THINNING IN CUT-OVER JARRAH STANDS.

W.R. Wallace and F.D. Podger.

Western Australia has some three and a half million acres of jarrah forest dedicated for permanent timber production. Of this, more than half has received at least one trade cut and much of the logged area now carries dense stands of jarrah saplings and poles.

These regrowth stands owe their structure to the effects of uncontrolled exploitation of a virgin forest characterised by a predominance of large overmature trees. The heavy logging and uncontrolled fires typical of the era before the implementation of forest control produced acres of densely stocked, relatively uniform jarrah regrowth.

Dense and uniform stands of jarrah regrowth are known to experience several periods of stagnation in the course of their development. This is due to intense mutual competition among the individual members of the stand and is expressed as a general decline in vigour.

The best placed and most vigorous trees are able to grow through a period of stagnation but, in the course of their development, these trees may again experience severe mutual competition and enter further periods of stagnation, up to 3 or 4 times in the course of a century. These periods of stagnation can be anticipated and loss in vigour avoided by thinning.

A major silvicultural problem and a factor which should influence the time of first thinning and the intensity of thinnings for jarrah is coppice development.

As no market for jarrah in small sizes has yet developed it is not possible to provide the necessary finance to thin the enormous backlog of untreated forest and only relatively small areas of thinnings are being undertaken at the present time.

Some indication of the very real benefit derived from thinning has been given by the study of an 80 year old second growth forest near Jarrahdale. Sample plots established in the thinned and unthinned areas show that while thinning does not materially reduce the total volume, the annual increment can be placed on a limited number of selected trees. This has the economically desirable effect of markedly reducing the period from seedling to sawlog.

Tests have shown that fast grown sawlogs from this 80 years old forest behave well on sawing and their strength properties are equal or slightly superior to mature timber from the original forest.

THINNING IN SECOND GROWTH JARRAH STANDS

By W.R. Wallace and F.D. Podger

Western Australia has some 3½ million acres of jarrah (Eucalyptus marginata) forest dedicated for permanent timber production. More than half has been logged for sawmilling one or more times, and much now carries dense stands of saplings and poles of various age classes. The thinning of these stands presents a problem.

The structure of the virgin forest, the manner of its regeneration and the persistence of the species together with the uncontrolled utilisation which took place in the era before forest management must be all understood before the thinning problem can be considered.

Regeneration of Virgin Stands :

In its virgin state jarrah is a high forest with the greater part of its volume in the mature and overmature trees of the larger size classes. Dormant juvenile growth is generally present in large numbers in the form of lignotuberous advanced growth up to 20 years of age or more. Following the death of a veteran, the small opening so caused provides sufficient stimulus for some, but not all, of the advanced growth to send up dynamic young saplings which continue to grow in the normal manner in competition for the space available. (Slide 1).

Regeneration of Cutover Stands :

The log quality of the mature trees in virgin jarrah forest is remarkably good and the past uncontrolled exploitation of these forests was typified by heavy cutting and considerable damage. Canopy cover was drastically reduced. Well developed advance growth on the forest floor prior to the cut responded immediately and where large numbers were present, dense stands of saplings became established. Fierce and uncontrolled fires which followed in the slash from felling operations burnt these young saplings back to ground level in many cases. An overstocking of evenaged coppice resulted and intense competition for the site developed. (Slide 2).

Development of Regrowth :

Periodically, overstocked stands of jarrah regrowth develop a condition known locally as "stagnation". The term expresses a general decline in vigour of all members of the stand and is marked by a decrease in crown density and girth increment. There is little doubt that this stagnation is the result of intense mutual competition for the site. It seems to persist until a reduced number of stems slowly assert dominance. These stems then show improved vigour and grow on until they, in turn, enter a new period of stagnation from which a further reduced number again emerge. These periods of stagnation may occur several times during the period of upward growth of the tree.

In areas at Dwellingup and Jarrahdale sample trees which have been measured periodically for 27 years show a decrease in current annual increment from the order of 0.6. inches to 0.3 inches per annum.

It is suggested that apart from overstocking, mutual competition resulting in periodic stagnation is aggravated by the extreme hardiness and persistence of jarrah, the very low fertility of the lateric soil on which it grows and the long summer drought experienced each year. However, whilst root competition is a highly important factor, competition for crown growing space is also quite significant. → ? light

Crown Abrasion and Stagnation :

The stage at which stagnation sets in may vary from stand to stand but two distinct situations can be recognised. The first can be seen where stagnation does not set in until the crown character begins to change from the perfect sapling stage to the pole stage. This situatim usually occurs in moderately well stocked stands and in stands arising from uneven regeneration.

Generally there is adequate room available for the development of most young sapling crowns because of their nature. Unless widely spaced the sapling does not carry strong, persistent branches and tends to maintain a crown spread of about 6' to 8'. The lower branches are shed in the fourth or fifth year and crown depth of vigorous saplings is rarely more than 10' to 12'.

Rapid height growth is usual at this stage and tends to maintain any initial differences in vertical distribution of the crowns (Slide 3). Once the units of this type of stand enter the small pole stage a crowding in the canopy commences. This is due to the lateral extension of the crowns by the retention of persistent side branches, an increase in crown depth and a reduction in the rate of height growth. This crowding may take place even where there was originally considerable vertical distribution in the young stand. Those units which enter the small pole stage experience a reduction in height growth to about 1-ft. per annum and retain their lower branches, whilst the sapling units at a lower level maintain normal height growth and soon grow into the canopy from below. At this stage "crown abrasion" becomes evident and stagnation sets in.

Lane Poole 1927 ref.

"Crown abrasion" is a local term used to define a characteristic reaction of jarrah to crown sway which causes the crown edges to rub against one another. The tree appears to be particularly sensitive to this treatment and crown spread is either halted or considerably reduced. It is of interest that competing crowns when at rest are never touching but show about 2-ft. of "abrasion space" between individuals.

The second situation for stagnation occurs in densely stocked and uniform sapling stands. Here crown abrasion becomes important at an early age and stagnation may occur at 10 - 15 years when the stand is no more than 30' in height.

Practical Thinning Problems :

Observations w/out replications.

The management of the jarrah forest is directed towards the perpetuation of the sawmilling industry and requires the production of maximum volume on trees of merchantable size in a minimum of time. If the requirements of management are to be fulfilled adequately, thinning of young stands is essential.

With thinning, however, there are two very real problems, one of economics and one of silviculture. Thinning to favour the best trees involves the costly removal of a large number of small stems. Unfortunately, no market exists for small size jarrah at present and there is no early prospect of improvement.

Because of the absence of a market and in view of the enormous backlog of unthinned areas, it is not possible to provide the necessary finance for large-scale operations and only relatively small areas are being treated at present.

In common with many other species the two most difficult decisions in thinning jarrah regrowth are when to thin and how much to remove. No other single factor appears to have greater bearing on both problems than coppice shoots which develop vigorously from the stumps of the removed trees. How far this coppice will develop and what competition it will provide depends on the intensity of the thinning and on the stage of development of the crop.

Heavy interventions in young sapling growth have proved for all practical purposes a complete failure. This has been clearly demonstrated in thinning plots established in 1928 in the Dwellingup Division. The plots were established in 15 year old saplings of about 30' codominant height and re-measurement in 1959 showed no improvement in the crop trees which could be attributed to the thinning. The figures relating to these plots are set out below :-

	Thinned		Thinned		Unthinned	
	1930	1959	1930	1959	1930	1959
B.Area (Sq.Ft.) 100 largest trees	20	73	19	73	20	67
Stems per acre	201	425	204	544	922	704

The stem numbers per acre show a marked increase on the thinned plots indicating that persistent coppice development has restored a condition of strong competition.

Effective thinning, however, has been achieved by delaying the operation until the stand has left the sapling stage. Thinning in stands of 50-60 ft. codominant

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height to provide ample crown room for the best trees has been carried out successfully. Coppice does develop but in most cases does not re-enter the level of crown competition.

The very real benefits which can result from effective thinning are well illustrated by results of a study recently carried out near Jarrahdale to determine the nature and the effect of a past thinning in second growth jarrah of known age.

This area was first cut about 1875 and again lightly in 1926. In 1928 a crown thinning was carried out and two acres were retained untreated for comparative purposes. In 1956 two plots were laid down, one in the unthinned area and one in adjacent thinned forest. The effect of the thinning is indicated by the data below.

TABLE 16

JARRAH 81 YEARS (REGENERATED 1875), THINNED AND UNTHINNED AT 53 YEARS (1928) MUNDLIMUP C1 - JARRAHDALE

Per Acre Figures	Age 1956	Mean Co-dom. Ht	Total Vol. u.b.	B.A.u.b	Vol. u.b. >54"	Vol. u.b. >72"	Bole Ht.	No. stems acre	Mean Girth of 20 Crop Trees
	(yrs)	(ft)	(c.ft)	(sq.ft)	(c.ft)	(c.ft)	(ft)	(No.)	5'0½"
Thinned 1928	81	91	2700	105.2	2250	1030	44	77	= 48.9 cm diam
Unthinned	81	91	3050	132.7	1150	430	48	188	4'0½" = 39.2 cm diam

The annual girth increment of the crop trees in the thinned stand is 0.75 in. and in the unthinned stand 0.6 in.

	Thinned	Unthinned
Mean girth	5'0½"	4'0½"
M.A.I. 81 years	0.76"	0.61"

Intensity of Thinning :

A study of the stumps remaining on the thinned plot has been attempted to determine the intensity of the 1928 treatment. The data obtained per acre is shown hereunder :-

	Stem Nos.	B.A.	Crown Cover
Before Thinning	125	90 sq.ft.	54%
After Thinning	71	57 sq.ft.	42%
% Reduction	43%	36%	

-12%

The intensity of this thinning was such as to effectively free the better stems without seriously reducing the crown cover. The stand was 53 years of age when thinned in 1928 and a photograph taken in the general area of the plots at that time shows that the retained members of the stand had reached the young tree stage, that is main crown division had commenced in codominants of the order of 70' total height.

Possibly the most effective time to thin is at the commencement of lateral crown extension which usually occurs on good sites at about 50' - 60' codominant height.

The trees at this stage seem able to take advantage of the growing space and to prevent the re-entry of coppice to the codominant level of the stand.

Thinning Yield :

A second thinning was made in the thinned plot in 1957 and involved 22% of the basal area of the codominants as shown below.

	Vol.u.b. c.ft. Per acre	B.A. u.b. sq.ft. Per acre	No.Stems Per acre
Before Thinning 1957	2700	105	77
Removed in Thinning	579	23	17

The stems removed were cut into small logs ranging in centre girth from 31" - 64" under bark and from 3.7 cubic feet to 24.9 cubic feet in volume. Practically the whole of this material would have been acceptable to small saw mills in the Metropolitan area.

A representative parcel was sent to Dwellingup for 1" experimental sawing and a recovery of 36% of boards was obtained. Samples of this material when tested showed significantly higher strength values than the average run of Jarrah from mature stands.

Conclusion :

This study suggests that, silviculturally, thinning should anticipate the periods of stagnation.

The costs of a series of unmerchantable thinnings cannot be envisaged within the present economy of the Department and second growth forest may have to be left to fight its own way through the early periods of stagnation.

A thinning just prior to the time of main crown division, can produce a favourable distribution of increment without significant loss of volume, and a second thinning 25 - 30 years later will then yield saw logs readily acceptable to the market.

Coppice growth from the stumps of removed trees provides serious competition with the remaining stems and, may offset any value of an early thinning operation.

Actual data is limited and much work remains to be done. Favourable levels of stocking for various sites and ages and an economic method for the reduction of competition from coppice must be determined, while the provision of a market for small thinnings below saw log sizes would do much to solve the economic problem at present associated with thinning operations.

indicates that thinned stands needed to be tended regularly ----