International Research Journal of Multidisciplinary Science & Technology
www.irjmrs.com ISSN : 2455-930X

SEED GERMINATION IMPROVEMENT STUDIES IN RED SANDERS (PTEROCARPUS SANTALINUS L.F) FROM KARNATAKA

K.P. Vijayalakshmi[1] and P.R.Renganayaki[2]

[1]*Assistant Professor, College of Forestry sirsi, University of Agricultural Sciences Dharwad*

[2]*Professor, Forest College and Research Institute Mettupalayam, Tamil Nadu Agricultural University, Tamil Nadu*

----------****----------

Abstract - *Pterocarpus santalinus L.f. is a highly valued timber species, because of its "heavy, dark claret-red heartwood," especially that possessing a 'wavy' grain. Red Sanders is an endemic and endangered species largely confined to the southern portion of the Eastern Ghats, Andhra Pradesh, India and propagated through seeds; problem in seed germination limits seedling production. Current study was carried out to find out best germination enhancement treatment. Mature pods collected from three different sources were subjected to 6 treatments in 4 replications and experimental was conducted in completely randomized design. The results showed that Alternate Wetting and Drying of pods (AWD) for 48h resulted more synchronized germination of 73 percent followed by water soaking for 48h (52%) as against 33% in control.*

Keywords: Pterocarpus santalinus, Alternate Wetting and Drying- improved seed germination.

1. INTRODUCTION

Red sanders (*Pterocarpus santalinus*) is an evergreen tree species grown under semi dry climates in well -drained lateritic soils,. endemic and endangered, largely confined to the southern portion of the Eastern Ghats, Andhra Pradesh, India (Shilpa *et al*., 2012), some pockets of Karnataka and Tamil Nadu (North Arcot hills); cultivated in Maharashtra, Odisha and West Bengal and introduced in Sri Lanka (Jain and Sastry, 1980). The reddish and fragrant heartwood has range of medicinal, pharmaceutical, industrial and timber value and thus economically placed in the same range as tusk and amber. Conventional vegetative propagation techniques such as grafting and air-layering have limitations in large-scale multiplication of this species and rooting of cutting was also found to be poor (Kesava Reddy *et al.,* 1990). Tissue culture has proved to be a promising technique for conservation and large scale multiplication of several woody species. However the members of Fabaceae have been difficult to culture *in vitro* owing to their recalcitrant nature, roots were robust and vigorous in air layers compared to stem cuttings, but the rate of manipulation is comparatively low and not enough to transplant in the nursery and main field (Rao and Raju, 2002). Based on the above reasons, the multiplication of the species largely depends on seed (Dayanand and Lohidas, 1988). Germination of Red sanders seed is often very difficult because of a hard seed coat coupled with poor viability (Dayanad *et a*l., 1988; Naidu *et al.,* 2001).Seed possessed with dormancy up to six months to one year, type of dormancy has not yet been elucidated. Presence of dormancy cause prolonged germination. Considering the commercial importance of *Pterocarpus santalinus* and problems faced in seed propagation, to generate scientific information on pod and seed factors responsible for poor germination and treatments to enhance the germination by overcoming the obstacles, the present study was carried out.

1.1: Materials and Methods

Seed germination improvement was carried during 2015-16 at Forest College and Research Institute, Mettupalayam, Tamil Nadu, India.

1.2: Seed sources

Seeds of *Pterocarpus santalinus* were collected during June, 2015 from Bangalore, Karnataka Latitude 12° 58' N Longitude 77° 38' E

1.3: Treatment details

Four hundred number of seed / pods used for each treatment from each source @ 100/replication.

1. Control (T0)

2. Mechanical Clipping of pod (T1)

Hard woody pod (Plate I.) was damaged at the distal end using wire cutter/secateurs and subjected to germination test.

Fig:1 Hard pod of Red sanders

3. Cow dung slurry (T2)

Pods were mixed with cow dung slurry (1:2 ratio of water and cow dung) and kept for 24h and tested for germination in nursery.

4. Water soaking for 24h (T3)

Pods were soaked in cold water for 24h duration and subjected to germination test.

5. Water soaking for 48h (T4)

Pods were soaked in cold water for 48h duration and subjected to germination test.

6. Alternate wetting and drying for 24h (AWD) (T5)

Pods were subjected to two cycles of 6h of wetting and 6 h of drying and subjected to germination test.

7. Alternate wetting and drying for 48h (AWD) (T6)

Pods were subjected to two cycles of 12h of wetting and 12h of drying and subjected to germination test.

2. Observations recorded

2.1 Days to initial germination

The nursery bed was observed daily, for seedling emergence. The day on which the first seedling emerged was expressed as days to initial germination.

2.2 Days to final germination (Mauromicale and Cavallaro, 1995)

The number of days on which the last seedling emerged was recorded and expressed as days to final germination.

2.3 Speed of germination (Czabator, 1962)

Speed of germination was calculated by the following formula,

Speed of germination= n1/d1+n2/d2+n3/d3+----------

Where, n = number of germinated seeds; d= number of days.

2.4 Germination per cent (ISTA, 2003)

The number of normal seedlings produced in each replication(4 replication/25 pods) was counted, and average was expressed in per cent.

$$\text{Germination percentage} = \frac{\text{Number of normal seedlings}}{\text{Total number of seed sown}} \times 100$$

2.5 Seedling length

All normal seedlings of each treatment were measured for length from root tip to shoot tip and the average was expressed in cm.

2.6 Dry weight

All normal seedlings were dried under shade for 24 h and then dried in hot air oven maintained at 85 ± 1°C for 48 h. It was cooled in a desiccator for 30 minutes and weighed. The values were expressed as 'g seedlings-1'.

2.7 Vigour Index (Abdul-Baki and Anderson, 1973)

Vigour index (VI) was computed using the following formula and expressed as whole number.

VI = Germination percentage x dry weight (g/seedling)

3. Statistical analysis

Result data (in per cent) were transformed to arcsine values before statistical analysis in order to unify the variance of the data (Ansari *et al*., 2012). The data were then analyzed by the 'F' test for significance at 0.05 level by using statistical software AGRESS.

4. Result and Discussion

For seed technologists, seed germination is emergence and development from the seed embryo of those essential structures which are indicative of the ability to produce a normal plant under favorable conditions. The environmental conditions which are necessary for germination are essentially water (during imbibitions and subsequent stages of growth and development) and oxygen and adequate temperatures for metabolism and growth after imbibition's.

No doubt different treatments had a significant and positive effect on improving and hastening seed germination the increment was low in mechanical clipping, cow dung slurry 24h, water soaking 24h and alternate wetting and drying 24h, but pronounced effect in other two ie. alternate wetting and drying 48h and water soaking 48h treatments. Different set of treatments might have their own effect either on weakening of hard seed coat, or leaching of water soluble inhibitors. Seed germination test conducted in

the present study revealed that resulted in poor germination percentage even after a period of 57 days with a value of 33 per cent (Table 1).

Mechanical clipping of pod make a point of water entry inside seed, would allowed the seed to start the germination process, which resulted in little increased and early germination compared to control. seed possessed with physical dormancy due to hard seed coat as in the case of *Delonix regia* (Aminu, 2012 and Shuaibu *et al,* 2015), or hard pod in the case of *Pterocarpus marsupium* (Venkataramaiah *et al*., 1980).

Table 1. Effect of treatment on seed germination characteristics

Treatment	Days to initiate germination	Days to final germination	Speed of germination	Germination %
T_0	13.00	57.00	00.21	33(35.06)
T_1	12.25	48.50	00.31	47(43.28)
T_2	14.25	28.75	00.78	50(45.00)
T_3	09.25	33.00	00.46	48(43.85)
T_4	08.75	28.50	00.53	52(46.14)
T_5	08.00	20.25	03.36	61(51.35)
T_6	08.00	16.00	04.79	73(58.69)
Mean	10.50	33.14	1.49	52(46.19)
SE.D	0.57	1.46	0.04	1.02
CD (P ≤0.05)	1.16	2.96	0.08	2.07

T0- Control ,

T1- Mechanical Clipping of pod

T2- Cow dung slurry coating

T3 - Water soaking(24h),

T4 - Water soaking (48h),

T5- Alternate Wetting and Drying (24h),

T6- Alternate Wetting and Drying (48h)

*Figures in parentheses indicate arc-sine value

The enhanced and more uniform germination with higher seedling vigour of the cowdung slurry treatment may be the result of corrosion of pod coat by the week acids, digestion of thin and strong veins by the microbes present in cow dung, both together might have resulted in the opening of pores, supports or aids in water entry to initiate pre germination metabolic events; entry of growth stimulants present in cow dung and adequate water through the opened pores made the seeds to perform positively. The results are supported by similar studies reported by Tendolkar (1978); Singh *et al.* (1989); Pampanna and Sulikeri (2001) and Anand *et al.* (2005).

Seed germination is a complex process in tropical forest species due to known and unknown factors. Consequences of germination of the species could be influenced by both environment and seed factor. In the present investigation alternate wetting and drying able to increase germination (73%) , where seeds germinated with a higher seedling length(19.77cm), vigour index(17.37), dry weight (00.24g) and survival percentage(90.29) within a shorter duration of 16 days (Table 2).

Table 2. Effect of treatment on seedling Characteristics

Treatment	Seedling length (cm)	Dry weight (g)	Vigour Index	Survival (%)
T_0	11.27	0.18	06.08	90.75
T_1	11.80	0.19	09.65	91.00
T_2	17.27	0.17	08.40	89.25
T_3	14.32	0.11	05.75	91.25
T_4	16.67	0.20	10.68	93.75
T_5	14.95	0.19	11.71	85.75
T_6	19.77	0.24	17.37	90.25
Mean	15.15	0.18	9.95	90.29
SE.D	0.42	0.01	1.07	0.59
CD (P ≤0.05)	0.88	0.04	2.17	1.20

The reason behind the treat mental effect might be expansion of cells during wetting and contraction during drying which resulted in weathering of pod coat, facilitated penetration of required quantity of water inside the pod and accelerated the initial process of germination *viz*., breakdown of food material and synthesis of enzymes, as quoted by Walter *et al*. (1981). Whereas in case of water soaking the gradual softening of seed coat facilitated the improvement , the results are in line with Lozumi *et al.* (2012) in *Acacia nilotica;*

5. Conclusion

In the present study carried out to find best germination improvement treatment for red sanders, revealed that subjecting the of pods to alternate wetting and drying for 48h would be the best one among six tried, but out of 96% of viable seeds only 73% seeds were able to germinate, the remaining 23% neither germinated nor dead even after imbibitions. The difference between viability and germination percentage, may be due to presence of dormancy, further studies on dormancy breaking apart from breaking hard pod and seed coat , may elucidate the fact.

6. Reference

[1] Baki, A.A.A. and Anderson,J.D.,1973, Vigor determination in soybean seed by multiple criteria.Crop Sci., **13**: 630-633.

[2] Bichi, A.M., 2012,Different pre-germination treatments and delonix regia seeds jorind. www.transcampus.org./journals, **10(2).**

[3] Anand, B., Devagiri, G.M., Gurav, M., Vasudev H.S. and Khaple, A.K., 2012, Effects of Pre-sowing Seed Treatments on Germination and Seedling Growth and early protein synthesis during germination of Melia dubia.

[4] Ansari, O., Choghazardi, H.R., Sharif, Z.F. and Nazarli, H. 2012, Seed reserve utilization and seedling growth of treated seeds of mountain ray(Seecale montanum) as affected by drought stress. Cercetări Agronomiceîn Moldova, **2(150)**: 43-48.

[5] Czabator, F. J., 1962, Germination value: An index combining speed and completeness of pine seed germination. Forest Science **8** : 386 – 395.

[6] Dayan and, T. and Lohidas, T., 1998, Effect of different treatments on pod germination of Red sanders.(Pterocarpus santalinus) L. Indian J forester **11**: 87-88.

[7] International Seed Testing Association (ISTA), 2003, ISTA Working Sheets on Tetrazolium Testing Vol. I. Agricultural, Vegetable & Horticultural Species. Ed Leist, N., Kramer, S., Jonitz, A., Basserdorf CH-Switzerland, pp. 200.

[8] Jain, S.K. and Sastry, A.R.K., Threatened Plants of India. A State-of-the Art Report, 1980;42. J. Agric. Sci.**, 14**: 1030- 1036

[9] Reddy, K.K. and Srivasuki. K.P., 1990, Vegetative propagation of Red sanders (Pterocarpus santalinus Linn.). Indian Forester**, 116**: 536-540.

[10] Venkataramaiah, V., Prasad, S. V., Rajeswara, R. G., Swamy. P. M., (1980). Level of phenolic acids in Pterocarpus santalinus L. Indian J Exp Biol., 18:887-889.

[11]Yaser, l., Hashemabadi, D., Eslami, A., Zarchini, M., Kaviani, B., Haider, R., Alam, Md.S. and Shutrodhar, A.R., 2016, Effect of pre-sowing treatment on seed germination and seedlings growth of Sapindus mukorossi Gaertn. - an important medicinal plants in Bangladesh. Journal of Bioscience and Agriculture Research, **6(2):** 570-577.

[12]Mauromicale, G. and Cavallaro, V., 1995, Effects of seed osmo priming on germination of tomato at different water potential. Seed Sci. Technol., **23**: 393-403.

[13]Naidu, C.V. Rajendrudu, G., 2001, Influence of kinetin and nitrogenous salts on seed germination of red sanders (Pterocarpus santalinus Linn.f.). Seed Sci. Technol, **29**: 669-72.

[14]Pampanna, Y. and Sulkeri, G.S., 2001, Effect of growth regulators on seed germination and seedling growth of Sapota. J. Agric. Sci. 14(4):1030- 1036.

[15]Pandita, V.K., Nagarajan, S. and Sharma, D., 1999, Reducing hard seededness in fenugreek by scarification technique. Seed Sci. Technol, **27**: 627-632.

[16]Rao S., Purnachandra, and Raju, S.A.J., 2002, Pollination ecology of the Red Sanders Pterocarpus santalinus (Fabaceae), an endemic and endangered tree species Current Science, **83(9)**.

[17]Shilpa, B., Reddy, C.S., Sudha, K., Sudhakar, S. and Raju, V.S., 2008, Vegetation cover mapping and landscape level disturbance gradient analysis in Warangal district, Andhra Pradesh: India using satellite remote sensing and GIS. Space Res. J, **1**: 29–38.

[18]Shuaibu, Y.M., Abdul, I., Abubakar, N. and Gambo, M., 2015, Effects of Different Methods of Breaking Seed Dormancy on the Germination of Flamboyant Seed (Delonix Regia) in Bauchi State, Nigeria. Int. J. Sci & Tech .(ISSN 2321 – 919X)., **3(8)**

[19]Singh, M., Singh, G.H., Singh, L.N. and Singh, B.N., 1989, Effect of gibberelic acid on seed germination in Mosambi (Citrus sinensis Obseek). Haryana Journal of Horticultural Sciences, **18**: 29-33.

[20]Tendolkar, S.S.P., 1978, Studies on growth of root stock and propagation of sapota (Manilkara achras (Mill) Fosberg). **M.Sc. Thesis**, Uni. Agric. Sci. Bangalore (India).

[21]Walter, S.M., Akeroyd, J.R., and Draba, L., 1981, **In**: Tutin, T.G. et al. (Eds.). Flora Europaea. 2nd Ed., 1993, reprinted 1996. Vol. 1. Psilotaceae to Platanaceae. Cambridge University Press xlvi, 581 pp., illus. ISBN 0-521-41007-X (HB). Pp. 372-377.