



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 8, August 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)

# Effect of Potting Media and Pre-sowing Treatment on the Germination and Growth of *Oroxylum indicum* (Tsampaka)

Sangay Dorjee<sup>1</sup>, Sangay Khandu<sup>1</sup>, Dorji Lhamo<sup>1</sup>, Karma Wangmo<sup>1</sup>, Januka Ghalley<sup>1</sup>, Tshering Samdrup<sup>2</sup>

Gyalsung Infra; His Majesty's Secretariat, Gyalsung Academy, Pemathang, Samdrup Jongkhar, Bhutan<sup>1</sup>

Department of Forests and Park Services, Samdrup Jongkhar, Bhutan<sup>2</sup>

**ABSTRACT:** The research aimed at investigating the germination response of *Oroxylum indicum* seeds, a valuable medicinal plant. *Oroxylum indicum* (Tsampaka) in Bhutan has been traditionally used for centuries as an important religious offering. Various methods of pre-treatment and growth mediums were examined to determine their impact on seed germination. Results revealed that soaking seeds in cold water for 6 and 12 hours led to higher rates of germination and better seedling growth. Among the growth mediums tested, 100% leaf mold showed the most favorable conditions for nurturing seedlings. Conversely, treatments involving hot water and the removal of seed wings proved ineffective. The study underscores the importance of pre-treatment strategies and growth mediums in influencing successful seed germination and robust seedling development. This research recommends cold water pre-treatments alongside 100% leaf mold as an ideal approach for enhancing *Oroxylum indicum* seed germination, with implications for sustainable propagation and potential economic advantages.

**KEYWORDS:** *Oroxylum indicum*, Growth, media, Seed treatment.

## I. INTRODUCTION

*Oroxylum indicum* (L.) Kurz, locally known as *Tsampaka* (Dz.), or *Totola* in Lotshamkha, is an important Asian traditional medicinal plant. It is a medium-sized tree belonging to the class Dicotyledon, sub-class Sympetaleae, order Tubiflorae, and family Bignoniaceae. It is found throughout Southeast and South Asian countries (Pandey *et al.*, 2018). It is native to the Indian sub-continent, in the Himalayan foothills, and extends into Southern China, Indo-China, and the Malaysia ecozone (Theobald, 1981). In India, it is found in the Himalayan foothills and Eastern and Western Ghats, and it is cultivated throughout India in forest areas it grows wild in Bangladesh in Chittagong, as well as other Hill Tracts districts (Sasidharan, 2004). It is found in Fujian, Guangdong, Guangxi, Guizhou, Sichuan, Taiwan, Yunan, Myanmar, Vietnam, Laos, Thailand, Cambodia, Malaysia, Philippines, Indonesia (Java, Sumatra), Nepal, Bhutan, Bangladesh, Pakistan, Sri Lanka (Dinda *et al.*, 2015)

It is called “Syonakh” or “Trumpet tree” in India, due to the resemblance of its flowers to the trumpet (Chopra *et al.*, 1992). In Sri Lanka, it is called ‘Thotila’, and in Malaysia, it is called “Midnight Horror” because the flowers open at night, emitting a powerful stink that attracts bats to facilitate pollination (Pandey *et al.*, 2018).

It is estimated that about 8 percent of the scientifically known plant species on the earth are presently on the brink of extinction (Chapin *et al.*, 2000). This situation has caused concern not only for the loss of species diversity but also for the availability of raw materials for their use in various medicines. Medicinal plants play a vital role in traditional healthcare the world over (Kala, 2000). It is estimated that about 80 percent of the world population residing in the vast rural areas of developing and underdeveloped countries still rely mainly on medicinal plants (WHO, 2002).

In Bhutan, it is found narrowly growing in the terai of the southern foothills and in the open subtropical forests at an elevation ranging from 150–900 m.a.s.l. Due to the non-sustainable collection, overexploitation, and low regeneration in its natural habitat, countable numbers of trees are seen in the wild, and only a few trees are found cultivated on the fringes of farmlands by the people for their use.

Bhutan being a Buddhist country, the plant has been traditionally used for centuries as an important religious decoration and offering. It is an herbal medicine in many Asian countries to cure various diseases. The root and stem

bark are used for fever, bronchitis, intestinal worms, leucoderma, asthma, inflammation, anal troubles, diarrhea, and dysentery (Pandey *et al.*, 2018). The fruits and seeds are used as an expectorant, purgative, and bitter tonic. In Indian Ayurveda medicine, the root bark, stem, and leaf are prescribed for snake bites, diarrhea, and dysentery (Kishor and Ram, 2019). In Traditional Chinese medicine, the seeds of the plant, which are named Mu Hu Die in Chinese, have been widely used for the treatment of cough, bronchitis, pharyngitis, pertussis, and other respiratory disorders (Dinda *et al.*, 2015).

The extremely diverse range of recorded traditional uses, wide geographical distribution in different Southeast and South Asian countries, and promising phytochemical profile and pharmacological studies of the plant have created an opportunity for greater development of the medicinal properties of the plant at both local and international levels. Hence, a critical review of this plant is needed (Pandey *et al.*, 2018).

Destructive and non-sustainable collection methods coupled with low regeneration and habitat destruction have posed serious threats to the survival and availability of *O. indicum*. This important medicinal plant has become vulnerable in different states of India (Pandey *et al.*, 2018). Hence, this species needs domestication, commercialization, and conservation in its natural habitats as well as ex-situ habitats.

In the present study, to obtain rapid, uniform, and high seed germination response of *O. indicum*, different pre-sowing treatments were performed.

Specifically, we have examined the pre-treatment (effect of temperature) with hot and cold water and winged and de-winged on *Oroxylum* seed germination response under different soil mediums, and established a suitable method to overcome its low and erratic germination rate.

## II. METHODOLOGY

Five different media types were applied to examine the impact of media on the germination and growth of seedlings. (i) Leafmold: Sand: Cocopeat (M1) with the ratio of 2:1:1 (ii) Leafmold: Cocopeat (M2) at the ratio of 1:1 (iii) 100% leaf-mold (M3), 100% Sand (M4), and 100% Cocopeat (M5).

Matured and healthy fruits of *Oroxylum indicum* were collected locally from the mother plant growing in the forests and on the fringes of farmland in Pemathang (26°52'47.38"N, 91°43'22.78"E) and Samrang (26°53'17.83"N 91°49'50.07"E) under Samdrup Choling Dungkhag, and brought to the Gyalsung Academy Nursery site in Pemathang (26°54' N, 91°48' E) at 361 m.a.s.l. Good pods were selected and kept at room temperature for two weeks. Good and viable seeds were then taken out from the pods and stored at room temperature until use.

Different pre-sowing treatments were performed to evaluate the germination response of seeds using different soil media. The selected seeds were treated by soaking in cold water (soaking in water for 6 hours (T1)), 12 hours (T2), and 24 hours (T3). Similarly, seeds were treated by soaking in hot water (soaking in boiling water for 30 seconds (T4)), 60 seconds (T5), 90 seconds (T6), and 120 seconds (T7). Seeds sown with wings were treated as (control) and de-winged (without the wings), removing the feathery cover (T8). Those pre-treated seeds were then sown in seedling trays (150 cc) and placed in the poly house for experimentation.

### **Germination Percentage (GP)**

Germination percentage represents the proportion of seeds that successfully germinated out of the total seeds planted for each treatment and media combination. GP was calculated as recommended by Pandey *et al.*, (2018);  $GP = (n/N \times 100)$ , where  $n$  = the total number of seeds germinated at the end of the experiment and  $N$  = the total number of seeds used for the germination test. The seed germination started seven days after sowing.

### **Seedling Vigor Index (SVI)**

As recommended by Pandey *et al.*, (2018), Seedling Vigor Index was calculated as;  $SVI = GP \times SL$ . Where GP = germination percent and SL = length of seedling at the end of the experiment.

### **Statistical Analysis**

Experiments were performed in a Randomized Complete Block Design (RCBD) to determine the effect of treatments and sowing conditions. Each treatment contained 100 seeds sown in five different mediums. A total of 9 treatments with 5 media for seed germination test were done and the data was recorded for 30 days. The data gathered through this experiment were then analyzed using SPSS version 20 and Microsoft Excel 2016.

### III. EXPERIMENTAL RESULTS

The research result revealed that Cold Water pre-treatments for "6 hours" and "Cold water 12 hours," has higher average seedling lengths (13.2 cm and 13.7 cm) and higher germination percentages (69.6% and 70.4%). Consequently, the Seedling Vigor Indices for these treatments are also notably higher, with values of 921.36 and 961.10 (Table 1), respectively.

#### 1. Effects of different pre-treatments on seed germination and seedling vigor

Table 1: Effect of the different types of pre-treatment on seed germination and seedling vigor

Treatment	Average seedling Length (cm)	Mean Germination %	Mean S.VI
Cold water for 6 hours	13.2	69.6	<b>921.36</b>
Cold water for 12 hours	13.7	<b>70.4</b>	<b>961.10</b>
Cold water 24 hours	13.4	58.8	788.97
Hot water treatment (30 sec)	0.0	2	0
Hot water treatment (60 sec)	7.5	13.2	98.42
Hot water treatment (90 sec)	11.8	33.6	397.21
Hot water treatment (120 sec)	11.9	29.8	354.20
De-winged	12.1	58	699.94
Control	11.7	63.2	<b>741.33</b>

Similar studies carried out by Singh *et al.*, (2014), have found the cold water treatment for 24 hours as an effective pre-treatment. This could be due to the experiment's environmental factors such as moisture content, humidity, and temperature as this experiment was conducted in normal nursery conditions without temperature regulation and free of growth hormone.

On the other hand, the "Hot water treatment (30 sec)" and "Hot water treatment (60 sec)" led to minimal germination percentages (2% and 13.2%). Longer hot water exposures, such as "Hot water treatment (90 sec)" and "Hot water treatment (120 sec)," showed improved seedling lengths and higher germination percentages, with corresponding Seedling Vigor Indices of 397.21 and 354.20. However, this study found that Hot water treatment and removal of seed wing treatment (removal of *Oroxylum* seed wings) are not recommended pre-treatment for this species.

#### 2. Effects of various growth media on seedling vigor

Table 2: Effect of growth medium on seedling vigor

Media	Average Length (cm)	Mean Germination	SVI
M1=Leafmold: Sand: Cocopeat ( 2:1:1)	10.04	57	572.66
M2= Leafmold: Cocopeat ( 1:1)	9.53	53.8	512.97
M3=100% leaf-mold	12.10	55.5	<b>671.61</b>
M4=100% Sand	8.10	28.1	227.67
M5=100% Cocopeat.	6.62	26.8	177.59

Table (2) presents the effects of various growth media on seedling vigor, characterized by average seedling length, mean germination percentage, and Seedling Vigor Index (SVI). Among the media compositions, "M3=100% leaf mold" supported the highest seedling vigor, with robust growth (12.10 cm average length) and relatively higher germination (55.5%). "M1=Leafmold: Sand: Cocopeat (2:1:1)" and "M2=Leafmold: Cocopeat (1:1)" displayed moderate vigor levels, while media composed solely of sand or cocopeat ("M4" and "M5") yielded feebler seedlings



and lower germination rates. The results emphasize the pivotal role of the growing medium in influencing seedling vigor and provide insights for optimizing seedling growth for commercial plantations.

**3. Synergetic effect of Growth media and pre-sowing treatment on germination of *Oroxylum* seeds**

Table 3: Effect of pre-treatment and media on germination percentage

Treatment	Germination percentage under different media					Mean
	M1	M2	M3	M4	M5	
Cold water (6 hours)	88	81	<b>95</b>	43	41	<b>69.6</b>
Cold water (12 hours)	92	84	<b>95</b>	39	42	<b>70.4</b>
Cold water (24 hours)	73	83	64	41	33	58.8
Hot water (30 sec)	2	4	4	0	0	2
Hot water (60 sec)	11	34	17	2	2	13.2
Hot water (90 sec)	49	20	37	29	33	33.6
Hot water (120sec)	28	35	30	29	27	29.8
De-winged Seed	85	74	68	33	30	58
Control	85	70	90	37	34	<b>63.2</b>
Mean	57	53.8	55.5	28.1	26.8	

M1= Leafmold: Sand: Cocopeat (2:1:1), M2= Leafmold: Cocopeat (1:1), M3=100% leaf-mold, M4=100% Sand, M5=100% Cocopeat.

Table (3) shows different treatments and the corresponding germination percentages observed under different growing mediums (M1, M2, M3, M4, M5). Seeds sown in the M3 (100% leaf mold) with Cold water (6 hours) and Coldwater (12 hours) treatments generally resulted in higher germination with a germination percentage of 95 respectively and across most media conditions with averages of 69.6 and 70.4, respectively. Hot water (30 sec) and Hot water (60 sec) treatments had very low germination percentages across all media conditions, both averaging around 2 and 13.2, respectively. In the control treatment, the germination percent is 63.2. This indicates that pre-treatment of seed with hot water and de-winged are not effective treatments to induce germination in *Oroxylum indicum*.

Table 4: Analysis of Variance

Anova for different growth Media					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8506.356	4	2126.58	2.72	.04
Within Groups	31252.889	40	781.32		
Total	39759.244	44			

Further, (Table 4) an analysis of Variance (ANOVA) test is done to compare the number of seeds germinated in different mediums and treatments. It was observed that there is a significant difference in the germination of seedlings ( $F, 2.72$ )  $P=.04$  across media and treatments. The seed germination in the different growing mediums was compared using post hoc analysis and Leaf molds (M3) were the most effective in germination of seed treated with pre-treatment (T1, T2). So, this study recommends cold water treatment for 6 hours and 12 hours with the growth media of 100% leaf molds for the germination and propagation of *Oroxylum indicum* seeds.



Figure 1: a) Seeds taken out of the fresh pod, b) Seeds stored at room temperature for two weeks c) Seeds sown in different soil media and pre-sowing treatments along with the labels.

Since the leaf mold is found abundant and available on the forest floor, the study recommend leaf mold be used as a medium with pre-treated seeds in cold water for 6 hours and 12 hours. Potting media and treatments influenced the majority of seed germination, similar results were observed by Kishor and Ram (2019).

However, this study is carried out within a short period using small sample sizes, further, similar experiments are recommended to compare the performance of different soil mediums and pre-sowing treatment. The finding of the study was based on one season of seed collection from Samdrup Choling and Samrang villages (Fig.1), and it may not necessarily be generalized and applied to other locations.

The study also recommended further studies on the properties of soil media and its effect on germination.



Figure 2: a) *Oroxylum* seed collection b) Healthy Seeds after 24 days c) 36 days old sapling

#### IV. CONCLUSION

Overall, the study underscores the importance of pre-treatment strategies and growing medium in influencing seed germination and seedling vigor. "Cold water 6 hours" and "Cold water 12 hours" treatments revealed effective for enhancing germination and vigor. The significance of "M3=100% leaf mold" as a growth medium for promoting seedling vigor was highlighted.

Recommendations for successful germination of *Oroxylum indicum* include the use of pre-treatments of soaking seeds in "Cold water for 6 hours" and soaking in "Cold water for 12 hours" under 100% "M3=100% leaf mold media".

#### V. ACKNOWLEDGEMENTS

The authors of this paper deeply express our sincere gratitude to the Management Head of the Gyalsung Academy Pemathang, **Colonel Dasho Tharchen**, and the **Project Director** at Gyalsung Infra for their unwavering support and encouragement. We would also like to acknowledge the participants of this study for their willingness to participate and their valuable contributions.

#### REFERENCES

- (1) Chopra RN, Nayar SL, Chopra IC. "Glossary of Indian Medicinal Plants". New Delhi: CSIR;p. 182, 1992.
- (2) Chapin FS, Zaveleta ES, Eviner VT, Naylor RL, Vitousek PM and Lavorel S, "Consequences of changing biotic diversity", Nature 405(3): 234-242, 2000.



- (3) Dinda, B, SilSarma I, Dinda, M, Rudrapaul, P, Oroxyllum indicum (L.) Kurz, an important Asian traditional medicine: From traditional uses to scientific data for its commercial exploitation. Journal of Ethnopharmacology Volume 161, 255-278, <https://doi.org/10.1016/j.jep.2014.12.027>, 2015.
- (4) FAO, "World deforestation slows down as more forests are better managed", News Article. [www.fao.org/news/story/en/item/326911/icode/FAO](http://www.fao.org/news/story/en/item/326911/icode/FAO), 2015. (Accessed on 7.03.2022).
- (5) Kala CP, "Status and conservation of rare and endangered medicinal plant in the Indian Trans-Himalaya", Biological Conservation 93(3): 371-379, 2000.
- (6) Kishor, KS, and Ram, J, "Growth and Development of Seedlings in Relation to Container Size and Potting Media under Nursery conditions in Oroxyllum indicum-A Multipurpose Medicinal Plant", Indian Journal of Ecology 46(1): 143-148, 2019.
- (7) Pandey, A; Ngashangya, N, and Tamta, S, "Effect of GA<sub>3</sub> treatments and sowing conditions on ex-situ seed germination of Oroxyllum indicum (L) Benth. Ex Kurz: A threatened high-value medicinal plant",. Journal of Applied Biology & Biotechnology Vol. 6(3), pp. 9-14, DOI:10.7324/JABB.2018.60302, 2018.
- (8) Sasidharan N, "Biodiversity Documentation for Kerala-Flowering Plants", Peechi, Kerala, India: Forest Research Institute; Vol. 6. p. 321-4, 2004.
- (9) Singh M, Singh KK, Badola HK, "Effect of Temperature and Plant Growth Regulators on Seed Germination Response of Oroxyllum indicum-A High Value Threatened Medicinal Plant of Sikkim Himalaya", J Plant Sci Res. 2014;1(4): 115, 2014.
- (10) Theobald WL. Bignoniaceae. In: Dassanayake MD, Fosberg FR, editors. "A Revised Handbook to the Flora of Ceylon", New Delhi, India: Amerind Publishing Co., Pvt., Ltd., 1981.
- (11) World Health Organization (WHO), "WHO Traditional Medicine Strategy 2002-2005", World Health Organization, Geneva, 2002.





**INNO SPACE**  
SJIF Scientific Journal Impact Factor  
**Impact Factor: 8.423**



**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details