Acacia mangium Willd.

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FABACEAE (BEAN FAMILY)

Mangium montanum Rumph.

Black wattle, hickory wattle, mangge hutan, mangium, Sabah salwood, tongke hutan (Turnbull 1986)

Acacia mangium is native to northern Queensland in Australia, Papua New Guinea, Irian Jaya, and the Moluccas Islands in Indonesia (Turnbull 1986). The species has been planted throughout the humid tropics (Centro Agronómico Tropical de Investigación y Enseñanza 1992, Szott 1995, Turnbull 1986). It has naturalized in Puerto Rico (Francis and Liogier 1991), Brazil, and many other areas.

Acacia mangium is a fast-growing, medium-sized, evergreen tree with phyllodes that serve as leaves (Nitrogen Fixing Tree Association 1987a). Trees reach 30 m in height and 60 cm in diameter in their native range (Turnbull 1986). The bole is usually straight and topped with a symmetrical crown of relatively light limbs; the lower bole is often fluted. The bark is reddish brown and lightly furrowed. *Acacia mangium* grows best in warm climates with 1500 to 3000 mm of mean annual rainfall (Turnbull 1986). The species grows in a wide variety of soil types. These soils are acid with medium-to-low fertility and can be poorly drained. Soils with high pH are not tolerated (Turnbull 1986).

Acacia mangium forms hybrids with *A. auriculiformis* in natural stands in Papua New Guinea and hybrids have been reported in cultivation in Sabah (Turnbull 1986). *Acacia mangium* is closely related to *A.auriculiformis* and *S. holosericea*.

Acacia mangium is planted primarily for site rehabilitation. Its quick growth and dense shade make it an effective tool in reforesting *Imperata* grass swards and reducing fire risk (Nitrogen Fixing Tree Association 1987a). Its ability to grow well on infertile soils, especially those low in phosphorus, make it a favorite for rehabilitation of mine spoils and eroded sites. The tree also produces a usable wood. It is hard and has an air-dry specific gravity of 0.69. The sapwood is cream colored; the heartwood is yellow-brown. The wood is suitable for particleboard, plywood, veneer, pulp, fenceposts, firewood, and charcoal (Nitrogen Fixing Tree Association 1987a). The leaves can be used as livestock fodder (Turnbull 1986).

The small flowers are grouped in spikes up to 10 cm long, singly or in pairs in the leaf axils near the branch tips. The trees flower annually, usually at the end of the rainy season or the early part of the dry season. Fruits ripen 5 to 7 months after flowering (Centro Agronómico Tropical de Investigación y Enseñanza 1992). Flowering occurs in May in Australia with fruits maturing from late October to December. Fruits ripen in July in Indonesia, September in Papua New Guinea (Turnbull 1986), and February to April in Central America (Centro Agronómico Tropical de Investigación y Enseñanza 1992). The dark brown, crinkled, and coiled ripe pods partially open, and the small (2.5 by 4 mm), black seeds hang by orange, fleshy funicles. The seeds are dispersed when small birds consume the oily funicle or they eventually fall to the ground under the mother trees. Individual trees in an *A. mangium* plantation produced 1 kg of seed per year (National Academy of Sciences 1980).

The fruits may be harvested by clipping them from trees with pruning poles when they change to the dark brown color and begin to crack open. Although they are best harvested before the fruits are fully open (Bowen 1981), the pods with hanging seeds remain available on the trees for several weeks. The viability of *A. mangium* seeds tends to increase over the course of the fruiting season while the seed size decreases (Bowen 1981). After air drying, small amounts of seed may be separated by hand. Mechanical separation involves hammer-milling the pods followed by shaking, blowing, and screening. Seed cleaning is difficult because the stringy funicles tangle with debris and screens. Cleaned seeds average 80,000 to 110,000 per kg (National Research Council 1980). Storage with moisture content of 4 to 12 percent at 3 to 5 °C in sealed contain-

ers is recommended, but seed stored at ambient temperatures will retain its viability for up to 2 years (Bowen 1981).

Pregermination treatments promote prompt, uniform, and high levels of germination. Seeds should be placed in boiling water for 30 seconds, then cooled by soaking in cold water for 2 hours before planting (Centro Agronómico Tropical de Investigación y Enseñanza 1992). Germination, reported at 60 to 80 percent (after pregermination treatments), may begin after 1 day and continue for 10 to 15 days (Centro Agronómico Tropical de Investigación y Enseñanza 1992, Newman 1989).

Seeds are sowed in germination trays or beds. When seedlings have about three leaves (Turnbull 1986), they are pricked into plastic nursery bags where they grow to plantable size. Seeds are sometimes sowed directly into 1- to 2-liter nursery bags; this method requires thinning to one plant per bag after seedlings emerge. Although *A. mangium* seedlings usually autoinoculate with *Rhizobium* symbiotic nitrogen fixers, artificial inoculation in the nursery is recommended (von Carlowitz 1991). Bare-root planting and direct seeding into prepared seed spots have been used, but because they give low survival, these methods are generally not favored. Seedlings are ready to outplant in about 16 weeks (Turnbull 1986). Plantation spacing affects growth, and individual trees respond with greater diameter increments in spacings from 2.5 by 2.5 m to 4.0 by 4.0 m (Szott 1995). Site preparation may include felling residual woody vegetation, burning grass and slash, and sometimes cultivating. On some sites, weeding may be unnecessary, but planted *Imperata* swards require weeding at 1.5, 3, and 5 months (Nitrogen Fixing Tree Association 1987a). Height growth between 1.5 and 5.0 m for each of the first 3 years, decreasing thereafter, has been observed in some plantations (Szott 1995). In other plantations, 1 to 2 m or more of height growth and 1 to 3 cm of diameter growth per year are usually obtained (Centro Agronómico Tropical de Investigación y Enseñanza 1992, National Research Council 1983b).

1cm