



Research Article

Exploring Novel Habitat for Critically Endangered *Aquilaria malaccensis* Lam. in Terai Region of Uttar Pradesh

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Abstract

Agarwood (*Aquilaria malaccensis* Lam.) is a highly prized fragrant resin-producing tree within the Thymelaeaceae family, renowned for its aromatic wood known as agar or oudh. With a market value of up to \$100,000 per kilogram, its natural habitat in Southeast Asia has faced significant depletion due to extensive extraction driven by demand. Although naturally occurring in South East Asian countries, its cultivation has extended to the home gardens of North Eastern states of India. Given its critical endangerment in the wild and confinement to specific regions, identifying suitable habitats for *ex-situ* conservation is imperative. The introduction of agarwood to the Terai region of Lakhimpur Kheri, Uttar Pradesh, India, characterized by a humid climate and high-water table, aims to address its economic importance and habitat loss concerns. This region, situated between 27.6° and 28.6° N longitude and 80.34° and 81.3° east latitude, with an elevation of 148 meters above sea level, experiences an average rainfall of 1275mm, concentrated mainly from June to September. Such efforts are crucial for the long-term survival of agarwood species under varying climate change scenarios, necessitating collaborative conservation measures by the scientific community and agroforestry managers.

Keywords: *Aquilaria malaccensis*, conservation, agroforestry, Terai, Uttar Pradesh.

1. Introduction

Agarwood (*Aquilaria malaccensis* Lam.) is one of 13 recognized fragrant resin producing trees of the Thymelaeaceae family. It is one of the most significant and prized tree species for its fragrant wood, which is also known as agar, oudh, etc¹. Depending on grade, agarwood may cost up to \$100,000 per kilogram². *Aquilaria malaccensis* possesses natural population in South East Asian countries. Large-scale extraction of *A. malaccensis* due to the high market price and demand for the resin has resulted in rapid decline in its native habitat³. The species is grown extensively in the home gardens of North Eastern states of India. As the species is naturally confined to the north eastern states and listed as critically endangered in wild therefore identification of suitable habitat for species is crucial for *ex-situ* conservation⁴. It will be helpful for scientific community and agroforestry managers to design suitable conservation measures along with adequate management activities for the long-term survival of the species of agar wood under different climate change scenarios.



Figure 1. *Aquilaria malaccensis* flowering branch

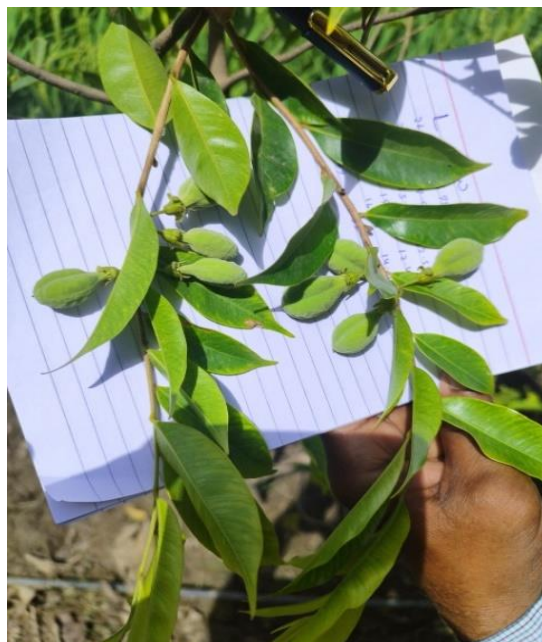


Figure 2. *Aquilaria malaccensis* fruiting branch



Figure 3. Single seeded fruits of *Aquilaria malaccensis*



Figure 4. Agar plant at Lakhimpur

Therefore, owing to its economic importance, swift disappearance of natural habitat, and increased demand, the species has been introduced in the Terai region of Lakhimpur kheri Uttar Pradesh, India which is located in the foothills of the Himalayas and is distinguished by a high-water table and humid climate (Figs. 1-4). Geographically, it lies between 27.6° and 28.6° N longitude and 80.34° and 81.3° east latitude in the middle plains, with an elevation of 148 m above mean sea level. The average rainfall of the region is 1275mm with erratic pattern of distribution, mostly concentrated in the month of June to September⁵.

Plantation trial of *Aquilaria malaccensis* was established of about 24-month-old seedlings (average height 0.78 m and average collar diameter 1.2 cm) procured from Rain Forest Research Institute, Assam. The soil composition of site was silty clay loam, having 7.51pH along with organic carbon 0.23%. Available NPK content was found to be 163.56, 25, and 240 kg/ha. Pits of uniform

dimension were dug with a spacing of 3 x3 m and filled with 1 kg of vermicompost along with treatment of termite. Plantation was done in the month of March 2022. During the summer drip irrigation facility was provided twice a week along with surface irrigation twice a month whereas during monsoon and winters irrigation was done as per the requirement. After a period of six months the survival percentage was 98% which was unchanged till date. After the establishment of plantation, growth parameters, viz., height (m), collar diameter (mm), number of primary branches and leaves were recorded at an interval of six months.

The average growth of height (m), collar diameter (mm), number of primary branches and leaves (Nos.) during a time frame of 18 months have been depicted in the Table.1. The average increment of height after 18 months of plantation was 0.73m whereas the average increment of collar diameter was 12.42 mm.

Table-1 Average growth of different parameters during 18 months

Age	Average height of plants (m.)	Average diameter of plants (mm.)	Average number of branches	Average number of leaves
At the time of plantation	0.78	12.31	3	132
After 6 months	1.20	15.17	5.54	165.18
After 12 months	1.32	20.35	9.26	321.79
After 18 months	1.51	24.73	12.64	385.2

2. Discussion

As per studies *Aquilaria malaccensis* is a fast-growing species during the early phase. At the age of 6 the mean annual increment of diameter and height is reported as 0.58 cm and 0.86 m, respectively. It is also reported that species can be cultivated under wide range of conditions having well drained soil⁶. Researchers have reported that Agar start flowering at the age of

3-4 years and flowering and fruiting occurs during the months of March-May and June-July respectively⁷. The same pattern of reproductive cycle was observed at the present trial. At the age of 3.5 years the flowering incidence was recorded in the month of March 2023. About 46% of plants were recorded under flowering. Further in the month of June

the fruiting was recorded in about 50% of the flowered plants.

A. malaccensis produces one and two-seeded fruits⁸. However, it was observed that fruits at the trial site were only single seeded. The average length, width and thickness of fruits were 26.92 mm, 16.28 mm and 12.82 mm, respectively. Reported average fruit length, width and thickness from Assam are 29.16 mm, 16.03 mm and 11.18 mm, respectively⁹.

3. Conclusion

Since *A. malaccensis* was initially brought to Uttar Pradesh, both academics and the general public have very little understanding of this species. It is anticipated that it will have the capacity to considerably increase farmers' and planters' incomes. A picture of the *A. malaccensis* plantation's early phase growth performance in the UP has been provided by the study. Additionally, it has opened up new research avenues for *A. malaccensis* in the Terai region of Uttar Pradesh.

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