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Influence of seed polymorphism on physical and physiological seed quality in Senna KKM (Se) 1(*Cassia angustifolia* Vahl)

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Abstract
Senna (*Cassia angustifolia* Vahl.) is one of the medicinal plants having tremendous therapeutic potential. The experiment was conducted at the unit of Seed Science and Technology, Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Killikulam, Tamil Nadu. In an attempt to optimize the suitable sieve size for grading senna seeds, larger seed (BSS 7 x 7 retained and BSS 6 X 6 retained) recorded 44 and 31 per cent seed recovery percentage respectively, the seeds retained on BSS 6x 6 sieves proved to be superior in physical quality characters *viz*.,seed length (0.8 cm), seed breath (0.4cm), 100 seed weight (2.75g) and Physiological seed quality characters *viz*.,germination (64%), hard seed (16%), higher shoot length (9.4cm), root length (9.8 cm) and vigour index (1229) compared to other sieve sizes and bulk. Hence for size grading, the seeds might be sieved with BSS 6x6 sieve size.

Keywords: Senna, Sieve size, Germination, Vigour index

Introduction
Senna (*Cassia angustifolia* Vahl.) is one of the medicinal plant having tremendous therapeutic potential. It belongs to the family Leguminosae (Annon, 2004) [1]. Senna was popular in the western countries for making 'herbal tea'. Nearly 85 per cent of senna produced in India was sent overseas. "The plant contains calcium sennoside, a chemical compound that is used as a laxative". Mostly, senna was being shipped to Japan, China, the USA, Germany, Spain, Thailand, Indonesia, Latvia, South American countries and Mexico. An export volume of 15,975 metric tonnes, valued at Rs.61 crore, was achieved in 2012-13. During last fiscal, exports was 13,576 metric tonnes worth Rs.51 crore, and in 2010-11, 14,435 mt of senna was exported. In 2009-10, shipments to the tune of 12,653 mt were made. Many senna farmers were buying seeds from exporters, who were involved in grading senna leaves and pods. Senna have for millennia played a major role in herbalism and folk medicine. Senna glycosides or sennosides are used in modern medicine as laxatives, some senna species are used as ornamental plants and landscaping. Cassia gum, an extract of the seeds of Chinese senna. Senna italic is used as a hair treatment. Senna drugs contain the dried leaves of (*Senna alexandrina*) the glysocides increase gastric fluid secretion and bowel mobility producing laxative action. Senna species also used for constipation, fungal skin infectious and hemorrhoids (Agarwal and Bajpai, 2010) [2].
Seed polymorphism is one of the major factors involved with seed quality characters in all crops. For obtaining homogeneity within the seed lot, seeds are graded either mechanically or manually, adopting the seed morphological features such as size, weight and colour, though the specifications required for grading vary with crop. Hence grading is considered as the integral part of post harvest handling, which is the process of conversion of heterogenous sample to homogenous status using seed morphological characters (Gregg, 1967) [3].

Materials and Methods
Bulk seeds obtained from Department of Horticulture, Agricultural College and Research Institute, Killikulam will be size graded with round perforated metal sieves of 6 X 6 R, 7 X 7 R, 8 X 8 R and 8 X 8 P along with bulk. The experiment will be conducted adopting factorial CRD with five replications. The size-graded seeds will be evaluated for the following physical, and physiological observations.

Seed recovery percentage was calculated as below

$$\text{Seed recovery (\%)} = \frac{\text{Weight of each of the seed size grade (g)}}{\text{Total weight of the seed}} \times 100$$

Hundred seed weight (g): The seeds were dried to 8 ± 1% under shade, the approximate equilibrium moisture content of seed. These seeds of each grade were counted manually as 100 seeds in eight replicates as per ISTA, (2010) [4] and the mean expressed as 100 seed weight in gram.

Seed length (cm): Five replications of ten seeds were randomly selected in each of the grade and the length between the micropylar end and chalazal end was measured using vernier calipers and the mean expressed as seed length in centimeter.

Seed breadth (cm): The seeds measured for seed length were measured for breadth at its largest portion using screw gauge and the mean expressed as seed breadth in centimeter.
The seeds of each of the size category were evaluated for the physiological seed quality characters of the seeds in terms of germination and vigour as follows.

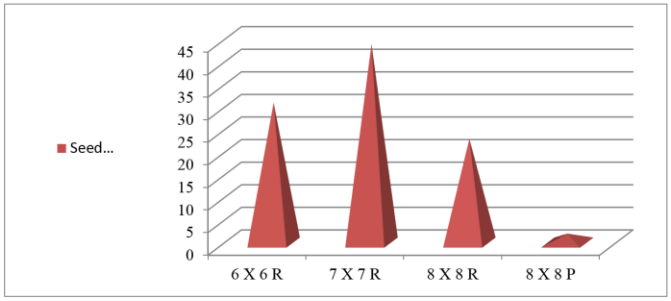
Germination: Were evaluated for germination in sand media in a germination room maintained at 25 ± 1°C and 90 ± 3% Relative Humidity using 100 seeds of four replicates (ISTA, 2010) [4]. After the germination period of 12 days, days to first germination, the test was terminated and evaluated for the occurrence of normal, abnormal and dead seeds based on the extend of exhibition as normal seedlings the germination percentage of each of the category were recorded in percentage.

Root and shoot length: Ten normal seedlings were selected at random in each of the replication and measured for their root and shoot length.

Vigour index: The values were also computed adopting the following formulae, as these values are the totality expressions seed quality characters.
Vigour index (Abdul - Baki and Anderson, 1973) [5] = Germination (%) × Seedling length (cm)

Statistical analysis: The data obtained from different experiments were analysed for 'F' test of significance following the methods described by Panse and Sukhatme (1995) [6] adopting FCRD for laboratory experiments and RBD for nursery studies. Wherever necessary, the per cent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5% probability level. The data were tested for statistical significance (*).

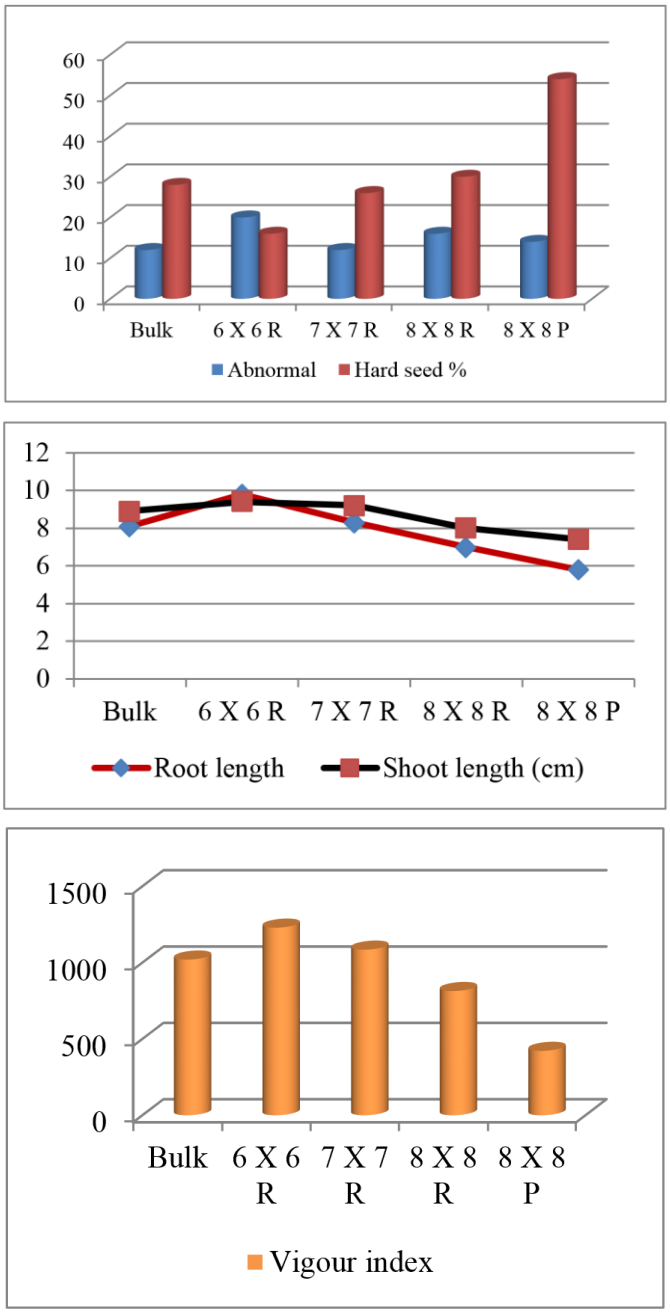
Results and Discussion
Seed grading is an important post harvest operation where the seeds are homogenized based on physical characters of seed (Katsuka, 1964) [7]. The importance of grading in seed is also documented with the theory of higher vigour exerted by higher initial capital (Ashby, 1936) [8]. In many of the silvicultural species (Manonmani *et al*. (1996) [9] and Srimathi, (1997) [10]) grading, that entitled to remove the empty, immature, broken and insect damaged seeds (Bonner and Switzer, 1971) [11] is identified as an integral part of post harvest operations that enhance the planting value of the seed lots. Grading is being practiced based on size, weight and colour of the seed. Among them, size grading is the widely accepted processing technique for maximization of seed quality (Edimann, (1934) [12] and Gupta *et al*., (1983) [13]). The positive influence of seed size on quality had been inferred in agricultural (Renugadevi *et al.*, (2009) [14]; Vishwanath *et al.*, (2011) [15]), horticultural (Ponnammal *et al*., (1993) [16]; Gunaga, (2006) [17]; Venudevan and Srimathi, (2013) [18]) and silvicultural (Parameswari and Srimathi, (2009) [19]; Fahrettin, (2010) [20]) crops.
In the present investigation, seeds were graded using three different sieves with 6 X 6 R, 7 X 7 R and 8 X 8 R round perforations. The results expressed that recovery of seeds retained on 7 X 7 R sieve was higher (44 per cent) and was followed by the seeds retained on 6 X 6 R sieve (31 %). The recovery of seeds retained on 8 X 8 R was 23 per cent, while the ill filled and immature seed developed with irregularities that passed through 8 X 8 P size was 2 per cent (Fig.1) indicating the variation in distribution of seed sizes within the lot, where larger and smaller seeds were distributed in higher order than the medium sized seed, which might be due to the wild nature of the species which is yet to be domesticated. Similar wider variations in seed size groups was also observed in *Aegle marmelos* by venudevan and Srimathi, (2013) [18].



R- Retained P- Passed

Fig 1: Influence of size grading on seed recovery percentage

Among the evaluated seed quality parameters, The germination capacity of seeds increased progressively with increase in seed size, where the larger seeds retained on 6 X 6 R recorded the highest germination (64 %) followed by seeds retained on 7 X 7 R mm (62 %). Sivakumar (2005) [21] in ambrette, Sumathi (2010) [22] in karpokkarasi, Venudevan and Srimathi (2013) [18] in *Aegle marmelos* also reported similar positive association between size and weight of seeds. This might be due to the differential translocation of reserve from endosperm to embryo in large and small seeds that varied due to differential nutrient filling in line with the views of Katsuka (1964) [7]. The higher germination of larger seeds is attributed to the higher amount of food reserves and increased the activity of redox-enzyme in the seeds that favoured faster breakdown of complex food reserve materials into simple soluble sugars as expressed by Gurbanov and Berth (1970) [23]. The other seed quality parameters like abnormal, hard seed, root and shoot length, and vigour index were also endorsed the superiority of large sized seeds retained on 6 X 6 R sieve followed by 7 X 7 R, 8 X 8 R sieves retained seeds and 8 X 8 passed seeds as below (Fig. 2 and 3).



R- Retained P- Passed

Fig 2: Influence of size grading on seedling quality character

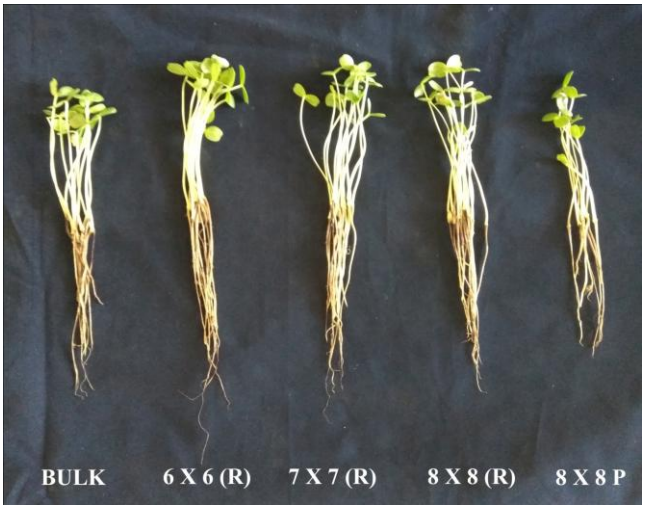


Fig 3: Influence of seed polymorphism on physical seed quality in Senna KKM (Se) 1 (*Cassia angustifolia* Vahl)

The relative high vigour associated with large sized seeds was ascribed to the well matured embryo and adequate accumulation of nutrient reserves, which contributed towards its physiological stamina and vigour factor residing in it (Pollock and Roos, 1972) [24]. In addition to the greater quantity of storage food reserves available in larger seeds, the seedling fresh weight, mitochondrial protein, respiration rate and energy (ATP) production were also reported to be positively correlated with seed weight and size by Bewley and Black (1994) [25]. Ashby (1936) [8] in his initial capital theory expressed that initial stamina of the seed is expressed during regeneration mostly based on the quantum of nutrient available within the seed, which resulted in positive association between seed size and seed quality characters as reported in the present study. Gurunathan (2006) [26] in *Jatropha curcas* and Vijayageetha (2007) [27] in mustard also viewed the influence of seed size and seedling quality characters as positive.

Seed is the economic product and fetches higher money with better quality characters, hence the sieve size recommended as a standard sieve for seed processing should have higher recovery with better seed quality characters. Based on the results of the present study recovery and seed and seedling quality characters, were higher with 6 X 6 R which could be selected as standard sieve for senna on instances of better selection irrespective of demand but when the demand is higher seed retained on 7 X 7 R size (44 % recovery and 100 seed weight 2.53g) (Table 1) could be selected as the seed quality characters and recovery will be higher to meet the demand, and the seeds perform better than bulk.

The overall performance of large and medium size seeds retained on 6 X 6 R and 7 X 7 sieves on seed grading revealed that these grades were better than bulk in all the evaluated seed quality characters as below.

Table 1: Influence of seed polymorphism on physical seed quality in Senna KKM (Se) 1 (*Cassia angustifolia* Vahl)

Sieve size BSS	Seed length (cm)	Seed breath (cm)	100 seed weight (g)
Bulk	0.6	0.3	2.45
6 X 6 R	0.8	0.4	2.75
7 X 7 R	0.6	0.4	2.53
8 X 8 R	0.5	0.2	2.15
8 X 8 P	0.4	0.1	1.85
Mean	0.5	0.2	2.34
SEd	0.005	0.002	0.033
CD(.05)	0.010	0.006	0.071

References

1. Annon. United States pharmacopoeia 27. Rockville, MD.U.S pharmacopoeia convention, 2004, 1686.
2. Agarwal V, Bajpai M. Pharmacognostical and biological studies on Senna & its products: an overview. 2010; 1(2):107
3. Gregg. Seed processing. National Seed Corporation. New Delhi, 1967.
4. ISTA. International Rules for Seed Testing: ISTA, Bassersdorf, Switzerland, 2010.
5. Abdul-Baki AA, Anderson JD. Vigour determination in soybean seed by multiple criteria. Crop Sci. 1973; 13:630-633.
6. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR publications, New Delhi, 1999.

7. Katsuka M. Distribution of nitrogenous compounds in seedlings of *Pinus thunberjii* developed for seeds of different weight. In: physiological basis of seed germination (Ed.). K.E. Ovcharov. Amerind publishing co, New Delhi, 1964.
8. Ashby E. Initial capital theory. Ann. Bot. 1936; 16:1006-1032.
9. Manonmani V, Vanangamudi K, Rai RSV, Vinaya RRS. Effect of seed size on seed germination and vigour in *Pongamia pinnata*. J Trop. For. Sci. 1996; 9(1):1-5.
10. Srimathi P. Research focus on seed collection, processing and storage of amla (*Emblica officinalis* Gaertn.), jamun (*Syzygium cuminii* Skeels.) and ber (*Zizyphus mauritiana* Lamk.). Ph.D. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore-3, 1997.
11. Bonner FT, Switzer GL. Upgrading yellow-Poplar seeds. USDA For. Serv. Res. Note. 1971; 50(129):4.
12. Edimann FE. Dekieming van den djati *Tectona grandis* L.F. Korte medededingen. Van het Bosch. Bowproetistation No-142. Tectona 1934; 117:283-287.
13. Gupta SK, Pathak PS, Debroy R. Seedling growth of *Leucaena leucocephala*. II Effect of seed size. Ind. J For. 1983; 6(3):202-204.
14. Renugadevi J, Natarajan N, Srimathi P. Influence of seed size on seed and seedling quality characteristics of cluster bean (*Cyamopsis tetragonoloba* (L.) taub.). Legume Res. 2009; 32(4):301-303.
15. Vishwanath K, Pallavi HM, Devraju PJ, Prashanth Y. Prediction of storability of different seed size grades of french bean varieties through accelerated ageing response. Research Journal of Agricultural Sciences. 2011; 2(2):213-216.
16. Ponnammal NR, Arjunan MC, Antony KA. Seedling growth and biomass production in *Hardwickia binata* Roxb. as affected by seed size. Indian For. 1993; 119:59-62.
17. Gunaga RP. Variation for seed, germination and seedling characters in *Mammea suriga*, a commercially important NTFP tree species of the Western Ghats. In: *Proc.* National Expert Mtg. on "NWFPs: Linking Gender, Livelihood and Management*"* Prakruti, Sirsi, Karnataka, October, 17-18, 2006, 14.
18. Venudevan, Srimathi. Influence of seed polymorphism on physical, physiological and biochemical seed quality characters of endangered medicinal tree Bael (*Aegle marmelos* (l.) corr.). 2013; 8(30):1413-1419.
19. Parameswari K, Srimathi P. Influence of seed source variation on size grades of tamarind (*Tamarindus indica*). Legume Res. 2009; 32(4):240-244.
20. Fahrettin T. Influence of acorn size and storage duration on moisture content, germination and survival of *Quercus petraea* (Mattuschka). Journal of Environmental Biology. 2010; 31:325-328.
21. Sivakumar D. Seed technological studies in ambrette (*Abelmoschus moschatus* Medic.). M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore, 2005.
22. Sumathi S. Studies on seed production, post harvest handling and seed testing in *Psoralea corylifolia.* Ph.D. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore-3, 2010.
23. Gurbanov YA V, Berth ZG. Effect of seed size and chemical composition on germination and seedling growth in triticale. Indian J Pl. Physiol. 1970; 25(4):427-431.
24. Pollock BM, Roos EE. Seed and seedling vigour. In: Seed Biology (Ed: T.T. Kozlowaski) Academic Press New York, 1972, 313-387.
25. Bewley JD, Black M. Physiology and biochemistry of seeds in relation to germination. Vol. 2. Springer - Verlag. Berlin, 1994, 77-94.
26. Gurunathan N. Studies on seed management techniques in *Jatropha curcas*. M.Sc. (For.) Thesis, Tamil Nadu Agricultural University, Coimbatore, 2006.
27. Vijayageetha V. Standardization of seed production, storage techniques, vigour tests and varietal characterization in mustard (*Brassica juncea* L.). Ph.D. Thesis. Department of Seed Science and Technology, Coimbatore, 2007.