

Leaf nitrogen concentration indicates the growth rate of *Falcataria falcata*, a major fast-growing tree in Southeast Asia

Falcataria falcata, a leguminous tree native to Indonesia, the Solomon Islands, and Papua New Guinea, is among the fastest-growing tree species in the world. Owing to its moderate wood strength and good workability, its timber is in high demand for wood products such as laminated lumber and plywood. However, growth rates vary greatly among individuals even within the same plantation. To improve wood productivity, it is essential to select fast-growing individuals and achieve more uniform growth in plantations. Identifying simple traits associated with growth rate would help shorten the time required for selecting superior trees. Leaf traits such as photosynthetic rate and specific leaf area (SLA) often correlate with growth rate, potentially serving as useful indicators. For *F. falcata*, however, differences in growth rate and leaf traits among genetically different populations remain unclear. In this study, we examined the relationships between growth rate, photosynthetic rate, and leaf traits among genetically different populations originating from Indonesia and the Solomon Islands.

Seeds of *F. falcata* collected from nine locations in Indonesia and the Solomon Islands (Fig. 1A) were grown under common environmental conditions (Fig. 1B). Relative growth rate (RGR)* over three weeks (Fig. 2), maximum leaf photosynthetic rate**, and leaf nitrogen concentration varied greatly among populations, whereas no significant differences were observed in SLA. The population-mean of leaf nitrogen concentration was positively associated with that of maximum leaf photosynthetic rate (Fig. 3) and RGR (Fig. 4).

These results suggest that leaf nitrogen concentration can be used as an indicator of growth performance and can accelerate the selection of fast-growing individuals. We also suggest that growth rate and photosynthetic traits in *F. falcata* have a genetic basis. These traits can therefore be utilized in breeding programs to develop varieties with superior growth performance and physiological characteristics. Conducting similar assessments in plantations and in mature trees will further strengthen the applicability of these findings.

*Relative growth rate (RGR): growth rate per unit biomass, where higher values indicate more efficient growth

**Maximum leaf photosynthetic rate: the maximum rate of leaf photosynthesis measured under non-limiting conditions of light, water, and temperature

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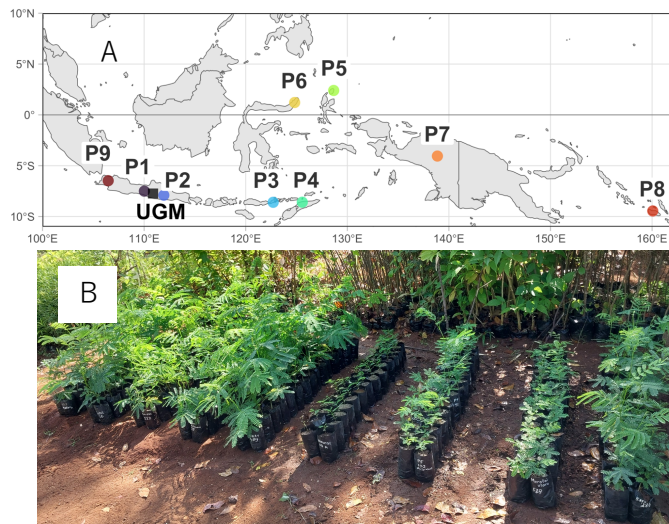


Fig. 1. Locations of seed collection of *Falcataria falcata* and Universitas Gadjah Mada (UGM) (A), and seedlings of *F. falcata* (B)

(A) Circles indicate the locations where *Falcataria falcata* seeds were collected, and the square indicates the location of Universitas Gadjah Mada (UGM). The labels represent populations. Seeds were collected from three plantations on Java Island (P1, P2, and P9) and from natural forests at all other sites. (B) *F. falcata* seedlings grown in the UGM's experimental forest.

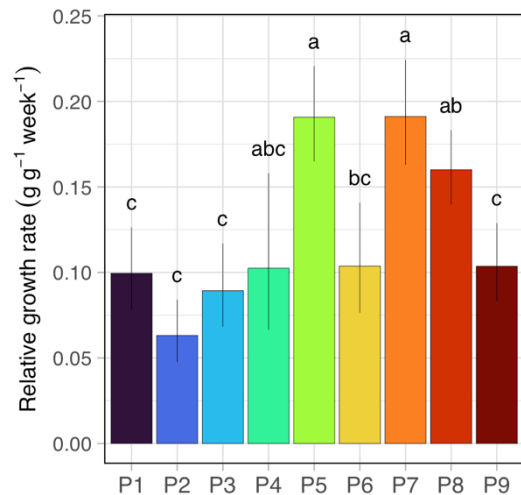


Fig. 2. Relative growth rate (RGR) of *F. falcata* across populations

Different letters indicate significant differences among populations based on Tukey's HSD test ($p < 0.05$). Error bars represent 95% confidence intervals ($n = 29-30$). Bar colors correspond to the populations shown in Fig. 1.

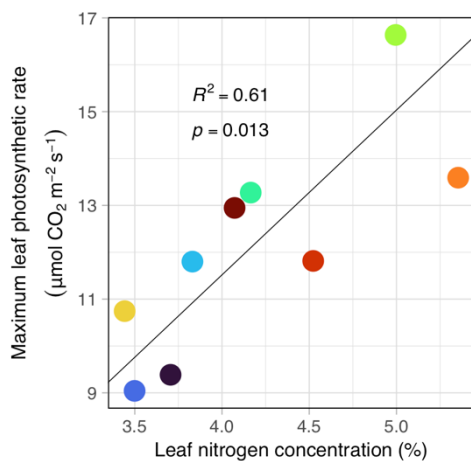


Fig. 3. Relationship between leaf nitrogen concentration and maximum leaf photosynthetic rate

Point colors correspond to the populations shown in Fig. 1, and the solid line represents the fitted linear regression. Each point represents the mean of five individuals.

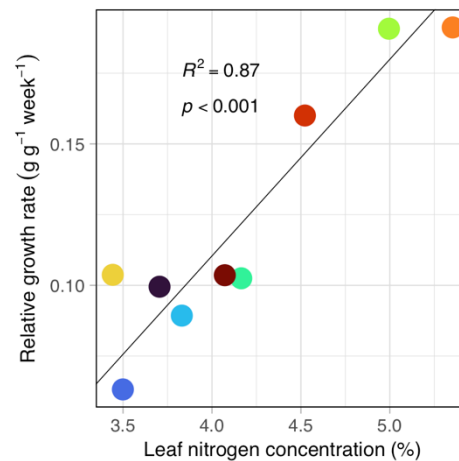


Fig. 4. Relationship between leaf nitrogen concentration and RGR

Point colors correspond to the populations shown in Fig. 1, and the solid line represents the fitted linear regression. For each point, leaf nitrogen concentration represents the mean of five individuals, and RGR represents the mean of 29–30 individuals.

Reference: Faridah et al. (2025) *Trees-Structure and Function* 39: 78. © Springer 2025

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