhemp; Ragupathi, (2017) in proso millet; Sivasubramaniam *et al.*, (2017) in tephrosia and Pozhilarasi *et al.*, (2018) in amaranthus. Therefore, the present study was made in barnyard millet to find out optimum sieve size for grading and its effect on sowing quality of seeds.

## MATERIALS AND METHODS

The bulk seeds of barnyard millet (*Echinochloa frumentacea* L.) var. MDU1 harvested from the crop raised at Department of Seed Science and Technology, AC and RI, Madurai during 2018 served as the basic materials for the present study. The pre-cleaned seeds were size graded

using sieve sizes BSS10×10, BSS12×12 and BSS14×14 wire mesh sieves (Fig. 1). During size grading, small seeds were discarded which are believed to include empty, underdeveloped and low vigour seeds. 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. For germination percentage, 100 seeds were germinated at the temperature of 25± 1°C and RH 96 ± 2 % with diffused light in 4 replications. After 7 days, the seedlings were evaluated and the normal seedlings produced were counted and expressed in percent as per the ISTA (1999). From the germinated seedlings, root length (cm), shoot length (cm), dry matter production (g/10 seedlings) were observed. The vigour index was calculated using the following formula as per Abdul-baki and Anderson (1973) and expressed in whole number:

$$\text{Vigour index} = \text{Germination (\%)} \times \text{Total seedling length (cm)} \dots\dots\dots \text{Eq.1}$$

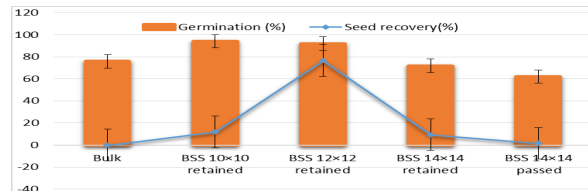
The data collected from various experiments were analysed statistically adopting the procedure described by (Panse and Sukatme, 1985). AGRES software package was used for finding critical differences (CD) values. The critical differences (CD) were calculated at 5 per cent probability level. Wherever necessary, percentage values were transformed to arc sin values before carrying out the statistical analysis.

**RESULTS AND DISCUSSION**

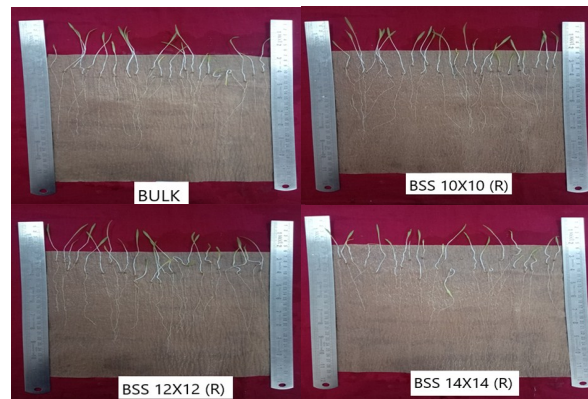
Among various post-harvest management techniques, grading plays an important role in improving the uniformity of the seed lot by removing seeds of same species with low quality and thereby resulting in uniform germination with higher planting value. The present study observed that seed recovery of barnyard millet was significantly influenced by size grades. The seeds retained by BSS 12×12 sieve recorded highest seed recovery of (76.67%) than those seeds retained by BSS 10×10 and BSS 14×14 sieves of (11.92%) and (9.38%) respectively (Fig. 2). Where seeds retained by BSS 10×10 and BSS 14×14 sieves were on par with each other. The seeds retained by BSS 10×10, BSS 12×12 and BSS 14×14 sieve recorded higher 1000 seed weight and that by BSS 14×14 passed seeds. 1000 seed weight of ungraded (bulk) seeds and seeds retained by BSS 12×12 sieves are on par with each other. Several studies like that of Sivasubramaniam, (2008) in kolinji, Menaka and Balamurugan, (2008) in amaranthus; Jerlin *et al.*, 2010 in jute;



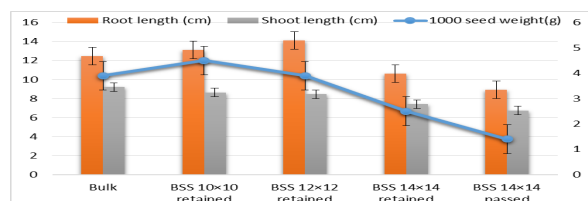
**Fig. 1.** Seed retained in BSS 10X10, BSS 12X12, BSS 14X14 and Bulk of barnyard millet MDU1.



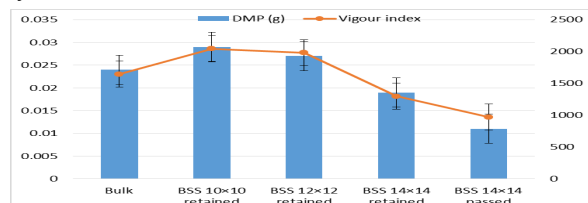
**Fig. 2.** Effect of size grading on seed recovery (%) and germination (%) in barnyard millet MDU1.



**Fig. 3.** Effect of germination on size graded seeds using BSS 10X10, BSS 12X12, BSS 14X14 and Bulk in barnyard millet MDU1.



**Fig. 4.** Effect of size grading on root length (cm), shoot length (cm) and 1000 seed weight (g) in barnyard millet MDU1.



**Fig. 5.** Effect of size grading on dry matter production (g seedling<sup>-10</sup>) and vigour index in barnyard millet MDU1.

Sadeghi *et al.*, 2011 in safflower; Udhaya *et al.*, 2016 in sunnhemp; Ragupathi (2017) in proso millet; Sivasubramaniam *et al.*, 2017 in tephrosia and Pozhilarasi *et al.*, 2018 in amaranthus report-

ed a positive association between size and weight of seeds.

The germination capacity increased progressively with increase in seed size. The larger seeds retained by BSS 10×10 sieve size recorded highest germination (94%) followed by the seeds retained by BSS 12×12 (92%) and BSS 14×14 (72%) whereas the control seeds recorded 76% of germination (Fig. 3). In statistical analysis, seeds retained in BSS 10×10, BSS 12×12, BSS 14×14 sieves and ungraded bulk was recording on par result with each other. The higher germination of larger seeds possessed more vigour than small seeds due to presence of more of food material and increased activity of redox-enzymes helps to breakdown complex food into simple soluble sugars. The results are in agreement with findings of Ndor et al. (2012) in pumpkin; Udhaya et al. (2016) in sunnhemp; Arunkumar et al. (2017) in foxtail millet; Sivasubramaniam et al. (2017) in Tephrosia and Pozhilarasi et al. (2018) in amaranthus.

The other seed quality parameters like root length (14.1cm), shoot length (8.63cm) dry matter production (0.029 g seedlings<sup>-10</sup>) and vigour index (2043) also endorsed the superiority of large sized seeds retained by BSS 10×10 and BSS 12×12 sieves (Fig.4 and 5) whereas ungraded bulk seeds(control) recorded rootlength (12.45cm), shoot length (9.2cm), dry matter production (0.024g) and vigour index (1645). Statistically, T<sub>2</sub> (BSS 10×10R) and T<sub>3</sub> (BSS 12×12R) was on par with each other and significantly higher than all other treatments in root length, dry matter production and vigour index. Where in shoot length, T<sub>1</sub> (Bulk), T<sub>2</sub> (BSS 10×10R) and T<sub>3</sub> (BSS 12×12R) was recording on par result and significantly higher than T<sub>4</sub> (BSS 14×14R) and T<sub>5</sub> (BSS 14×14P). The seeds passed through BSS 14×14 sieve were found to be of inferior quality and recorded lower values in all the parameters like seed recovery (1.67%), 1000 seed weight (1.4g), germination percentage (62%), root length (8.92cm), shoot length (6.73cm), dry matter production (0.011) and vigour index (970). Due to the greater quantity of storage materials and nutrient reserves available in larger seeds contributed higher energy production. Similar findings were also reported by Farahani et al. (2011) in wheat; Ponmani, (2015) in barnyard millet; Arunkumar et al. (2017) in foxtail millet; Sivasubramaniam et al. (2017) in tephrosia and Pozhilarasi et al. (2018) in amaranthus.

### Conclusion

It was concluded that though barnyard millet seed quality was higher in BSS10×10 retained seeds but the seed recovery was very low. The seeds graded with BSS12×12 recorded higher seed recovery with required seed quality parameters viz.,

germination %, seedling length, dry matter production and vigour index. Therefore, BSS12×12 sieve could be recommended for size grading of barnyard millet MDU-1 on the basis of the seed quality parameters.

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