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Research Article

THE INVESTIGATION ON EFFECT OF SEED SIZE ON GERMINATION OF EUCALYPTUS SPECIES

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ABSTRACT

The present study was conducted to investigate the effect of seed size of eucalyptus on germination. Open pollinated seeds of seven lots of *Eucalyptus tereticornis* and *E. camaldulensis* collected in 2013 from two provenance viz. Pudukottai and Karunuya were used in this study. The seed was graded in to three class viz., Grade I, Grade II and Grade III using sieves. Among all seed lots, the Grade III seed was largest class. The data revealed that seed size and weight had significant effect on seed germination. The Grade II seed can be used for production of uniform seedlings of eucalyptus. The sieve based grading method is simple and cost – effective method for grading of small seeds like *Eucalyptus* sp.

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INTRODUCTION

Nursery personnel and foresters separate seeds of tree species into size classes for more uniform sowing density, better synchrony in germination, and better control of seedling size¹. Separating seeds into size or weight classes is easy to do, but factors other than inherent growth potential of the embryo may affect seed size, such as seed maturity², fruit/cone size³, and mother tree⁴. *Eucalyptus* seed is small, irregularly-shaped and must be graded according to size. Grading of *Eucalyptus* seed aids precision sowing and increases crop uniformity in the nursery⁵. The latter is attributed to the varying germination rates of the different seed grades with the largest seed germinating the fastest and producing the highest final germination⁶.

The superior germination of larger seed is ascribed to a greater amount of endosperm reserves that are available during the germination process⁷. Seed availability is often a constraint in nurseries, especially for high value seed and recalcitrant species. It is considered necessary to know the effect of seed size and weight in the seed germination, so as to get healthy seedling of plant species for a purpose of transplantation in the field. Hence, an attempt has been to investigate the effect of size on seed germination of this plant species.

MATERIALS AND METHODS

To study the effect of seed size on seed germination of *Eucalyptus tereticornis* and *E. camaldulensis*, the cleaned and fresh open pollinated seeds were collected in 2013 from two provenance viz. Pudukottai and Karunuya at seven different occasions (each collection was maintained as a separate lot). To grade the seed based on size, three sieves of different size arranged one above other in such way that largest diameter sieve was on the top and smallest sieve was at bottom. A 100g of seed was poured on top of sieve set and the sieve set was shaken slowly to grade seeds. Then, seeds were retained on topmost sieve rated as Grade -I (> 1.0mm), seeds retained on 2nd sieve was Grade -II (0.5 -1.0mm), seeds were found on 3rd sieve as Grade III (0.25 – 0.5mm) and seeds passed through all 3-sieves were graded as Grade -IV (<0.25mm). Seed weights of each grade were quantified by using the electronic balance and percent share of each grade was calculated. A 0.2g of seeds of each grade was weighed and sown on the moistened germination paper placed on petridish and then sufficient moisture was maintained through regular watering. Germination of seeds was counted for 10-days continuously from first day of emergence. Petri dishes were arranged in a randomised complete block design with four replications per treatment. The data was analysed statistically with standard procedures.

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RESULTS

Seed Grading and its Distribution in Seed lots

For *E. camaldulensis*, the Grade III ranges from 75% to 85% of total seed weight taken. The highest percent of Grade III was recorded in, P397 seed lot where lowest of the same was found in P391. The Grade II was ranged between 13% and 21% of total seed weight. The highest and lowest share of grade II was found in the seed lot P391 and P397, respectively. Thus, it was just reverse trend of Grade III. The Grade IV had lied between 2% and 4% of total seed weight taken. In case of *E. tereticornis* too, the grade III was predominant, which ranged from 76% to 87% of the total seed weight taken. The K394 had highest percent of Grade III with about 87% followed by K417, P396 and P420. The Grade II of *E.tereticornis* lied between 12 – 23% of the total seed weight taken. The Grade IV too was found dominant in K394 lot and minimum share was 0.85% in K417 lot (Fig 1). The Grade IV Grade was absent in all seed lot of the two above-said species. Thus, seed size of the *E. camaldulensis* and *E.tereticornis* lied in the range between 0.25mm and 1.0mm (Table 1).

Effect of seed size on Germination of *E. Camaldulensis* and *E.tereticornis*

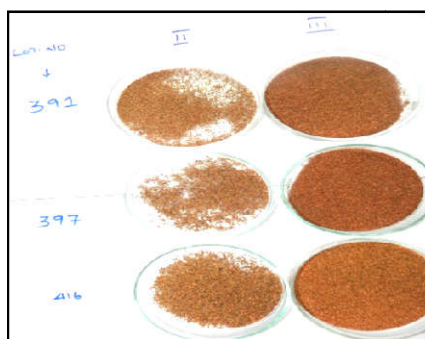
The germination per cent was found in the high in the Grade II seeds while the smallest seed i.e. Grade IV had shown poor seed germination. Depending on the species and seed lot, 0 to 403 germinates per 0.2g seed was observed between Grade I and Grade IV seed (Fig 1). No germinant was recorded in both Grade I and IV except seed lot P391 and K417 (Table 2).

Table 1 Distribution of seed grades in seed lots

Species	Provenance	Seed Lot	Seed grade (in mm)			
			I (>1)	II (1-0.5)	III (0.5-0.25)	IV (<0.25)
<i>E. camaldulensis</i>	Karunya	K416	0.00	20.32	77.46	2.22
	Pudukottai	P397	0.00	12.61	84.73	2.66
	Pudukottai	P391	0.00	21.24	74.95	3.81
<i>E. tereticornis</i>	Karunya	K394	0.00	12.12	86.87	1.01
	Karunya	K417	0.00	21.60	77.55	0.85
	Pudukottai	P420	0.00	23.43	75.61	0.96
	Pudukottai	P396	0.00	21.59	77.47	0.94

Table 2 Effect of seed grading on germination in *E. camaldulensis* and *E.tereticornis* (mean ± sd)

Seed Grade	<i>E. camaldulensis</i>				<i>E. tereticornis</i>			
	P391	P397	K416	P396	P420	K394	K417	
I (>1mm)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	
II (1-0.5mm)	216 ± 4	402.8 ± 5	201.3 ± 3	246.3 ± 9	215 ± 6	241 ± 3	212.3 ± 6	
III (0.5-0.25mm)	6 ± 2	14 ± 5	2 ± 1	32 ± 3	9.75 ± 1	4.5 ± 1	2 ± 1	
IV (<0.25mm)	2 ± 1	0 ± 0	0.0	0.5 ± 1	0 ± 0	0.5 ± 1	1.5 ± 1	



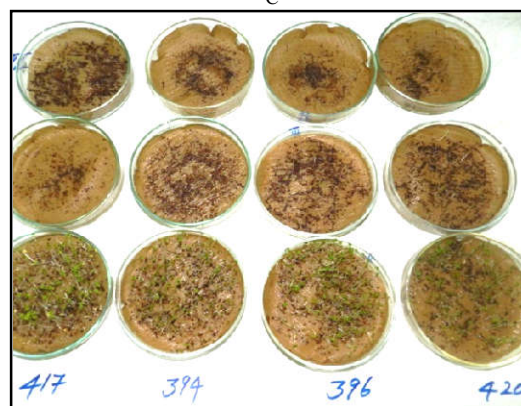
A



B



C



D

Fig 1 Grading and seed germination of Eucalyptus sp. a) Seed lot and its grading; b). Viable seeds; c). Chaff; d). Grades and its germination

DISCUSSION

As the *eucalyptus* seed is small and irregularly-shaped, it needs to be graded according to size. Grading of *Eucalyptus* seed aids precision sowing and increases crop uniformity in the nursery⁵ (Naidu & Jones, 2007). In the present study, eucalyptus seeds were classified into four grades viz., Grade –I (> 1.0mm), seeds retained on 2nd sieve was Grade –II (0.5 -1.0mm), seeds was found on 3rd sieve as Grade III (0.25 – 0.5mm) and seed was passed through all 3-sieves was graded as Grade -IV (<0.25mm) according to the size. The data revealed that germinates were recorded in the Grade –II and III and no germinates was found in Grade –I and IV. The highest final germination was found in the Grade –II. It shows that Grade –II & III were only viable seeds and rest was chaff or non-viable

seeds. As the largest seed had greater amount of endosperm reserves that are available during the germination process⁷ (Schmidt, 2000), it has shown the fastest and the highest final germination⁶ (McRae, 2005). It is reported that large loblolly pine seed germinated faster and produced a larger seedling compared to small seed⁸. A similar trend was reported for *E. globulus*, where larger seeds germinated better than smaller seeds⁹ and *E.grandis* and *E.smithii*⁵. In addition, the small Grade IV seed produced the shortest seedlings⁵. Thus, the results of the present were comparable with earlier studies.

CONCLUSION

From this study, it is concluded that the seed size and weight have significant effect on seed germination. As the grade II seed with size (1-0.5mm) have shown highest germination, it can therefore be used in a commercial nursery for uniform seedlings production. Further, the sieve based grading method is simple and cost – effective method for grading of small seeds like *Eucalyptus* sp.

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