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Standardization of Screen Aperture Size for Grading of Dhaincha Seeds

Shivakumar, B. Bagli [a++*], Basave Gowda [b#], S. R. Doddagoudar [c‡], N. M. Shakuntala [a†], Gururaj Sunkad [d^] and M. K. Meena [e##]

[a] Department of Seed Science and Technology, UAS, Raichur, India.
[b] University of Agricultural Sciences, UAS, GKVK, Bangalore, India.
[c] Seed Unit, UAS, Raichur, India.
[d] MARS, UAS, Raichur, India.
[e] Directorate of Research, UAS, Raichur, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

To standardize the sieve size for seed grading in dhaincha during Kharif, 2019–20 and 2020–21, an experiment was carried out. The native dhaincha species was processed using slotted perforated metal sieves with CRD design ranging S_1 - 1.4 mm (S), S_2- 1.6 mm (S), S_3- 1.8 mm (S), S_4 - 2.0 mm (S), and S_5- 2.2 mm (S). The study realized that 2.0 mm and 2.2 mm sieves recorded highest seed quality standards and yielded larger-sized seeds. the results revealed that the seed recovery

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[++] Ph.D scholar;
[#] Registrar;
[‡] Assistant Professor (SST);
[†] Professor and Head;
[^] Associate Directorate of Research;
[##] Assistant Professor (CPH),
**Corresponding author;*

per cent in the 1.4 mm screen was maximum, whereas, the seed quality, nevertheless was better when seeds were graded using 2.0 mm and 2.2 mm sieves. From the combined average data of the two years, the highest quality seeds were retrieved by grading the seeds using 2.0 mm screen with good seed recovery per cent *viz.,* SR (92.99%), PP (98.46%), PLS (90.37%), TW (26.16 g), SG (81.63 %), TSL (25.2 cm), SDW (14.4 mg), SVI-I (2103) and SVI-II (1174). Hence, the 2.0 mm screen can be used to obtained highest quality seeds with economical seed recovery.

Keywords: Dhaincha; grading and screen size.

1. INTRODUCTION

A conventional cultivation technique for preserving the fertility of the soil is referred to as "green manuring." While marginalizing the use of green manures in intensive crop cultivation, the rise of green farming has boosted the use of chemical fertilizers. Over time, the space beneath crops grown with green manure has shrunk, demonstrating this. Green manure crops are said to be grown over 1.23 million hectares of land in India [1]. India's transition from a food-insecure to a food-secure region has been facilitated by increased fertilizer use at subsidized prices, but organic manure use, particularly green manure crops, has drastically dropped. In recent years, the overall price of inorganic fertilizer's has gone up, and soil productivity resilience is gaining momentum. Green manure crops are an affordable as well as effective way to bring down fertilizer expenditures while maintaining the productivity and health of the soil. Almost every green manure crops, whether used in-situ or ex-situ, have all the plant nutrients necessary for boosting crop growth and maintaining the health of the soil.

Among the green manure crops dhaincha (*Sesbania aculeata*) is one of the most important green manure crop. The ease of establishment, fast growth leading to accumulation of large quantity of biomass, rich in nutrients especially nitrogen in short period and quick decomposition upon incorporation in paddy (puddle rice lands) can release nutrients as per the need of rice crop made dhaincha the most widely grown green manure crop. Further, it is promising for cultivation in salt affected ill drained soils and areas with higher rainfall [2].

Seed processing is critical in scientific seed production because it preserves the physical integrity of seeds while also allowing for the recovery of ideal sized seeds for uniform crop establishment and growth. Seed size is a key determinant of seed vigour because it affects seed performance in soil. Although the seed mass after harvest contains a wide range of seed sizes, not all of them are equally valuable for planting. Farmers have long recognized the importance of utilizing homogeneous, high-viability seeds to achieve high emergence and growth. There is no recommended sieve size for sorting dhaincha seed at this time. The current grading process attempts to exclude non-viable seeds so that sound, disease-free seed of uniform size is accessible for planting, resulting in optimal plant population and increased yields.

One of the requirements in the Minimum Seed Certification Standard (MSCS) for seed approval by the Indian government is the determination of the best sieve size and kind of screen. The sieve size recommended for processing various agricultural seeds under the minimum seed certification standard appears to be more general and unsuitable for all newer types, resulting in low seed recovery [3]. There is a pressing need to standardize the sieve size for grading dhaincha seed, as it is frequently noted that seed growers are losing a significant amount of good seed that is classified as a rejection. Given the high demand from farmers for certified seeds of dhaincha, this is an essential necessity.

As a result, the current study on standardizing sieves for grading dhaincha seed was planned and undertaken.

2. MATERIALS AND METHODS

The investigation was carried by using bulk dhaincha seeds harvested from seed production block, seed unit, UAS, Raichur. The initial moisture content of the seeds had been lowered to around 9 per cent by drying them out in the shade. The grading was carried out in the seed processing unit and seed quality testing was done in Seed Quality Assurance and Research Laboratory, Seed Unit, University of Agricultural Sciences, Raichur during 2019–20 and 2020–21. Five separate sieve sizes were used for sorting the seeds. The experiment was laid out in Complete Randomized Design with four replications to impose treatments i.e., S_1- 1.4 mm (S), S_2- 1.6 mm (S), S_3- 1.8 mm (S), S_4- 2.0 mm (S) and S_5- 2.2 mm (S) screen aperture sizes. The seeds obtained from different sieves were assessed for various seed quality seed parameters like seed recovery, physical purity, pure live seed, test weight, germination, seedling length, SDW and SVI. Gomez and Gomez's [4] Fischer method of Analysis of Variance approach was employed for the statistical examination as well as interpretation of the results of the experiment. For experiments in laboratories, the F test's 1% level of significance was employed.

3. RESULTS AND DISCUSSION

By eliminating inferior seeds of the same species, sorting aims at improving the uniformity of the seed lot. Small seeds, which is believed to comprise void, underdeveloped, and low vigour seeds, are flung out during size grading. For practically all of the characteristics under inspection, highly significant variance was observed among the various sieve sizes. Menaka and Balamurugan [5] reported on the value of seed size.

According to Suma et al. [6], sorting is one of the essential after harvest management processes that homogenizes the seed lot and promotes consistent germination with increased planting value.

Seed size exerted a significant influence on the seed recovery, test weight, physical purity, pure live seed, germination, total seedling length, seedling dry weight and seedling vigour index (Tables 1, 2 and 3).

Seed recovery, physical purity and pure live seed: Assessing the results on SR (%) displayed in Table 1 reveals that varying screen sizes during 2019–20 and 2020–21 and aggregated data of two years substantially impacted seed recovery (%). The seeds retained on S_1 (1.4 mm) displayed maximum SR (98.18%) with minimum physical purity and PLS (95.47 and 68.69 %). Whereas, the minimum SR (87.95%) was recorded in S_5 (2.2 mm) with maximum physical purity and PLS (99.16 % and 83.78 %) which was on par with S_4 (2.0 mm) with economical seed recovery (92.99%) and maximum physical purity and PLS (98.46% and 90.37%) respectively, as per pooled data for two years.

From the above results seed recovery was significantly influenced by different sieve sizes. The seeds graded with 1.4 mm sieve size recorded higher SR (%) compared to seeds graded with 1.6, 1.8, 2.0 and 2.2 mm sieves. The reduction in SR is due to increase in screen aperture size which led to removal undersized seeds keeping good and bold seeds at top of the screen. As the screen size decreased from 2.2 to 1.4 mm, the per cent seed recovery increased. This is in conformity with the findings of Anuradha et al. [7] in chickpea, Ganiger et al. [8] in greengram and Kausal et al. [9] in soybean. Significantly higher physical purity was recorded in processed seeds i.e., seeds retained on sieves S_5 (2.2 mm) and S_4 (2.0 mm) as compared to S_1 (1.4 mm), S_2 (1.6 mm) and S_3 (1.8 mm) due to effective processing (Fig. 1). Further, all the impurities were removed and whereas the seeds retained on smaller screens had impurities so less physical purity was observed. Similar observations of improved physical purity have been reported by Ganiger et al. [8] in greengram and soybean.

Test weight, germination, total seedling length and seedling dry weight: In pooled mean data of two years, highest test weight, germination, total seedling length, seedling dry weight, SVI I and II (27.20 g and 84.47 %, 26.3 cm, 15.3 mg, 2225 and 1292) was recorded in seeds retained on S_5 (2.2 mm) which was noticed on par with S_4 (2.0 mm) (26.16 g, 81.63 %, 25.2 cm, 14.4 mg, 2103 and 1174), PLS (90.37 %), TSL (25.2 cm), SDW (14.4 mg) and SVI-I and II (2103 and 1174) respectively. Whereas, the lowest was recorded in S_1 (1.4 mm) (22.32 g and 71.94 %, 21.3 cm, 11.1 mg, 1561 and 795), respectively (Table 2 and Fig. 2). The data was presented in Table 3.

From the above obtained results, the seeds retained on 2.2 mm screen were larger in size and gave higher test weight and seed germination (Plate 1) which may be due to undesirable materials, low graded seeds are dropped through screens and retaining only goodgraded seeds which has better reserve food material available in the storage tissues. These results are in conformity with findings of Dharmalingam and Ramakrishnan [10] in black gram, Kausal et al. [11] in sorghum and greengram, Negi et al. [2] in soybean, Paul et al. [13] in mustard, Vishwanth et al. [14] in french bean, Kausal et al. [11] in sorghum and greengram and Raghavendra Rao et al. [15] in sorghum.

Table 1. Seed recovery, physical purity and pure live seed as influenced by different screen sizes in Dhaincha

Treatments	Seed recovery (%)			Physical purity (%)			Pure live seed (%)		
	2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled
S_1 (1.4 mm)	98.92	98.28	**98.18**	95.77	95.18	**95.47**	67.61	69.76	**68.69**
S_2 (1.6 mm)	98.44	97.92	**97.91**	96.48	96.43	**96.46**	71.63	72.87	**72.25**
S_3 (1.8 mm)	96.05	96.33	**95.33**	97.49	97.48	**97.49**	74.34	75.55	**74.94**
S_4 (2.0 mm)	94.08	94.03	**92.99**	98.47	98.46	**98.46**	79.50	81.25	**80.37**
S_5 (2.2 mm)	86.35	87.66	**87.95**	99.21	99.11	**99.16**	83.65	83.91	**83.78**
Mean	**94.77**	**94.84**	**94.47**	**97.48**	**97.33**	**97.41**	**75.35**	**76.67**	**78.01**
S.Em±	0.59	0.66	0.31	0.37	0.28	0.39	1.34	1.19	0.94
CD at 1 %	2.24	2.51	1.16	1.55	1.18	1.62	5.60	4.97	3.90

Table 2. Test weight and germination as influenced by different screen sizes in Dhaincha

	Test weight (g)			Germination (%)		
Treatments	2019	2020	Pooled	2019	2020	Pooled
S_1 (1.4 mm)	21.99	22.45	**22.22**	70.58	73.30	**71.94**
S_2 (1.6 mm)	23.93	24.34	**24.13**	74.20	75.59	**74.89**
S_3 (1.8 mm)	25.30	25.37	**25.34**	76.27	77.51	**76.89**
S_4 (2.0 mm)	26.28	26.04	**26.16**	80.72	82.54	**81.63**
S_5 (2.2 mm)	27.21	27.19	**27.20**	84.28	84.66	**84.47**
Mean	**24.94**	**25.08**	**25.01**	**77.21**	**78.72**	**77.96**
S.Em±	0.33	0.40	0.36	1.02	1.14	0.30
CD at 1 %	1.39	1.69	1.51	4.26	4.76	1.24

Table 3. Total seedling length and seedling dry weight as influenced by different screen sizes in Dhaincha

Treatments	Total seedling length (cm)			Seedling dry weight (mg)		
	2019	2020	Pooled	2019	2020	Pooled
S_1 (1.4 mm)	21.3	21.3	**21.3**	10.9	11.2	**11.1**
S_2 (1.6 mm)	24.1	23.4	**23.8**	11.8	12.2	**12.0**
S_3 (1.8 mm)	24.6	23.7	**24.1**	13.3	13.7	**13.5**
S_4 (2.0 mm)	25.5	24.9	**25.2**	14.4	14.3	**14.4**
S_5 (2.2 mm)	27.7	26.2	**27.0**	15.3	15.2	**15.3**
Mean	**24.6**	**23.9**	**24.3**	**13.1**	**13.3**	**13.2**
S.Em±	0.3	0.2	0.2	0.2	0.3	0.2
CD at 5 %	1.2	0.7	0.8	0.7	1.2	0.9

Table 4. Seedling vigour index as influenced by different screen sizes in dhaincha

Treatments	Seedling vigour index-I			Seedling vigour index-II		
	2019	2020	Pooled	2019	2020	Pooled
S_1 (1.4 mm)	1550	1572	**1561**	769	821	**795**
S_2 (1.6 mm)	1732	1778	**1755**	877	923	**900**
S_3 (1.8 mm)	1855	1848	**1851**	1013	1029	**1021**
S_4 (2.0 mm)	2131	2075	**2103**	1166	1181	**1174**
S_5 (2.2 mm)	2211	2239	**2225**	1294	1290	**1292**
Mean	**1896**	**1902**	**1899**	**1024**	**1049**	**1036**
S.Em±	32	30	21	27	8	15
CD at 5 %	132	126	63	115	34	61

Plate 1. Germination (%) as influenced by different screen sizes in dhaincha

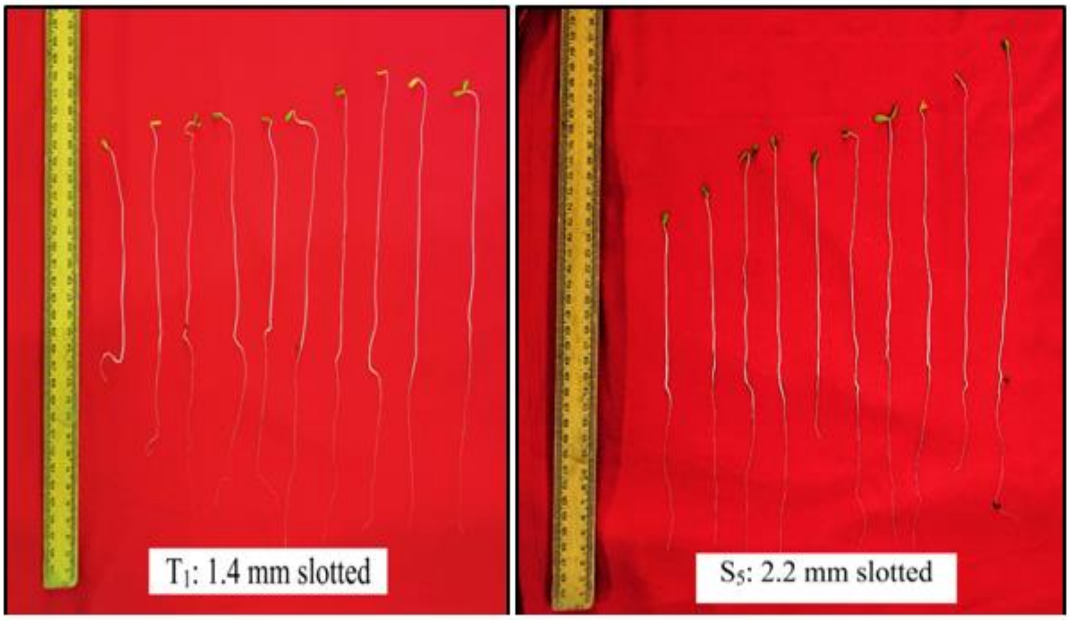

Plate 2. Total seedling length (cm) as influenced by different screen sizes in dhaincha

Total seedling length and seedling dry weight was recorded highest in seeds which were retained on large screen size i.e. 2.2 mm (Plate 2). While, the lowest was recorded in small screen size of 1.4 mm. This may be due to adequate quantity of reserve food material in the small to medium sized seeds endosperm and better supply of food to the embryo for a long period of time which helped for higher mobilization efficiency of reserve food material during germination leading to more number of cells per cotyledon in the form of reserve food resulting in increased root, shoot length [16]. As there has been better seedling growth, which might have led to an increase in mean seedling dry weight and similar results were also documented by Sudeep Kumar et al. [17] in fieldbean.

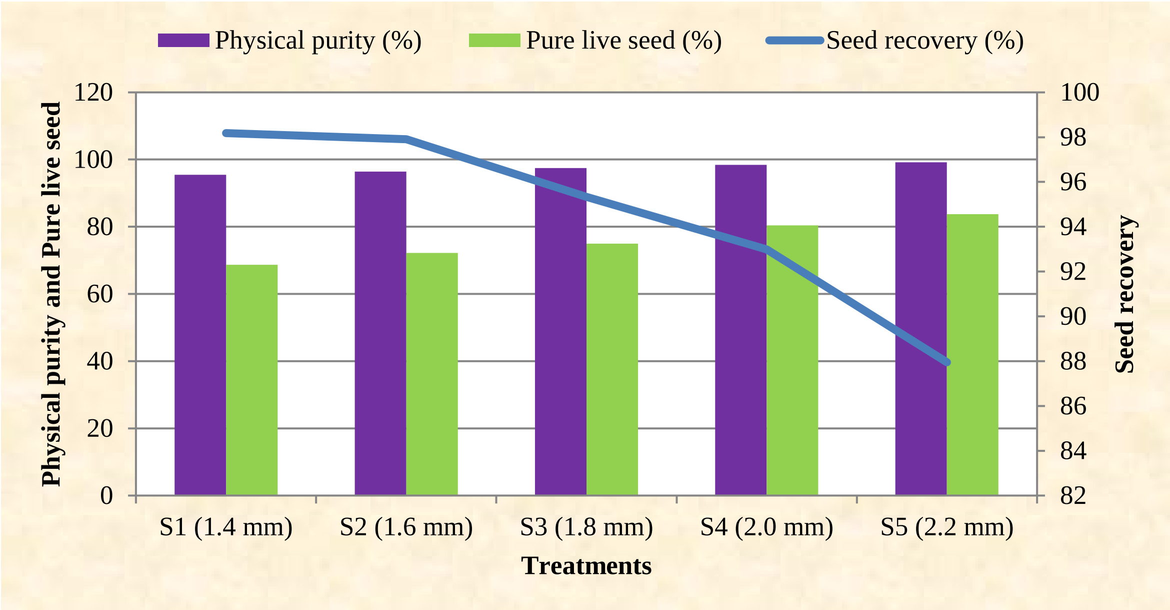

Fig. 1. Seed recovery, physical purity and pure live seed as influenced by different screen sizes in dhaincha

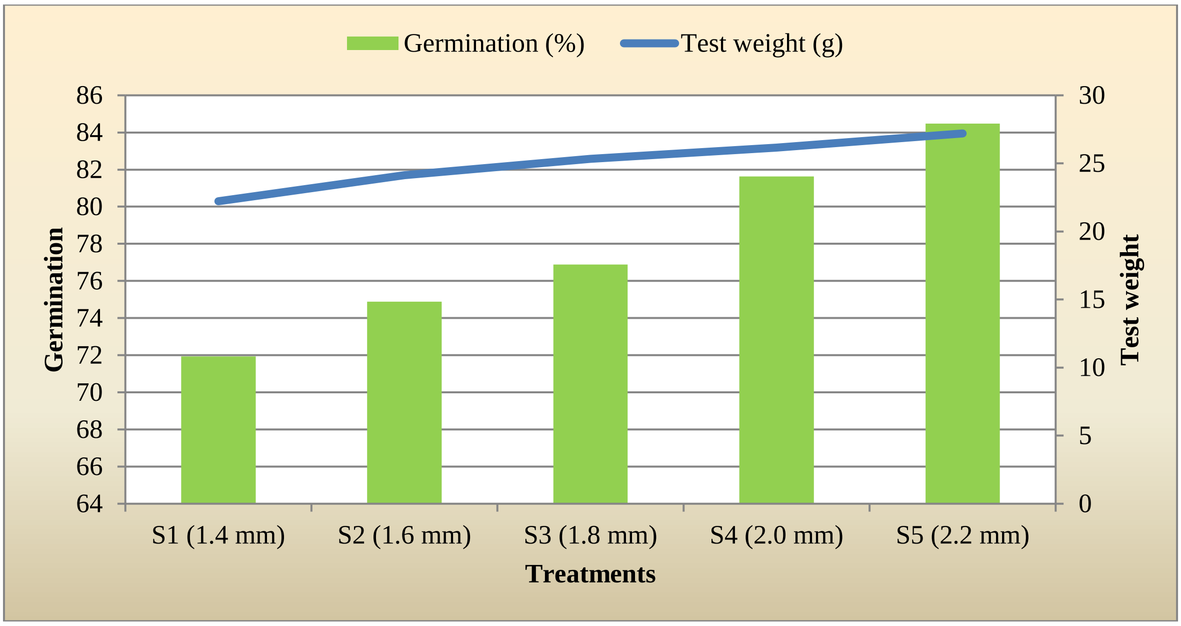

Fig. 2. Germination and test weight as influenced by different screen sizes in dhaincha

4. CONCLUSION

The study inferred that, the highest seed quality parameters were recorded in 2.2 mm sieve whereas the results were on par in seeds retrieved by sorting with 2.0 mm (S) sieve which registered economical SR (92.99 %) compared to other screens with maximum seed quality parameters *viz.*, PP (98.48 %), SG (81.63 %), TW (26.16 g), PLS (90.37 %), TSL (25.2 cm), SDW (14.4 mg), SVI-I (2103) and SVI-II (1174) which were found to be above the indian minimum seed certification standards. Hence the dhaincha seeds can be graded using 2.0 mm (S) sieve for better seed recovery and quality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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