



Influence of Seed Treatment with Potassium Nitrate and Thiourea on Germination and Seedling Vigour of Teak (*Tectona grandis* Linn. f)

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Studies were conducted to find out the influence of presowing treatments on germination and seedling vigour of 9 month-old teak drupes (fruit with seed). The presowing treatments included were soaking in water followed by drying (S-D) for 6 days at 12 hr interval, S-D for 5 days at 12 hr interval and 6th day soaking in ten different concentrations of potassium nitrate and thio urea (0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0%) solution separately for 12 hr with dry drupes as control. The results revealed that soaking and drying of drupes for 5 days at an interval of 12hr followed by soaking in 1% KNO₃ or 2% thiourea gave 40% and 36% germination (23% over control) respectively. In addition to enhanced germination, in treated drupes, early emergence (12days) with more number of seedling/100 drupes and better seedling vigour were observed.

Key words: *Tectona grandis*, potassium nitrate, thiourea, S-D treatment, seedling vigour

Teak (*Tectona grandis* Linn. f) is a seed propagated timber species. Large scale cultivation is limited by poor germination (Dharmalingam, 1995) attributed to various factors such as hard endocarp (Gupta and Pattanath 1975), germination inhibitors present in the felt like mesocarp (Masilamani *et al.* 1998), emptiness of fruit (Dharmalingam and Masilamani, 1997), after ripening (Gupta and Adarshkumar, 1976), agro-ecological condition (Masilamani *et al.* 1997), fertility of the site and genetic quality of seed (Tewari, 1992). In spite of these, germination improvement still has unsolved problems. To overcome the hurdles, studies were conducted to find out the influence of presowing treatment on germination and seedling vigour of teak.

Materials and Methods

Teak drupes were collected from Top Slip, Anaimalai seed production areas (74° 34' E longitude, 15° 07' latitude 750 MSL) of Tamil Nadu, India. Nine month old teak drupes (Stored in 28° C in gunny bags) were subjected to pre-sowing treatment *viz.*, soaking in water followed by drying (S-D) for 6 days at 12 hr interval, S-D for 5 days at 12 hr interval and 6th day soaking in ten different concentrations of potassium nitrate and thio urea (0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0% concentrations) solutions separately for 12hr with dry drupes serving as control. The pre-conditioned and control drupes were placed for germination in sand filled earthen pots (30cm height and 30cm

upper dia) and kept in open sunlight (30°C and 63% RH) for 28 days. The experiment was conducted in a Factorial Completely Randomized design (FCRD) and ten replications of 30 drupes each were used in both the treatment. A germination period of 28 days was followed (ISTA 1993). The normal seedling produced by a single drupe was counted as one and germination percentage was computed. The total number of seedlings produced by 30 drupes were also counted and the mean value expressed as 100-1. The vigour index was derived from the formula of Abdul Baki and Anderson (1973).

$$\text{Vigour index} = \frac{\text{Germination \%} \times \text{Seedling length (cm)}}{\text{Seedling length (cm)}}$$

The results was subjected to analysis of variance and tested (t-tested) for significant difference ($p=0.05$) as suggested by Panse and Sukhatme (1967). Percentage values were transformed into arcsine values prior to statistical analysis. The mean values of the experiment were compared using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

The results revealed that the drupes treated with KNO₃ or thiourea improved the germination. S-D followed by soaking in 1% KNO₃ gave 40% germination followed by 1.5% KNO₃ (39%) treatment. Regarding thiourea treatment, S-D followed by soaking in 2% thiourea gave 36% germination against 23% in control. Results on total number of

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seedlings produced by 100 drupes reflected the same trend of germination in both KNO_3 and thiourea soaking treatments. In drupes soaked with KNO_3 or thiourea, seedling emergence took place within 12-15 days against 18 days in control. The higher vigour index values of 847 and 562 were recorded in drupes soaked in KNO_3 (1%) and thiourea (2%) respectively (Table 1 & 2).

Nine month-old teak drupes subjected to soaking treatment with KNO_3 or thiourea solution exhibited higher percentage of germination and seedling vigour. Perusal of literature did not show any work involving KNO_3 or thiourea as presowing treatment in teak drupes. In the recent past, various hypotheses have been proposed to account for the

Table 1. Effect of KNO_3 soaking on germination and seedling growth attributes of teak

Treatments	Germination (%)	Seedling/100 drupes	Days taken for seedling emergence	Vigour Index
T ₀ - Control	23 (28.66) b	30 a	18 c	268 c
T ₁ - S-D for 6 days	31 (33.63) ab	41 ab	13 ab	565 b
T ₂ - S-D for 5 days + Soaking in 0.5% KNO_3 12 hours.	36 (36.87) a	43 ab	13 ab	716 ab
T ₃ - S-D for 5 days + Soaking in 1% KNO_3 12 hours.	40 (39.23) a	50 a	12 a	847 a
T ₄ - S-D for 5 days + Soaking in 1.5% KNO_3 12 hours.	39 (38.65) a	47 a	13 b	761 ab
T ₅ - S-D for 5 days + Soaking in 2% KNO_3 12 hours.	39 (38.65) a	44 ab	13 ab	735 ab
T ₆ - S-D for 5 days + Soaking in 2.5% KNO_3 12 hours.	37 (37.46) a	43 ab	14 b	687 ab
T ₇ - S-D for 5 days + Soaking in 3% KNO_3 12 hours.	40 (39.23) a	43 ab	13 ab	767 ab
T ₈ - S-D for 5 days + Soaking in 3.5% KNO_3 12 hours.	39 (38.65) a	44 ab	14 b	740 ab
T ₉ - S-D for 5 days + Soaking in 4% KNO_3 12 hours.	38 (38.06) a	43 ab	13 ab	739 ab
T ₁₀ - S-D for 5 days + Soaking in 4.5% KNO_3 12 hours.	39 (38.65) a	44 ab	14 b	703 ab
T ₁₁ - S-D for 5 days + Soaking in 5% KNO_3 12 hours.	38 (38.06) a	48 a	14 b	672 ab
Mean	36 (36.87)	43.5	14	683
SEd	0.207	0.272	0.402	3.021
CD (P=0.05%)	0.43	0.56	0.83	6.24

Means followed by same letter in column are not significantly different by DMRT. (Figures in parentheses indicate Arcsine percentage values)

action of nitrate in seed germination. These include action of Pentose Phosphate Pathway (Roberts and Smith, 1977), stimulation of oxygen uptake (Hilton and Thomas, 1986) and action as a co-factor of phytochrome (Hilhorst and Karssen, 1988). Increased germination following treatment with potas nitrate has been reported in Loblolly pine and Bald cypress (Biswas *et al.*, 1972), *Peltophorum ferugenum* (Muthopodhyay *et al.*, 1990), Silky oak

(Masilamani and Dharmalingam, 1995) and *Acacia nilotica* (Palani *et al.*, 1995). Enhanced germination and seedling vigour in thiourea soaking had perhaps replaced the light and temperature requirements for the physiological process occurring naturally during after-ripening (Copeland, 1988). The findings of Roy (1992) in *Albizia lebbek* and Villiers and Wareing (1960) in *Fraxinus excelsior* also lend support to this contention. These studies

Table 2. Effect of thiourea pre soaking on germination and seedling growth attributes of teak

Treatments	Germination (%)	Seedling/100 drupes	Days taken for seedling emergence	Vigour Index
T ₀ - Control	23 (28.66) f	29 i	18 d	318 de
T ₁ - S-D for 6 days	24 (29.33) e	31 g	15 bc	329 cd
T ₂ - S-D for 5 days + Soaking in 0.5% Thiourea 12 hours.	26 (30.66) d	30 h	14 b	387 bc
T ₃ - S-D for 5 days + Soaking in 1% Thiourea 12 hours.	29 (32.58) c	37 c	13 ab	388 bc
T ₄ - S-D for 5 days + Soaking in 1.5% Thiourea 12 hours.	26 (30.66) d	30 h	14 b	348 cd
T ₅ - S-D for 5 days + Soaking in 2% Thiourea 12 hours.	36 (36.87) a	40 b	12 a	562 a
T ₆ - S-D for 5 days + Soaking in 2.5% Thiourea 12 hours.	32 (34.45) b	47 a	13 ab	432 bc
T ₇ - S-D for 5 days + Soaking in 3% Thiourea 12 hours.	29 (32.58) c	37 c	14 b	435 bc
T ₈ - S-D for 5 days + Soaking in 3.5% Thiourea 12 hours.	33 (35.06) b	33 f	15 bc	435 bc
T ₉ - S-D for 5 days + Soaking in 4% Thiourea 12 hours.	33 (35.06) b	37 c	15 bc	475 ab
T ₁₀ - S-D for 5 days + Soaking in 4.5% Thiourea 12 hours.	24 (29.33) e	35 d	14 b	346 cd
T ₁₁ - S-D for 5 days + Soaking in 5% Thiourea 12 hours.	26 (30.66) d	34 e	14 b	372 ab
Mean	28 (31.95)	35	14	402
SEd	0.797	0.303	0.340	25.107
CD P=0.05%	1.65	0.63	0.71	52.07

Means followed by same letter in column are not significantly different by DMRT. (Figures in parentheses indicate Arcsine percentage values)

confirmed the utility of pre soaking treatment such as KNO_3 or thiourea for getting early and maximum germination with more number of seedling /100 drupes and better seedling vigour.

Acknowledgment

The senior author is thankful to Sterling Tree Magnum (India) Limited, Chennai for their financial assistance in the form of Ph.D fellowship in Seed Science & Technology.

References

- Abdul-Baki, A.A. and Anderson. 1973. Vigour determination in Soybean seed by multiple criteria. *Crop Sci.*, **13**: 630-633.
- Biswas, P.K, Bonamy, P.A. and Paul, K.B. 1972. Germination promotion of Loblolly pine and Bald cypress seeds by stratification and chemical treatments. *Physiol. Plant.*, **27**: 71-76.
- Copeland, L.O. 1988. Principles of seed science and technology. Burgess publishing company. Minneapolis. 368 pp.
- Dharmalingam, C. 1995. Certain new approaches in bringing out the germination problems of teak (*Tectona grandis* Linn. f) seeds. Paper presented during seed technology workshop. July, 19-22 1995. Institute of Forest Genetics and Tree Breeding, Combatore, Tamil Nadu, India.
- Dharmalingam, C. and Masilamani, P. 1997. Radiography technique for testing the quality of teak (*Tectona grandis* Linn. f) seed. *Bangladesh J. For. Sci.*, **26**: 51-55.
- Gomez, K.A. and Gomez, A.A. 1984. In "Statistical procedure for Agricultural Research. A wiley inter Science publication, John wiley sons. New York. 680 pp.
- Gupta, B.N. and Pattanath, P.G. 1975. Factors effecting germination behaviour of teak seeds of eighteen Indian orgings, *Indian For.*, **101**: 584-588.
- Gupta, B.N. and Adarshkumar. 1976. Estimation of potential germinability of teak (*Tectona grandis* Linn. F) fruits from 23 Indian sources by cutting test. *Indian For.*, **102**: 808-813.
- Hilhorst, H.W.M. and Karssen, C.M. 1988. Duel effect of light on the gibberellin and nitrate stimulated seed germination of *Sisymbrium officinale* and *Arabidopsis thaliana*, *Plant. Physiol.*, **86**: 591-597.
- Hilton, J.R. and Thomas, J.A. 1986. Regulation of pre germinative rates of respiration in seeds of various species by potassium nitrate. *J. Exp. Botany* **37**: 1516-1524.
- International Seed Testing Association. 1993. International rules for seed testing, *Seed Sci. Technol.*, **21**: 177.
- Masilamani, P. and Dharmalingam, C. 1995. Enhancing germination of silky oak (*Grevillea robusta*. A. Cunn) through pre soaking treatment, *Tree Breeding and Propagation News*. **4**: 6.
- Masilamani, P., Dharmalingam, C. and Gurudevsiingh, B. 1997. An innovative method for early and enhanced germination of Teak (*Tectona grandis* Linn. f) drupes. In Proc., Symposium on Innovations in forest tree seed science and nursery technology, Rajpur, India, 1997. International Union of Forest Research Organisation, 1997, p.177.
- Masilamani, P., Dharmalingam, C. and Annadurai, K. 1998. Allelopathic effect of teak drupe extract on crop seeds: In proc III Int. Cong. Allelopathy in Ecological Agriculture and Forestry, Dharwad, India. p.94.
- Mukhopadhyay, T.P., Bhattacharjee, S.K. and Biswas, B. 1990. Effect of GA_3 and other chemicals on germination and viability of *Peltophorum ferrugineum* Seeds, *My For.*, **26**: 148-152.
- Palani, M., Dasthagir, M.G. and Kumaran, K. 1995. Effect of Presowing Chemical treatment on germination and seedling growth in *Acacia nilotica*, *Intl. Tree Crop J.* **8**: 189-192.
- Panase, V.G. and Sukhatme, R.V. 1967. Statistical methods for Agricultural workers, Indian Council of Agricultural Research publications. 175 pp.
- Roberts, E.H. and Smith, R.D. 1977. Dormancy and the pentose phosphate pathway. In: The Physiology and Biochemistry of Seed Dormancy and Germination (Khan, A.a. ed) Elsevier Biomedical Press. Amsberdam. p.385-411.
- Roy, M.M. 1992. Effect of seed treatment with Potassium nitrate and thiourea on germination of *Albizia lebbeck* (L.). BENTH, *Indian For.*, **105**: 356-357.
- Tewari, D.N. 1992. A monograph on teak (*Tectona grandis* Linn. F). International Book Distributors, Dehra Dun. India. p.479.
- Villiers, T.A. and wareing, P.F. 1960. Interaction of growth inhibitor and a natural germination stimulator in the dormancy of *Fraxinus excelsior* *Nature*. **185**: 112-14.