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Improving seed germination in sapindus emarginatus vahl

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ABSTRACT

Poor germination in tree species is a common problem which can be overcome by giving suitable treatment. Sapindus emarginatus Vahl., is a large tree belongs to the family Sapindaceae, capable of colonising in dry shallow soils, loamy soils and lateritic soils. Fresh seeds were collected during summer months from a 20- year-old natural stand at National Pulses Research Centre, Pudukkottai, South India. (8o30'N, 78o24'E, 120m.a.s.l) and subjected to the following treatments i). Inundation in cold water for 24 hr ii). Inundation in boiled water (80oC) and allowed to cool for 24 hr iii). Inundation in cow's urine for 24 hr iv). Inundation in cow dung slurry (1:2 ratio of dung and water) for 24 hr. v). No treatment (unsoaked dry seeds) The data on germination and related attributes were statistically analysed for ANOVA. Germination indices like (i). Germination percent (ii). Germination value (after Djavanshir and Pourbeik, 1976), (iii) Germination Value (after Czabator,1962) and (iv) Emergency energy value and Germination energy were calculated. The results indicated that germination in Sapindus emarginatus could be increased by inundating the seeds in cold water for 24 hr before sowing. The study throws light on exploiting this technique on other tree seeds having the same problem.

Keywords: Germination, Inundation, soaking

1. INTRODUCTION

Sapindus emarginatus Vahl, is a large tree belonging to the family *Sapindaceae*, capable of colonising dry shallow soils, loamy soils and lateritic soils. It is commonly occurring in Southern India and cultivated in villages of Madhya Pradesh, Utter Pradesh and Bihar. Fruits are used as detergent and used for washing woollen clothes and ornaments (Umrao singh et al 1996). The fruit is a fleshy drupe, occurs in 2 or 3 numbers. It is raised by direct sowing or by planting out seedlings. But the central problem in this species is poor germinability. The time taken to flower and fruit development also plays a role in germination of seeds in Jatropha (Swaminathan, 2010). Seed treatments like pre-sprouting of seeds increased germination in Hardwickia binata (Suresh et al 1994); pre soaking of seeds enhanced germination in Acacia concinna (Swaminathan and Srimathi, 1994) and inundation of seeds in boiled water for 24 hours enhanced germination in Acacia sp. (Swaminathan and Swarnapiria, 2001). Accordingly this study is designed with an objective of increasing germination in *Sapindus emarginatus*.

Materials and Methods:

Fresh seeds were collected during summer months from a 20-year-old natural stand at National Pulses Research Centre, Pudukkottai, South India. (8o30'N, 78o24'E, 120m.a.s.l) and the experiment was conducted at Department of Soil and Crops, Agricultural College & Research Institute, Killikulam, Thoothukudi District during the year 2007-08. The seeds were given the following treatments i). Inundation in cold water for 24 hr ii). Inundation in boiled water (80oC) and allowed to cool for 24 hr iii). Inundation in cow's urine for 24 hr iv). Inundation in cow dung slurry (1:2 ratio of dung and water) for 24 hr. v). No inundation treatment (unsoaked dry seeds).

As a prophylactic measure, seeds were dipped in 0.1% copper sulphate prior to sowing. The seeds at the rate of 50 for each treatment were sown in 200 gauge poly pots measuring 20 x 10 cm filled with nursery mixture comprising of red soil, sand and compost at 3:1:1 ratio. The experiment was set up in a Randomised Block design with four replications. Number of germinant was counted daily from the on set of germination up to 30 days thereafter. Emergence of cotyledons above the soil was reckoned as germination (Bahuguna, et al 1987). From the daily counts the following parameters were computed. (i). Germination percent (ii). Germination value (after Djavanshir and Pourbeik, 1976), (iii) Germination value (after Czabator,1962) and (iv) Emergency Energy Value

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(EEV). Germination energy (GE) was calculated after Maguire (1962) by the formula.

$$GE = X_1 / Y_1 + (X_2 - X_1)/ Y_2 + ... + (X_n - X_{n-1}) / Y_n$$

Where X_n is the number of germinants on the nth counting date and Yn, the number of days from sowing to the nth count. Germination value as defined by Czabator (1962) is the integral of final mean daily germination percentage (MDG) and peak value (PV). Final MDG is the cumulative percentage of full seed germination at the end of the test divided by the number of days elapsed since sowing date. Peak value is the maximum mean daily germination obtained by dividing the maximum cumulative percentage reached at any time during the test period by the number of days from sowing when that maximum was reached. Germination value (GV) as proposed by Djavanshir and Pourbeik (1976) is given by the formula.

$$GV = (\sum DGS / N) \times GP/10$$

Where GV is germination value, GP is germination per cent at the end of the test, DGS is the daily germination speed obtained by dividing the cumulative germination per cent by the number of days since sowing $\sum DGS$ is the summation of all DGS figures and N, the number of daily counts effective from the date of first germination. Emergence energy value is the highest value obtained when the germination percentage on a day is divided by the number of days since test when that germination percentage was reached (Bahuguna et al. 1987).

Results and Discussion

The data on germination and related attributes are presented in table 1. A maximum of 88 % germination was recorded by inundating seeds in cold water for 24 hours. Compared to the unsoaked dry seeds, coldwater inundation of seeds for 24 hours recorded increased germination and the magnitude of increase was 16%. However inundation treatments with boiled water, cow's urine and cow dung slurry had lowered seed germination. The least germination was registered in boiled water inundation for 24 hours (56%). Coldwater inundation proved distinctly superior to all other treatments from the standpoint of all parameters evaluated. The on set germination is advanced in cold water inundation for 24 hr which helps to reduce the tying of nursery during the initial period of germination and also reduces the input requirements. Germination energy is a measure of the speed of germination and hence supposedly of the vigour of the seed. The interest in germination energy stems from the theory despite the lack of much experimental evidence that only seeds which germinate rapidly in the laboratory will produce vigorous seedlings in the field. This parameter was distinctly high when seeds were inundated in cold water for 24 hours. Germination value combines as it does both total germination capacity and germination energy, and hence is better measure of seed performance. In terms of this germination value also, coldwater inundation of seeds for 24 hr is indicated to be superior where the germination value, as an integrated measure of seed quality (Costales and Veracion, 1978).

Germination value alternatively proposed by Djavanshir and Pourbeik (1976) was found by some researchers to be more closely related to survival of plants in field nurseries than was Czabator's method. The emergence energy value, a measure of speed of germination, is also superior for cold water inundation treatment, which also advanced on set of germination by two days compared to unsoaked dry seeds. Soaking of seeds in cold water for 24 hours followed y pre-sprouting in wet gunny bags for 48 hours increased germination in *Hardwickia binata* (Suresh et al 1994). Pre soaking of seeds of *Acacia concinna* in GA or IAA for 120 minutes enhanced germination (Swaminathan and Srimathi, 1994). On contrary boiled water inundation and cow's urine treatment decreased germination in this species, which may be avoided. However Swaminathan and Swarnapiria (2001) reported that inundation of seeds of *Acacia mangium* and *Acacia crassicarpa* in boiled water for 24 hours enhanced germination as well as all the germination indices studied. From the studies it may be concluded that germination in *Sapindus emarginatus* could be increased as well as advanced by inundating the seeds in cold water for 24 hr before sowing.

Table 1. Response of seeds of Sapindus emarginatus to inundation treatments

No.	Inundation treatment	Onset of Germination (days)	Germination (%)	GE	Czabator's GV	GV (D & P)	EEV
1	No inundation treatment (unsoaked dry seeds)	14	76	1.41	283	10.22	1.68
2	Inundation in cold water for 24 hr	12	88	1.61	4.02	16.95	2.5
3	Inundation in boiled water and allowed to cool for 24 hr	18	56	0.9	1.58	3.92	1.27
4	Inundation in cow's urine for 24 hr	17	64	1.17	2.02	5.81	1.42
5	Inundation in cow dung slurry	14	72	1.33	2.62	8.45	1.64
	LSD (5%)	--	6.4	0.21	0.62	3.45	0.35

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