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Effect of seed treatments and potting medium on seed germination parameters in threatened *Stereospermum suaveolens* (Roxb.) DC. – A dashmool species

Saxena Hari Om[1] ✉, Naseer Mohammad [2], Parihar Samiksha[1] and Kumar Sant[1]

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Abstract

An experiment was conducted to investigate the effect of different seed treatment and potting media on germination percentage and associate parameters in *Stereospermum suaveolens*, a threatened dashmool species during May, 2019 at Silviculture Nursery of Tropical Forest Research Institute, Jabalpur (Madhya Pradesh). Experimental treatments comprised of twenty treatment combinations consisting of four different seed treatment and five growth mediums. Data on daily seed germination was recorded and used for estimation of final germination percentage (FGP), mean germination time (MGT), coefficient of velocity of germination (CVG), germination rate index (GRI), time spread of germination (TSG), energy period (EP) and peak value of mean germination (PVMG). Critical perusal of analysis revealed that treatment combination 'Sand + Hot Water' was resulted in positive effect on all the characters studied and could be used for mass raising of seedlings of *S. suaveolens*.

Key words: ***growth medium, seed germination, seed treatment, Stereospermum suaveolens***

Introduction

Although forest tree species are generally propagated by seeds, research reports describing standard package of practices for raising health seedlings are limited due to fragmented research (Mng'omba *et al.,* 2007). AOSA (1970) defines germination as the emergence and development from the seed of those essential structures which are indicative of the ability to produce a normal plant under favorable conditions. In forest tree species, mostly seed germination is low due to hard seed coats and dormant seed embryos (Jaiswal and Chaudhary, 2005) and they often fail to germinate even under favourable conditions (Urgenc and Cepel 2001). Published reports suggest that pre-treatments like seed soaking in cold or hot water, acid scarification with sulphuric or hydrochloric acid are known to overcome dormancy of seeds (Bedell, 1998). Pre-soaking of seeds in growth regulator like gibberellic acid (GA_3) and indole acetic acid (IAA) also reported to enhance seed germination percentage (Chauhan *et al.,* 2009). Planting substrate is also reported to have significant effect on overall seed germination percentage and its other associated parameters. Therefore, in nurseries importance is given to substrate for raising seedlings (Jaiswal and Chaudhary, 2005). A suitable substrate is the one which contain numerous air spaces, provides adequate aeration (Thomson, 1992), non-toxic, free from moulds and microorganisms, cost effective and is easy to handle (Agrawal, 1997).

Stereospermum suaveolens (Roxb.) DC. is commonly known as Patala/ Padar, belongs to the family Bignoniaceae. It contains lapachol and lapachonone, which act against dermatitis (Anonymous, 1998). The plant is of immense importance in Indian system of medicine for its pharmacological potential. Various parts of the plant are used in folk medicine for the treatment of diabetes, diuretic, pain, fever, inflammations and asthma but it is the root which is extensively utilized in the preparation of "Dashmoolarista", an established ayurvedic drug for treating general fatigue, oral sores and several gynecological disorders. Roots of the plant also have an anticancer activity. The species has become threatened in the

Author's Address
[1]NWFP section, Silviculture, Forest Management & Agroforestry Division, Tropical Forest Research Institute, Jabalpur (M.P.), India
[2]Genetics and Tree Improvement Division, Tropical Forest Research Institute, Jabalpur (M.P.), India
E-mail.: *hariomsaxena81@gmail.com*

wild due to its over-exploitation, unscientific harvesting, loss and fragmentation of habitats. Very fragmented population of *S. suaveolens* is reported in Madhya Pradesh and species has become rare and vulnerable. The reduced seed production caused gradual erosion of its natural populations. The propagation material of this species is mainly seeds and collecting them is a laborious process as their pericarps are winged. The natural regeneration of the species in the wild is very meager due to poor germination rate. Looking to the commercial importance and rare status of this species, the conservation of the species is of utmost importance. Hence, at Tropical Forest Research Institute,
Jabalpur efforts are initiated to conserve this tree species of high economic value. The present study was undertaken to investigate the effect of different seed treatment and potting media on germination percentage and other associate parameters for *S. suaveolens*.

Material and Methods

The seeds of *S. suaveolens* were collected from Mandla Forest Division, Madhya Pradesh. Twenty treatment combinations consisting of four different seed treatments and five growth mediums were used for the experimentation is given in table 1. For different treatments, the winged pericarp was removed from the seeds and then they were soaked for 24 h in distilled water, IAA and GA_3. For hot water treatment, seeds were soaked in hot water (100°C) for 15 min and then transferred to distilled water at room temperature. Growth medium Cocopeat, Soil, Sand, Soil + Manure + Sand (equal ratio1:1:1), Soil + Manure (equal ratio1:1) were used. Experiments were laid out in completely randomized design with two replications. Uniform maintenance and protection measures recorded every day on number of seeds germinated. Final Germination Percentage and other associated germinating parameters were estimated following standard methodology (table 2).

Table 1. Details of treatment combinations used in investigation

Treatment No.	Treatment composition	Treatment No.	Treatment composition
T1	Cocopeat+GA_3	T11	Cocopeat+ Distilled Water
T2	Sand+GA_3	T12	Sand+ Distilled Water
T3	(Soil+Manure) +GA_3	T13	Soil+ Distilled Water
T4	Soil+GA_3	T14	Soil+ Distilled Water
T5	(Soil+Manure+Sand) +GA_3	T15	(Soil+Manure)+ Distilled Water
T6	Cocopeat+IAA	T16	Cocopeat+ Hot Water
T7	Sand+IAA	T17	Sand+ Hot Water
T8	(Soil+Manure) +IAA	T18	(Soil+Manure) + Hot Water
T9	Soil+IAA	T19	Soil+ Hot Water
T10	(Soil+Manure+Sand) +IAA	T20	(Soil+Manure+Sand) + Hot Water

Results and Discussion

Estimates of the final germination percentage and other associate parameters are presented in Table 3 and graphically visualized in Figures 1. Critical perusal of the Table 3 revealed that final germination percentage and associated parameters were varied in different treatment combinations indicating effect of the potting medium and seed treatments. Highest value of final germination

percentage was obtained in T17 (Sand + Hot Water) i.e. 56% followed by the T1 (Cocopeat+GA_3). Lowest final germination percentage was reported in T14 (Soil + Distilled Water) i.e. 6%. Mean germination time which is negatively related to the speed of germination (Orchard, 1977) is lower in T1 (Cocopeat+GA_3) compared to the T17 (Sand + Hot Water). This indicates that speed of germination is higher in T1 compared to the T17.Germination rate index (GRI) and Germination index (GI) have positive correlation with each other and indicates higher and faster germination showed higher values in treatment combination of Cocopeat+GA_3 i.e. T1 compared to the Sand + Hot Water, although final germination percentage is higher in T17 (Figure 1).

Table 2. Details of germination parameters estimated in present investigation

Germination Parameter	Unit	Formula for Calculation	Description of Formula	Reference
Final Germination Percentage (FGP)	%	FGP =Final no. of seeds germinated in a seed lot × 100	-	Scott *et al.* (1984)
Mean Germination Time (MGT)	Day	MGT = ∑f ·x/∑f	f=Seeds germinated on day x	Orchard (1977)
Coefficient of Velocity of Germination (CVG)	-	CVG =N1+N2+⋯+N x/100×N1T1+⋯ +NxTx	N=No. of seeds germinated each day, T=No. of days from seeding corresponding to N	Jones and Sanders (1987)
Germination Rate Index (GRI)	(%/day)	GRI=G1/1+ G2/2+⋯+Gx/x	G1=Germination percentage × 100 at thefirst day after sowing, G2=Germination percentage × 100 at thesecond day after sowing.	Esechi (1994) after modificatio n.
Germination Index (GI)	-	GI=(10×n1) +(9×n2) +⋯+ (1×n10)	n1, n2... n10= No. of germinated seeds on the first, second and subsequent days until the10th day; 10, 9 . . . and 1 are weights given to the number of germinated seeds on the first, second and subsequent days, respectively	Bench Arnold *et al.* (1991)
Time Spread of germination (TSG)	Day	TSG=The time in days between the first and last germination events occurring in a seed lot		Kader (1998)

Table 3. Germination percentage and other parameters of *S. suaveolens* in different treatment combination of potting media and seed treatments

Germination Parameters	Treatments									
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
FGP	45.00	15.00	35.00	19.00	39.00	23.00	6.00	20.00	42.00	20.00
MGT	8.38	11.93	9.11	12.00	8.62	8.22	12.17	8.30	11.57	9.95
CVG	11.94	8.38	10.97	8.33	11.61	12.17	8.22	12.05	8.64	10.05
GRI	5.58	1.34	4.12	1.62	4.79	2.92	0.56	2.56	3.80	2.11
GI	1018.0	286.0	766.0	361.0	873.0	524.0	113.0	454.0	816.0	421.0
TSG	6.00	10.00	8.00	7.00	8.00	6.00	11.00	8.00	7.00	8.00

Germination Parameters	Treatments									
	T11	**T12**	**T13**	**T14**	**T15**	**T16**	**T17**	**T18**	**T19**	**T20**
FGP	23.00	9.00	21.00	6.00	20	43.0	56.0	43.0	32.0	20.0
MGT	9.52	18.56	9.62	17.33	10.1	18.3	19.0	17.7	16.8	15.9
CVG	10.50	5.39	10.40	5.77	9.901	5.5	5.3	5.7	6.0	6.3
GRI	2.53	0.49	2.30	0.35	2.080	2.4	3.0	2.5	1.9	1.3
GI	494.0	112.0	449.0	82.00	418	547.0	671.0	573.0	455.0	303.0
TSG	7.00	3.00	7.00	5.00	7	10.0	14.0	10.0	10.0	3.0

Where, T1-Cocopeat+GA3, T2-Sand+GA3, T3-(S+M)+GA3, T4-Soil+GA3, T5-(S+M+S)+GA3, T6-Cocopeat+IAA, T7-Sand+IAA,T8-(S+M)+IAA, T9-Soil+IAA, T10-(S+M+S)+IAA, T11-Cocopeat+Distilled Water, T12-Sand+Distilled Water, T13-S+M+Distilled Water, T14-Soil+Distilled Water, T15-S+M+S+Distilled Water, T16-Cocopeat+Hot Water, T17-Sand+ Hot Water, T18- S+M+ Hot Water, T19-Soil+Hot Water, T20-S+M+S+ Hot Water

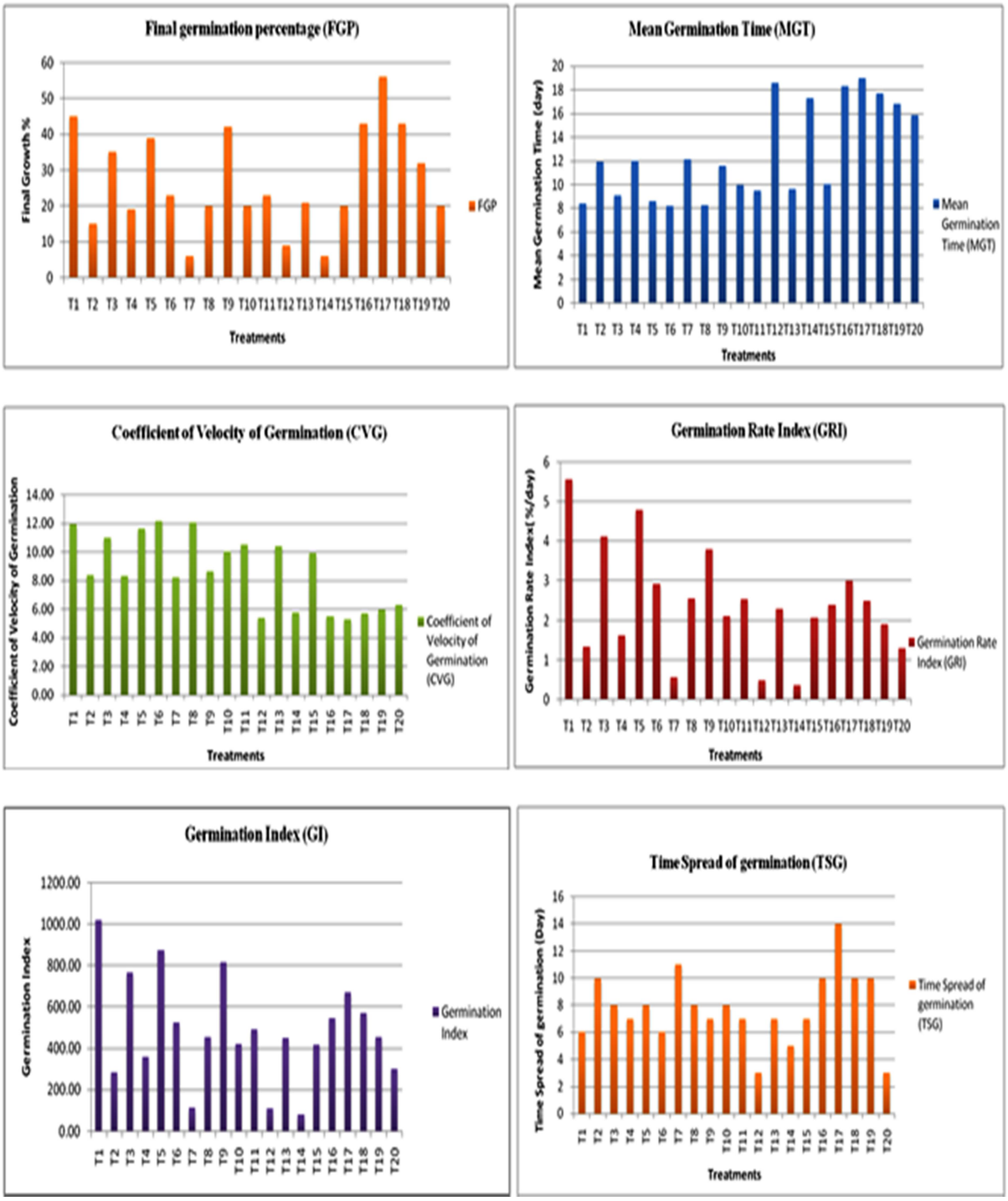

Figure 1. Graphical presentation of the estimates of final germination percentage and other germination parameters under different treatment combination of potting media and seed treatments.
[Where, T1-Cocopeat+GA3, T2-Sand+GA3, T3-(S+M)+GA3, T4-Soil+GA3, T5-(S+M+S)+GA3, T6-Cocopeat+IAA, T7-Sand+IAA,T8-(S+M)+IAA, T9-Soil+IAA, T10-(S+M+S)+IAA, T11-Cocopeat+Distilled Water, T12-Sand+Distilled Water, T13-S+M+Distilled Water, T14-Soil+Distilled Water, T15-S+M+S+Distilled Water, T16-Cocopeat+Hot Water, T17-Sand+ Hot Water, T18- S+M+ Hot Water, T19-Soil+Hot Water, T20-S+M+S+ Hot Water]

Conclusion

It may be concluded that under the constraints i.e. limitation of time, nursery space, etc, treatment combination of 'Cocopeat+GA3' may be adopted for raising the seedlings, whereas, under no constraints of space, time i.e. when one is able to maintain the germination trial for longer period, treatment combination of 'Sand + Hot Water' is suggested.

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