

TreeNote

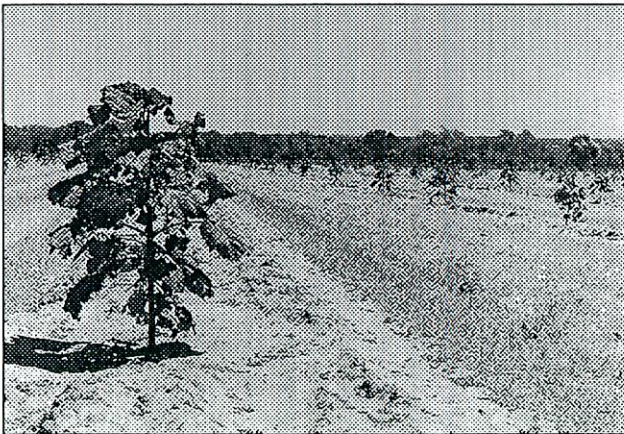
No. 9
June 1998

Paulownia

Introduction

Paulownia has been promoted by several private companies as a tree suitable for farm forestry in Australia. So far, Western Australian experience is limited and no formal trials have been carried out. Since there is little reliable information about many aspects of its cultivation, it remains experimental. Some land owners in Western Australia are growing small areas, and several large plantations have been established.

This TreeNote contains information collated from a number of publications, and from interviews with paulownia promoters and growers.



Paulownia in a large plantation at Gingin. These trees were planted out in October 1997 and photographed in early February 1998. PHOTO BY COURTESY OF MURRAY ROGERS

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Commercial potential in southern Western Australia

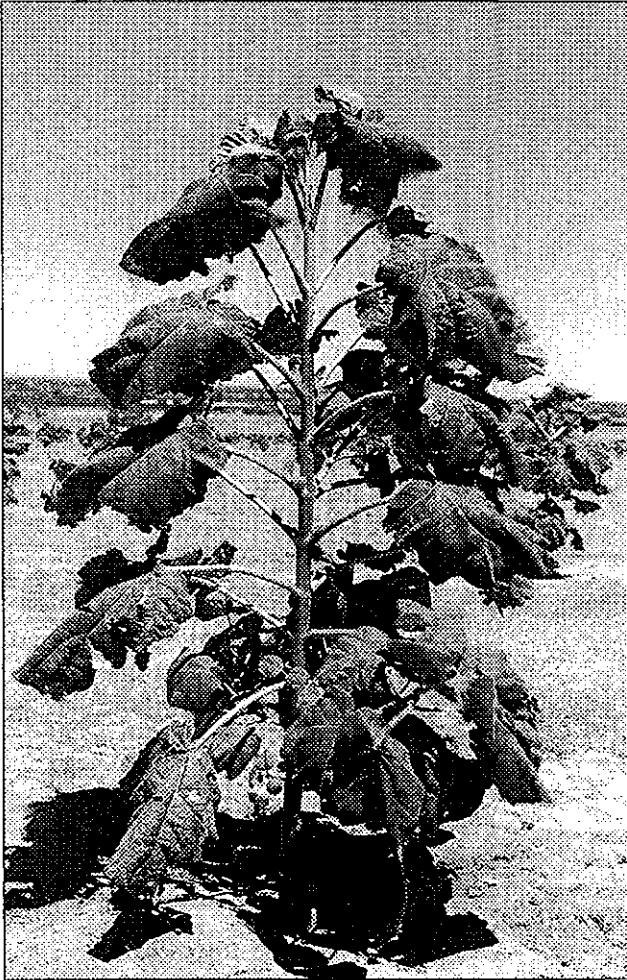
Positive view

- Paulownia can grow quickly, with harvest potential after 10 years.
- Its timber has a high value in export markets.
- Paulownia may replace imported rainforest timber in the local market.
- Growers may receive high returns.

Cautious view

- Many small and large scale plantings have failed.
- Paulownia is not suited to a climate with hot, dry summers and may struggle to survive.
- Horticulture may be more profitable on the high quality sites required for successful paulownia growth.
- Little local growth data is available, especially for trees older than five years.
- Logs which receive high prices in Japan are from slow-grown trees, usually 35 years of age or older. Young, rapidly grown timber has a much lower value.
- Current export markets are very small, while the potential supply from China is large.
- There is no established market for paulownia timber in Western Australia. It will not threaten imported timbers such as meranti until a large and continuous supply of timber of consistent quality is available.
- Other tree species can be grown more easily and reliably on a wider range of sites to produce timber products for existing markets.

Continued overleaf...



Another view of Gingin Plantation (from front page).
PHOTO BY COURTESY OF MURRAY ROGERS

Characteristics of paulownia

Species

There are nine recognised species of paulownia, within which there are numerous different provenances, as well as a range of hybrids. All are native to China and its neighbours. The two species most often cultivated in China are *Paulownia fortunei* from the humid sub-tropics south of the Yangtze River, and *P. elongata* from warm temperate areas north of the Yangtze River. Both species are available in Australia. The trade name "Powton" has been given to one collection of paulownia clones.

Cultivation

Paulownias have been cultivated in China for at least 2000 years. In recent decades, agroforestry plantings have increased in China, to shelter crops and provide firewood and timber. It is estimated that 2.5 million hectares of Chinese farm land now has paulownia shelter belts planted on it, from which up to 10 million cubic metres of logs may be produced each year.

Within Asia, paulownia is grown in Taiwan, Vietnam, Cambodia, Laos, Korea and Japan. Elsewhere, paulownia is grown commercially in South America and the United States, where it has naturalised in Appalachian forests. Commercial development has been attempted in Australia, New Zealand and South Africa.

Description

Paulownias are summer-growing deciduous trees. They are medium sized and wide spreading, with large, dark green, downy leaves, occasionally exceeding 50 cm in both length and width. The trees can grow extremely rapidly in their first few years, after which growth rates slow. As they mature, their leaves become smaller and their crowns become sparse. The leaves can provide useful fodder for stock, and the flowers, which bloom in spring before the leaves emerge, produce large amounts of nectar.

Timber

The timber is very light (about 300 kg/m³) and is unsuitable for structural use. However, some denser paulownia wood from large, old trees is highly valued in Japan for furniture making. The highest prices are paid for slow-grown yellowish timber with numerous regular, close-spaced annual growth rings.

Features of paulownia timber are:

- Pale yellow to pale red, odourless, with straight grain and an attractive finish.
- Air dries quickly, but is susceptible to sap staining moulds while drying.
- High strength to weight ratio.
- Low shrinkage coefficient. Rarely warps, cracks or deforms.
- Easy to work, but soft and easily dented and marked.
- Good thermal and electrical insulation.

Growing requirements

Producers of paulownia plants warn that careful site selection and good management are essential. Growing it without adequate water and nutrients, or without careful and detailed management, is likely to result in failure.

Climatic needs

- High summer temperatures - mean daily temperature 24 - 29°C.
- Absence of late spring frosts, which can damage new growth.

- High summer rainfall. Irrigation, or access to fresh groundwater 1.5 to 5 metres below the surface is essential where summers are dry. Without irrigation, trees are rarely tall or of large diameter. However, irrigation with stored surface water, or pumped groundwater may not be profitable.
- High summer humidity. Exposure to hot, dry winds may damage the trees, even if irrigated.
- Grows best in full sun.
- Needs protection from strong winds, especially when the trees are young.

Soils, drainage and salinity

- Grows best on deep, well-drained fertile soils such as loam or sandy loam. Grows poorly on shallow soils and shallow duplex soils.
- If waterlogged, even for periods as short as a few days, paulownia defoliates and may die. At least 1.5 metres of well-drained soil above the water table is recommended.
- Growth is retarded by saline soil or water.
- Recommended pH is 5.5 to 8.

Fertiliser

Large amounts of NPK fertiliser are needed for young trees, to produce rapid growth and a tall, straight stem in the early years. Once established, the trees may need less fertiliser, depending on the fertility of the site and the desired growth rate. Minor elements may need to be applied.

Pests and diseases

There is little information available for Australia. In Asia, paulownia is affected by many pests and disease, including anthracnose, mistletoe and insect attack. The most serious disease is "witches' broom", which has contributed to the decline in paulownia production in Japan. It does not appear to be present in Australia.

Potential sites in Western Australia

Sheltered sites in the lower south-west, with deep soils and rainfall greater than 750 mm have the most potential. Since summer irrigation and high levels of nutrients are needed for rapid growth, there may be opportunities to grow paulownias in association with effluent disposal. Possible sources are dairies, piggeries, feedlots and rural towns.

Propagation

Paulownia plants can be propagated from seed or from stem and root cuttings. Although trees grown from seed are reported to have better early root development and to be less susceptible to heartwood

rot, they vary in growth rate and form. The most common propagation method, to produce uniform trees of known parentage, is to take cuttings from superior parent plants. Root cuttings are more commonly used than stem cuttings because they strike more reliably. Tissue culture is sometimes used for cloning superior trees, and for propagating disease-free material for export across quarantine boundaries.

Root cuttings can be taken from young plants, or from mature trees. Sections of root 15 cm long and 1 to 4 cm in diameter are planted vertically in pots, in nursery beds, or directly into the field during winter dormancy.

Potential growers should try to obtain disease-free planting stock which has been shown to grow well in environments where planting is intended.

Silviculture

Preparation

Ground preparation should include ripping, weed control, and provision of irrigation. Depending on the soil depth and availability of fresh groundwater, even mature trees may need irrigating every summer to survive and grow. The irrigation system can be used to supply nutrients with the water ('fertigation').

Growth habit

Paulownia lengthens its stem rapidly in the first and second years of growth, after which further height increases are slower. In good conditions, trees may grow 4 to 6 metres in the first year, and another 2 to 3 metres in the second year.

During winter dormancy, the tip tends to die - more commonly in *P. elongata* than in *P. fortunei*, and more commonly in areas with winter frosts. When growth resumes in spring, new side shoots develop below the tip. Various pruning techniques can be used to encourage one of the new season's shoots to grow vertically and continue to extend the trunk length. A long, straight trunk free of side branches, is needed to produce high quality, knot-free logs suitable for veneers and joinery.

Growing methods

Nursery method. One way of producing young trees with long straight stems is to grow them at close spacing (1 m x 1 m) in a nursery for the first year, providing them with ample water and foliar nutrient applications. Weeds are controlled to minimise competition, and side branches are removed to maximise growth of a single straight stem. When dormant in winter, one year old trees 4 to 6 m tall are dug up and replanted in the field at their final density - usually at about 5 m x 5 m. Transplanted trees need ample water while they re-establish their roots.

Coppice method. A less labour intensive method is to plant seedlings or cuttings in the field at the required final spacing, allow them to grow for one or two years to establish their roots, then cut them back close to ground level in winter, when dormant. In spring, vigorous new shoots appear from the coppiced stump. The best new shoot is retained, to produce a single, tall, straight stem. In this method, the tree's established root system supports the rapid regrowth of the selected stem.

Trees which grow poorly, have poor form, or are damaged, can be coppiced again (in winter) until a tall, straight stem is produced.

After harvest, a second crop can be grown from the stumps without replanting. However, the resulting trees may be more susceptible to disease than newly planted trees.

Economics

Until local data is available on tree growth, the profitability of growing paulownia in Western Australia is a matter of conjecture. Indications are that it is unlikely to become a major farm forestry crop in the agricultural areas of Western Australia. Soil, temperature and water requirements are such that it is best suited to sites which are highly valued for horticulture. The high cost of these resources limits the potential profitability of a tree crop which may take 35 years to fetch high prices.

Further reading

Borough, C. 'Paulownia – wonder tree or this year's wonder?' Special Liftout Section No. 18, *Australian Forest Grower*, Vol. 14, No. 3, Spring 1991.

Lyons, A. 'Paulownia'. In *Agroforestry – trees for productive farming*. Ed. by D. Race, pp 149-154, Agmedia, Melbourne, 1993.

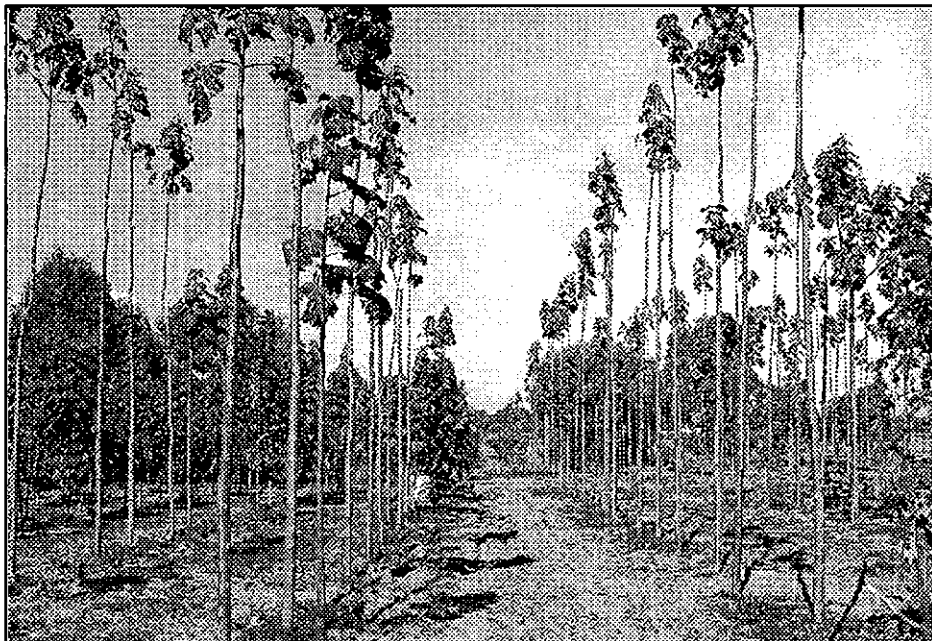
Chinese Academy of Forestry Staff (1986). 'Paulownia in China, cultivation and utilisation'. Asian network for Biological Sciences and International Development Research Centre.

Wilson, G. 'Paulownia: designed for agroforestry'. *Australian Farm Journal*, Vol. 1, No. 11, pp 59-61, January 1992.

Publications on paulownia and further industry information may be sought from:

The Tree Crops Centre
208 Nicholson Road
Subiaco WA 6008
Ph. (08) 9388 1965
Fax (08) 9388 1852

Website directory: www.AOI.com.au/atcros
(This website is a national information base on tree crops.)



A private paulownia plantation (M. Rabbitt) of P. fortunei at Herne Hill. These trees are about 7 m tall and show two summers' growth from coppiced one-year-old root stock.

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