Making the grade

The challenge for teak-growers is to improve the wood quality of fast-grown trees

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Carpenter's pride: a tradesman applies his craft to this teakwood panel. *Photo: H.O. Ma*

WOOD quality is the cumulative effect of wood properties on the end-use of a timber species (Zobel & van Buijtenen 1989). These wood properties impact either negatively or positively on the recovery, utilisation and market price of timber and wood products. For example, in timbers with a clearly demarcated sapwood and heartwood, those with a high percentage of heartwood will yield more saleable timber; conversely, a high proportion of sapwood is not a problem in treated poles because sapwood is easily penetrated by preservatives and thereafter may be more resistant to pests and fungal infections than the heartwood itself, which may not be treatable or durable (Graham 1973; Oteng-Amoako & Lawer-Yolar 1999; see *figure*).

Natural forest teak: quality and uses

Teak (*Tectona grandis*) timber produced in the natural forests of Myanmar, India and Thailand has exalted status in international markets, commanding prices as high as US$2000/m³ for logs (ITTO 2002). This status is due, at least in part, to the inherent quality of the natural-grown timber: it has a high proportion of heartwood, which tends to be dark and of a uniform golden-brown colour, a medium texture, straight grain, streaky to uniform figure, and a small microfibril angle which means that there is minimal shrinkage on drying. The wood's density is medium (in the range 600–750 kg/m³), its strength moderately high and it is dimensionally stable. Teak timber peels, nails and screws well and takes good sanding and varnish. The heartwood contains an extractive—sesquiturpine—which renders it very resistant to fungal attack and immune to *Lyctus*, a wood-boring beetle, and other insects (Chandrasekharan 2003). Teak products therefore have a long service life, making the timber a long-term prospect for carbon storage (Bhat 2003; Keogh 2003).

Teak is not a perfect timber, though. For example, natural-grown teak has high lipid deposits—between 4.7% and 8.6%—which give the wood an oily feeling and makes it more difficult to glue with standard glues (Nobuchi et al. 2003). Teak's high silica content of about 1.4% may have a dulling effect on saws, and special carbide- or tungsten-tipped saws are usually recommended for milling (Chandrasekharan 2003; Kajar et al. 1999).

Such relatively minor faults not withstanding, natural-forest teak remains one of the most sought-after and highly valued timbers in the world, being used for flooring, interior and exterior furniture, joinery, musical instruments, poles and piles, structural applications, vehicle- and ship-building, sporting goods, veneer and plywood.

Plantation teak as substitute for natural forest teak

The high prices paid for teak, which can be attributed to the limited availability of natural teak in the international market, have prompted the establishment of a large and growing teak plantation estate across the tropics. Unfortunately, this has resulted in sacrifices in wood quality. Compared to its natural-forest counterpart, plantation teak grown on rotations of 21–30 years often has a high proportion of sapwood and juvenile wood, while wood figure including colour, grain and texture are supposedly inferior. Plantation teakwood has lower density and strength than natural teak, a larger microfibril angle (leading to greater shrinkage) and less durable heartwood. Some studies suggest that these differences may not always be great: Bailleres and Duran (2000), for example, reported that 21-year-old plantation teakwood can have similar strength to mature-aged teakwood from natural forest. Nevertheless, the cumulative effect of differences in various wood properties, coupled with the much smaller dimensions on offer in plantations, is that plantation teakwood is no match for mature-aged natural teak in the marketplace.

Determining factors for market price

Differences in export prices are a good indicator of this: the US$300/m³ fetched on average by plantation teak logs is markedly less than the average price of US$700/m³ for natural forest teak. Even within natural-grown teak the wide range of prices reflects differences in quality: at the end of 2003, FOB (free-on-board) prices for natural teak sawlogs ranged between US$420 and US$1615/m³ depending on log grade (ITTO 2003/2004). While prices for plantation teak tend to hover in a narrower range, variations in quality can still have an effect on price. For example, the export price of teak boules from Ghana is in the range US$200–350/m³ depending on wood quality, which is far superior in the country's deciduous forest zone compared to products sourced from the savanna forests, where bushfire and grazing are major problems (Oteng-Amoako & Sarfo 2003). In Côte d'Ivoire, the average export price of plantation teak logs between 2000 and 2001 was US$180/m³, while in Myanmar it was US$470/m³ (ITTO 2002).

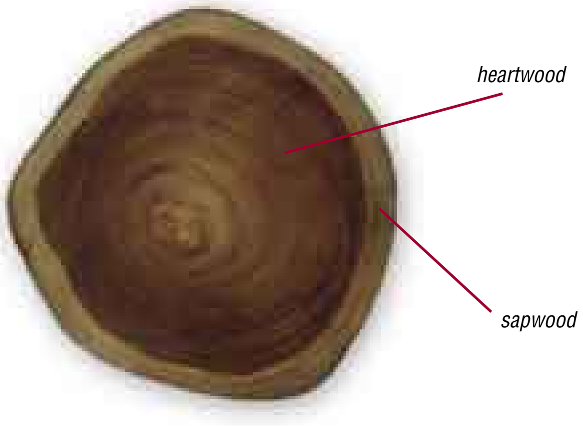
The way forward

The challenge for teak-growers is to raise the quality of plantation-grown teakwood under fast-growth regimes. Extending the rotation length would yield better quality, but most investors demand a faster return on their money. Genetic selection and manipulation through tissue culture techniques and prudent silvicultural practices will help: Mandal and Chawhaan (2003), for example, advise that efforts should be made to increase specific gravity, since any small gains will have a positive impact on wood quality; they found a low but positive correlation between specific gravity and height, heartwood and diameter at breast height. Specific gravity is an inherited trait and is therefore amenable to genetic improvement (Zobel & Talbert 1984). Silvicultural treatments like thinning and pruning, if carried out judiciously, should also improve wood quality, producing timber with fewer knots and bends, less taper and more heartwood.

The question of how to optimise wood quality under fast-growth regimes in teak plantations will continue to tax the plantation-forestry community. Efforts to address this question through genetic and silvicultural improvement should continue, and there will also be an increasing need for technological interventions that allow the efficient and value-added processing and use of tomorrow's teakwood.

Big hearted?

Cross-section of a plantation-grown teak log. Depending on end-use, the extent of sapwood can have a positive or negative impact on the marketability of the wood.



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