



## RESEARCH PAPER

# Influence of seed fortification treatment with leaf extract on seedling production in bael tree (*Aegle marmelos* L.)

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**Abstract :** In cultivation of medicinal trees, seed germination is a very important problem. Various seed enhancements are being adopted nowadays to improve seedling emergence. Among these seed enhancement, seed fortification is an efficient method for increasing of seed vigour and improvement of germination and seedling growth. The laboratory experiment was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. The present study was conducted for evaluation of ecofriendly seed treatment with three botanical fresh leaf extracts in two concentrations with the soaking durations of 3 and 6h in Bael (*Aegle marmelos*). The results revealed that soaking of seeds in one per cent moringa (*Moringa oleifera*) leaf extract for 6h adopting 1:1 seed to solution ratio enhanced the seedling quality characters of bael in germination room and it was followed by 0.5 per cent tamarind (*Tamarindus indica*) leaf extract. On evaluation of these treatments at polypot nursery upto three months also exposed the efficacy of these treatments in production elite seedlings.

**Key Words :** Seed germination, Seed vigour, Ecofriendly, *Moringa oleifera*

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## INTRODUCTION

Organic nutrients are the other alternatives to growth regulators and inorganic nutrients as they are cost effective and the lethality rate will be lesser at supra optimal conditions. Beneficial influence of botanicals in seed invigouration was reported by several authors (Suma, 2003; Albert *et al.*, 2006; Jagathambal, 1996 and Krishnasamy *et al.*, 2005) who claimed its influence in enhancing the productivity of crops.

The foundation for revitalization of local health traditions (FRLHT), Bangalore, India listed bael (*Aegle*

*marmelos*) as RET (Rare, Endangered and Threatened) species specifically endangered species. Hence, more importance is being given for mass multiplication through afforestation. The tree is normally propagated through seeds (Nayak and Sen, 1999) and seed requires specific quality characters for its better performance. It is mainly raised as seedling and transplanted to the main field. Bael is utilized in cosmetic and pharmaceutical industry to treat neural, broncheal, gastro intestinal, cardiac and uro disorders. Bael fruit juice is also popularized as health drink in aurvedic medicines. The crop is propagated through seeds and asexually through grafting where

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seeds are used for raising the stock seedlings. Hence, for identification of an ecofriendly seed treatment for Bael seedling production and conservation, the study has been initiated.

## MATERIAL AND METHODS

The fruits were collected as fresh from Ramnagar seed source of Coimbatore district (76°57 E, 11°8 N and 320 MSL) and the seeds were extracted as wet extraction and were dried under shade for a week to reduce the moisture content to ten per cent. The fresh leaves were collected from trees of moringa (*Moringa oleifera*), pungam (*Pongamia pinnata*) and tamarind (*Tamarindus indica*) with good growth and macerated with distilled water @ 500 milligram per 100 milliliters and 1gram per 100 milliliters to obtain 0.5 and one per cent solution, respectively. The bael seeds were soaked in these solutions (0.5 % and 1%) botanical leaf extracts viz., moringa, pungam and tamarind along with water adopting the seed to solution ratio of 1:1 in two different soaking durations viz., 3 and 6h. Then the seeds were dried back to their original moisture content of 10 per cent. The treated seeds along with control were sown as 100 seeds of 4 replicates in sand media prepared as per ISTA (Anonymous, 1985) and were kept in a germination room maintained at 25±2°C and 95±1 per cent RH. During the process of germination, the seeds were observed for days to first germination and based on the observations on daily germination the speed of emergence was calculated (Maguire,1962). After 23 days of germination period they were evaluated for germination based on normal seedling and the results were reported in percentage. Ten randomly selected

normal seedlings were measured for the vigour parameters viz., root length (cm), shoot length (cm) and for dry matter production (g). To have the totality expressions of seed quality characters, vigour index values were computed adopting the formula, Vigour index = Germination (%) × Total seedling length (cm) (Abdul-Baki and Anderson, 1973).

The seed fortification treatments scored in first two places (moringa and tamarind) were evaluated for the seedling quality characters in polypot nursery raised with polybags of size 25 × 15 cm filled with soil: sand: farm yard manure mixed in 2:1:1 ratio in four replicates of 25 seeds /bags along with control and water soaked (hydro-fortified) seeds. At nursery, the observations were on seedling emergence cum survival (%), root length (the length between the collar region and the tip of primary root in centimeter, shoot length (the length between the collar region and the tip of primary shoot) number of leaves and drymatter production (ten normal seedlings were dried at first in shade and then dried in a hot air oven maintained at 105 ± 2°C for 17 h, then cooled in desiccators, weighed in milligram 10 seedling<sup>-1</sup>) and vigour index values after three months of nursery period. The data gathered were statistically scrutinized (Panse and Sukhatme, 1967) under F test of significance for understanding the level of significance among the seed treatments for the evaluated seed and seedling quality characters.

## RESULTS AND DISCUSSION

The Bael seeds fortified with fresh botanical leaf extracts in different concentrations (0.5 % and 1%) for a duration of 3 and 6h expressed highly significant results

**Table 1 : Influence of seed fortification treatment with leaf extracts on days to first germination and germination percentage of bael**

Leaf extracts	Concentration (%) and soaking duration in hours													
	0.5 %			1 %			0.5 %			1 %				
	3	6	Mean	3	6	Mean	3	6	Mean	3	6	Mean		
Days to first germination						Germination %								
Control	16	16	16	16	16	16	58 (49.604)	58 (49.604)	58 (49.604)	58 (49.604)	58 (49.604)	58 (49.604)		
Water	16	15	16	16	15	16	60 (50.769)	64 (53.131)	62 (51.944)	60 (50.769)	64 (53.131)	62 (51.944)		
Moringa	14	15	15	15	13	14	72 (58.053)	74 (59.344)	73 (58.695)	74 (59.344)	88 (69.734)	81 (64.159)		
Pungam	15	15	15	16	16	16	68 (55.551)	70 (56.790)	69 (56.168)	66 (54.333)	70 (56.790)	68 (55.551)		
Tamarind	15	15	15	15	16	16	70 (56.790)	78 (62.029)	74 (59.344)	68 (55.551)	76 (60.667)	72 (58.053)		
Mean	15	15	15	16	15	16	66 (54.333)	69 (56.168)	67 (54.940)	65 (53.730)	71 (57.418)	68 (55.551)		
	T	C	D	T×C	C×D	T×D	T×C×D	T	C	D	T×C	C×D	T×D	T×C×D
S.E. ±	0.540	0.342	0.342	0.764	0.483	0.764	1.081	0.540	0.342	0.342	0.764	0.483	0.764	1.081
C.D. (P=0.05)	1.076	NS	NS	NS	NS	NS	2.152	1.076	0.680	0.680	1.522	0.962	1.522	2.152

NS=Non-significant

among the fortification treatments (Table 1, 2 and 3). Among the treatments, based on the evaluated seedling quality characters (germination and vigour), the hike due to 1 per cent leaf extract of *Moringa* for 6 h was the highest, which exerted a hike in seed and seedling quality characters to a tune of 19, 30, 54, 66, 38 and 141 per

cent compared with control, respectively for days to first germination, germination per cent, root length, shoot length, dry matter production and vigour index. The performances of other treatments vary widely with the leaf extracts and their concentrations. The invigourative influence of the botanics on germination and vigour index

**Table 2 : Influence of seed fortification treatment with leaf extracts on root length and shoot length of bael**

Leaf extracts	Concentration (%) and soaking duration in hours													
	0.5 %			1 %			0.5 %			1 %				
	3	6	Mean	3	6	Mean	3	6	Mean	3	6	Mean		
	Root length (cm)						Shoot length (cm)							
Control	7.8	7.8	7.8	7.8	7.8	7.8	5.9	5.9	5.9	5.9	5.9	5.9		
Water	8.1	8.4	8.3	8.1	8.4	8.3	6.3	6.8	6.6	6.5	7.0	6.8		
Moringa	10.2	10.5	10.4	9.7	12.0	10.9	7.6	8.2	7.9	8.0	9.8	8.9		
Pungam	9.0	8.6	8.8	9.4	8.7	9.1	7.9	8.1	8.0	7.0	7.2	7.1		
Tamarind	9.9	10.1	10.0	9.8	9.7	9.8	7.4	8.3	7.9	7.8	7.4	7.6		
Mean	9.0	9.1	9.1	9.0	9.3	9.2	7.2	7.5	7.3	7.0	7.5	7.3		
	T	C	D	T×C	C×D	T×D	T×C×D	T	C	D	T×C	C×D	T×D	T×C×D
S.E. ±	0.618	0.391	0.391	0.875	0.553	0.875	1.237	0.539	0.340	0.340	0.762	0.482	0.762	1.078
C.D. (P=0.05)	1.231	NS	NS	NS	NS	NS	NS	1.072	NS	NS	NS	NS	NS	NS

NS=Non-significant

**Table 3 : Influence of seed fortification treatment with leaf extracts on dry matter production and vigour index of bael**

Leaf extracts	Dry matter production (mg seedlings <sup>10</sup> )						Vigour index							
	0.5 %			1 %			0.5 %			1 %				
	3	6	Mean	3	6	Mean	3	6	Mean	3	6	Mean		
Control	220	220	220	220	220	220	795	795	795	795	795	795		
Water	225	231	228	225	231	228	864	973	919	876	986	931		
Moringa	293	286	290	257	304	281	1282	1384	1333	1310	1918	1614		
Pungam	280	294	287	281	236	259	1149	1169	1159	1082	1113	1098		
Tamarind	270	278	274	275	240	259	1274	1365	1320	1197	1300	1249		
Mean	258	262	260	252	246	249	1073	1137	1105	1052	1222	1137		
	T	C	D	T×C	C×D	T×D	T×C×D	T	C	D	T×C	C×D	T×D	T×C×D
S.E. ±	0.620	0.392	0.392	0.877	0.554	0.877	1.240	0.574	0.363	0.363	0.812	0.513	0.812	1.148
C.D. (P=0.05)	1.234	0.780	0.780	1.746	1.104	1.746	2.469	1.143	0.723	0.723	1.616	1.022	1.616	2.286

**Table 4 : Invigourative influence of the botanics on germination and vigour index as per cent increase**

Leaf extracts	Germination (%)						Vigour index					
	0.5 %			1 %			0.5 %			1 %		
Soaking durations in hours												
	3	6	Mean	3	6	Mean	3	6	Mean	3	6	mean
Per cent hike in treatments compared to control												
Moringa	14	16	15	16	30	23	61	74	68	65	141	103
Pungam	10	12	11	8	12	10	45	47	46	36	40	38
Tamarind	12	20	16	10	18	14	60	72	66	51	64	58
Per cent hike in treatments compared to water soaking												
Moringa	12	10	11	14	24	19	48	42	45	50	95	72
Pungam	8	6	7	6	6	6	33	20	27	24	13	18
Tamarind	10	14	12	8	12	10	47	40	44	37	32	34

**Table 5 : Better performance of moringa, tamarind and pungam leaf extract**

Leaf extract	Probable causes for seed invigouraion	Authour
Moringa ( <i>Moringa oleifera</i> )	Presence of cytokinin, amino acids, ascorbate, zeatin and minerals, that have triggers the germination process earlier.	Wasif <i>et al.</i> (2012)
Tamarind <i>Tamarindus indica</i> )	Rich in vitamin C and beta-carotene and the mineral content viz., potassium, phosphorous, calcium and magnesium, tartaric acid and maleic acid	Sumathi and Srimathi (2009)
Pungam ( <i>Pongamia pinnata</i> )	Rich in saponin, tannins, flavonoids glycosides and phenolic compounds	Sathish <i>et al.</i> (2007)

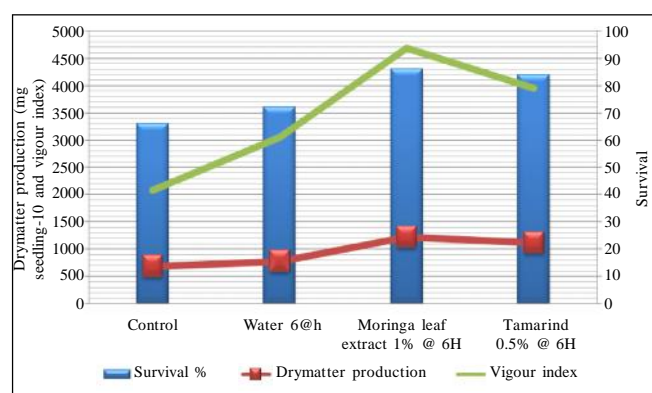
**Table 6 : Percentage increase in seedling quality characters of selected treatments compared to control at nursery after three months of nursery period**

Leaf extract	Root length	Shoot length	Drymatter production	Number of leaves	Vigour index
1 % Moringa	165	53	63	33	149
0.5 % Tamarind	138	20	62	17	104

as per cent increase over compared to water soaking and control as shown in Table 1.

Based on their positive influence on invigourative effect both on germination per cent and seedling vigour, the influence was in the order of soaking in 1per cent moringa leaf extract for 6h , 0.5 per cent tamarind leaf extract for 6h and 1 per cent pungam leaf extract for 3h for production of quality seedlings in Bael. The improvement in seed quality characters as expressed by the seeds fortified with leaf extract was opined to be due to the micro-nutrients and chlorophyll content present in the leaf extracts that have activated the enzymes responsible for germination and enforces an invigourative effect on seedling quality characters (Natarajan, 2003) working with various leaf extracts in petunia. The growth-promoting potential and thereby invigorating the seed for better performance of moringa, tamarind and pungam leaf extract were expressed by researchers as below :

At nursery, also the performance (Fig. 1) was similar with these leaf extracts as below highlighting the causes



**Fig. 1 :** Influence of seed fortification treatment with leaf extracts on seed and seedling quality characteristics of bael after three months in nursery

for invigouration as detailed elsewhere.

### Conclusion :

Thus, the study expressed that seed fortification with 1 per cent leaf extract of moringa for 6h adopting the seed to solution ratio of 1:1 enhanced the seed and seedling quality characters of bael and improved the sowing quality of seed at nursery. These invigouration agents are not only organic but also are inexpensive, easily adapted, and environmentally friendly. In order to develop strategies for conservation of this endangered tree, a sound cultivation and in depth approach is required to assess distribution patterns, regeneration status and uses by the indigenous society.

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