1984 FORESTS DEPARTMENT RESEARCH CONFERENCE

# Silvicultural Research in the Jarrah Forest

Ian Abbott (Como Research)

This paper describes the scientific basis for silviculturally treating the northern jarrah forest. It is organized under three main topics: Early stages (1-4) of regeneration; Growth rate of poles, piles, trees and coppice (stages 6-10); and Form of jarrah (stages 5-10). Current research and recommendations for future research are then outlined.

## Early stages of regeneration (Stages 1-4)

- Nearly half of the jarrah seeds placed on the forest floor do not germinate because they are harvested by ants.
- Root competition, light or litter depth do not affect germination or seedling (stage 1) establishment.
- Herbivores kill nearly 90% of stage 1 jarrah.
- Root competition reduces height growth of stage 1 jarrah.
- In typical long cut-over forest, growth from seed into stage 4 takes 15-20 years.
- The lignotuber increases the chance of survival of the jarrah plant.
- Low intensity fire kills 30-70% of lignotuberous seedlings (stage 2).
- High intensity fire results in very rapid coppice growth of the tallest shoot (stage 4).
- Ashbeds provide best conditions for fast growth of stages 1 and 2.
- Thinning of forest has little practical effect on height growth of stage 2 jarrah.
- Substantial reduction in forest basal area is essential to convert stage 4 into stage 5. This is achieved by weakening of overstorey competition through old age, wildfire or logging.
- Prolific stump and stool coppice (stages 9,10) was not controllable until the advent of arboricides (1961).
- Fertilizer reduces mortality of transplanted stage 2 jarrah.
- Seedlings in pots grow most rapidly when both N and P are applied. Most growth is in the shoots and not the roots.
- NPK fertilizer applied to stage 2 jarrah in the forest increases shoot growth.

## Growth rate of poles, piles, trees and coppice (stages 6-10)

- Growth rate is much influenced by site quality.
- Growth rate in overstocked cut-over stands of high quality averages 0.2 cm $yr^{-1}$ (DUB), 0.2 $m^2ha^{-1}yr^{-1}$ (BAUB) and 1.2 $m^3ha^{-1}yr^{-1}$ (VUB).
- Vigour and position of the crown relative to the forest canopy are good predictors of diameter growth rate.
- In high quality stands, diameter growth varies inversely with basal area, and basal area and volume growth vary with number of stems $ha^{-1}$.
- Diameter and BA growth in regrowth stands decline with age (overstocking), probably from both crown and root competition. Such stands need thinning, the three advantages of which are: trees retained grow larger; the rotation is shortened; and water yields from catchments are increased.
- Thinning should be of crowns and stems. The largest of the dominated stems and groups of crowded crop trees should be thinned to maintain suitable spacings. Trees with small, sparsely-leafed crowns, whether co- or sub-dominant, should be removed.

..2

- Stocking levels in relation to site quality and BAOB have been determined, and a group relating stocking levels to stand BAOB, mean DOB, and spacing has been produced. In high quality regrowth, suppression stocking (100%) = 31 $m^2ha^{-1}$, critical stocking (70%) = 22 $m^2ha^{-1}$ and threshold stocking (25%) = 8 $m^2ha^{-1}$ (for diameter growth) or 12 $m^2ha^{-1}$ (for volume growth).
- Diameter growth of stage 9 (stump coppice) decreases markedly 10-15 years after logging, probably indicating that full stocking is achieved quickly.
- Low intensity fire has no appreciable effect on diameter growth, either in the short- or long-term.
- Moderate intensity fire which scorches the crowns of poles increases their stem-diameter growth.
- Poles in unthinned stands show no response in BA growth to NPK (8 treatments).
- Poles in thinned stands show increased BA growth to N, NP and NK. Thinning evidently increases the availability of water to trees.
- Poles treated with NP or NK develop the densest crowns.
- Poles show most basal area growth 2-3 years after fertilizing with nitrogen, implying that future applications should be frequent.
- Unlike seedlings in pots, poles show no significant N x P interaction.
- N is the nutrient most limiting productivity of the jarrah forest.
- Jarrah has a growth potential of 1-2 cm $yr^{-1}$, an increase of c. an order of magnitude over present average growth rates.

**Form of jarrah (Stages 5-10)**

- Low intensity fire does not increase the incidence of fire scars; high intensity fire (wildfire) does.
- Fire-scars develop from low intensity fire only if débris has accumulated close by. This usually indicates inadequate top-disposal.
- Regeneration has to be protected from fire until it is well into stage 5 (c. 4 m tall, c. 10 years after logging), otherwise the leading shoot will be killed. This results in the stem developing kinks.

**Current research on jarrah silviculture in the northern jarrah forest (G. Stoneman)**

Remeasurements of several thinning plots are being analysed. The Yarragil 4L subcatchment was thinned last year. The thinning response of trees in it is being related to site and diameter class.

**Major outstanding research questions**

- What is the influence of site quality on regeneration (stages 1-5).
- What is the influence of fire on density and form of regeneration?
- What is the influence of fertilizer on the development of saplings directly from incipient ground coppice (stage 4) and on lignotuber and root development of younger stages?
- Why is stage 4 jarrah sometimes present in insufficient numbers?
- What is the influence of thinning and/or fertilizer on tree form, in particular thickness of the bark from ground-level to crown-break, wood quality, bole-length and form factor? Does thinning increase taper and does fertilizing decrease taper?