Department of Conservation
and Land Management

Date:
Reference:

Wood Utilisation Research Centre

DRYING AND GRADING MARRI BOARDS

W.R. Hanks

March 1990
W.U.R.C. Technical Report No 16.
Limited Distribution

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SUMMARY

The use of marri (*Eucalyptus calophylla* R. Br. ex Lindl.) as appearance grade timber has been restricted by the extensive occurrence of kino veins. This study assessed the drying behaviour of 25 mm thick marri boards, which were dried in a tunnel kiln. The percentage of boards with some face checking varied considerably between bundles, but most checking was removed when the boards were dressed. The recovery of clear and feature grade boards was 38 per cent; only 0.7 per cent was rejected. Careful selection of boards to minimise the occurrence of kino veins is required to produce an acceptable product after drying.

INTRODUCTION

Marri (*Eucalyptus calophylla* R. Br. ex Lindl.) is a major Western Australian species which has been used mainly for scantling, weatherboards and case material, but its use for sawn timber has been restricted by the extensive occurrence of kino veins. Because of low durability (Standards Association Australia 1988) the species can be used as fence posts and piles only if it is preservative treated. Marri is also the chief source of export wood chips from Western Australian forests.

The sapwood of marri is susceptible to Lyctid attack and must be treated. The colour of the heartwood ranges from pale yellow to light brown, making it suitable for furniture manufacture (Bootle 1983). Because of the extensive kino veins, commercial seasoning has been limited and individual furniture manufacturers have selected and seasoned marri for their own purposes. Drying of marri timber for sporting goods and tool handles has been done commercially.

This trial was designed to dry mature marri boards to produce timber of a quality suitable for furniture use. The tunnel kiln was used in a batch process, with all stacks loaded on the same day. The standard progressive system has a green stack loaded each week after a dry stack has been removed from the other end of the kiln. The timber was graded using rules developed at the Wood Utilisation Research Centre (W.U.R.C.).

METHODS

The marri used in this trial was selected quality 25 mm thick material sawn from mature logs by McLean's sawmill, Denmark. After sawing, the marri was block stacked and wrapped in plastic.

The timber had widths ranging from 50 to 200 mm and lengths from 0.5 to 2.1 m. The total volume supplied and seasoned was 4.5 m^3, separated into 9 bundles of 0.5 m^3 each.

On arrival at the Wood Utilisation Research Centre, Harvey in September 1988, the boards were strip stacked onto the tunnel kiln trolleys, using 20 mm thick strip sticks.

During this stacking, moisture content samples and residual boards were taken for each bundle. Residual boards were weighed and placed in the second row from the top of each bundle. The moisture content was assessed using the oven-dried method described in A.S. 1080, Part 1 (Standards Association of Australia 1972).

The bundles were then placed in a tunnel kiln and dried in a batch process. The operation is maintained by a micro computer running through a process controller, which controls the evaporative cooler, electric heater and dampers. Air is recirculated through the kiln, and venting is used to decrease humidity, the evaporative cooler to increase humidity, and the heater to increase temperature.

For this marri charge the tunnel kiln was run to the schedule shown in Table 1, with an air speed of approximately 0.5 m/s (Fig.1). The kiln was controlled using data from a sensor at the 'dry' end (Bundle 1) so the conditions at the 'wet' end (Bundle 9) were much milder than those requested by the controller.

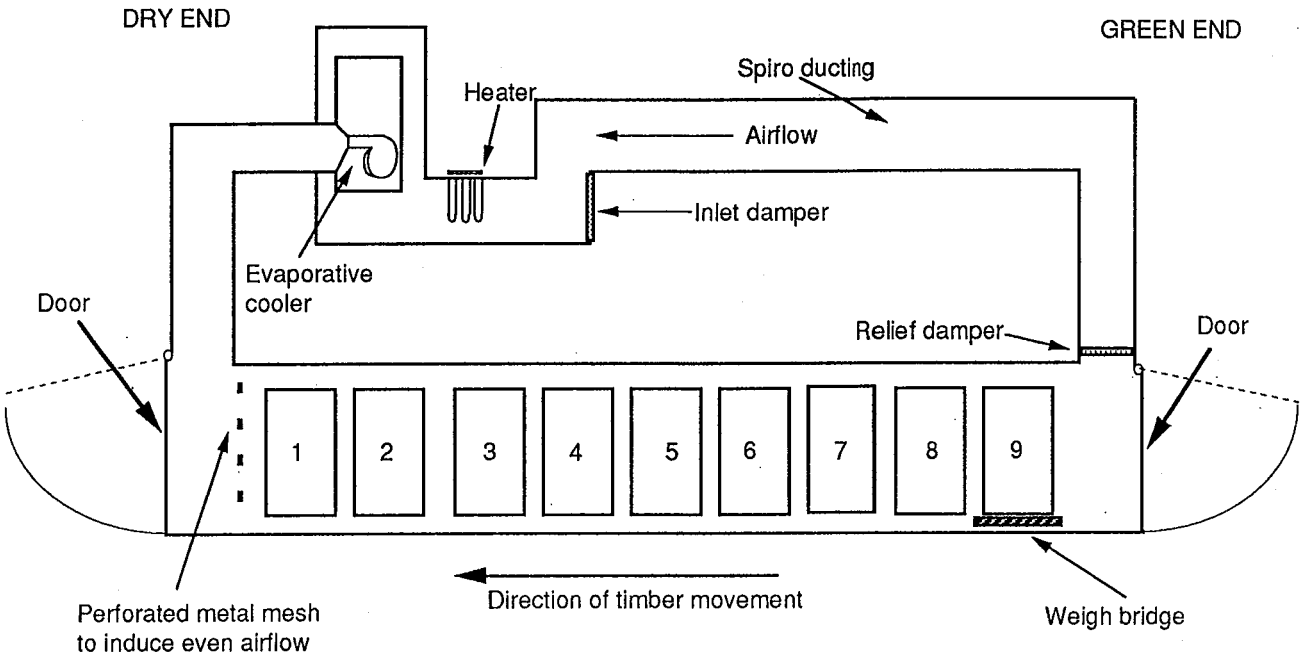
Table 1
Schedule for tunnel kiln drying of 25 mm thick marri

Date	Dry bulb (°C)	WBD (°C)	Humidity (%)	Air Speed (m/s)
14/9/88	20	1.0	92	0.5
10/10/88	20	1.9	82	0.5
19/10/88	20	2.3	78	0.5
21/11/88	30	2.9	78	0.5
28/11/88	30	3.2	76	0.5
4/1/89	40	4.75	72	0.5
30/1/89	kiln turned off			

WBD = wet bulb depression

Figure 1.

Layout of No 2 tunnel kiln at the W.U.R.C., used in the present marri trial



The schedule used was based on results from batch kiln trials of drying regrowth jarrah (*E. marginata* Donn ex Sm.) (Brennan and Glossop, unpublished data). During drying, monitoring of the two end bundles (Bundles 1 and 9) (Fig. 1) was carried out by removing these bundles from the kiln and weighing the residual boards. The progressive weights of the residual boards were used in the following formula to estimate the moisture contents (CSIR 1947).

$$MC = \frac{WT\,(1 + OMC/100)}{GW} \times 100$$

where MC = Moisture content at time of sampling (%)
WT = Weight of residual board at time of sampling (g)
OMC= Oven dried initial moisture content (%)
GW = Green weight of residual board (g)

After the moisture contents reached the fibre saturation point (f.s.p.), the kiln charge was removed and samples were taken for oven-drying, before final drying was done.

An assessment of checking was carried out at the f.s.p. stage on Bundles 1, 6 and 9 (Fig. 1). Draft 3 of the W.U.R.C. grading rules (Appendix 1) was used for the assessment. The phantom docking method was used, which identified the proportion of each grade in the individual board without actually docking the piece.

RESULTS AND DISCUSSION

The drying data in this report only cover the seasoning from green to f.s.p., as drying from f.s.p. to final moisture content was carried out using a conventional high temperature drying schedule as used for jarrah. The schedule was to increase the temperature up to 100°C in about 4 hours, and reconditioning by steaming for 2 hours after the timber dried below e.m.c.

The humidity in the tunnel kiln was kept high with a low air speed (Table 1). Because of the tunnel kiln effect (as the air gets further from the fan end the conditions get milder because the air picks up moisture from the timber), condensation occurred at the loading end of the kiln (Fig. 1), which assisted attack of the sapwood by sapstaining fungi. This could be minimised in a different type of kiln where condensation can be controlled.

As shown in Table 2, the moisture loss over weeks 1 to 8 was minimal (an average of 0.3 per cent per day). The drying process could be speeded up considerably, without being detrimental to the timber, by altering the conditions sooner.

Table 2
Mean moisture content (MC) and drying rates in Bundles 1 and 9

Date	Bundle 9		Bundle 1	
	Mean MC (%)	Mean dry rate (%/day)	Mean MC (%)	Mean dry rate (%/day)
14/9/88	76.5	-	87.1	-
18/10/88	77.7	0.3	73.5	3.4
26/10/88	76.8	0.1	63.9	1.2
10/11/88	72.7	0.3	52.7	0.7
17/11/88	66.8	0.8	47.1	0.8
24/11/88	61.5	0.8	39.7	1.1
2/12/88	54.2	0.9	31.2	1.1
9/12/88	49.8	0.6	28.9	0.3
30/12/88	38.2	0.6	21.7	0.3
10/1/89	31.3	0.6	17.9	0.3
2/2/89	12.7	0.8	11.0	0.3
14/2/89	11.2	0.1	10.9	0

The assessment of face checking (Table 3) was carried out on bundles from each end of the kiln as well as one bundle from near the centre of the kiln (Bundles 1, 6 and 9). The results clearly showed more degrade at the fan end (Bundle 1) with the level of degrade more than double that at the loading end (Bundle 9). The dry end of the kiln was exposed to more sunlight because of the orientation and location of the kiln, which must be taken into account when interpreting these results. The very low percentage of checks in Bundle 6 is apparently a result of the sampling procedure.

Table 3
Survey of face checking in marri boards

Bundle No.	Total Boards	Face Checked	Percentage Checked
1	85	24	28.2
6	72	10	3.8
9	91	11	12.1

Grading results (Table 4) were reasonable, with 38 per cent being in the high value Clear and Feature grades, 18 per cent in Processing grade, and 43.1 per cent in Merchantable grade. (i.e. more than 50 per cent was a higher grade than Merchantable). Table 5 shows that the greatest amount of degrade was from gum, with 69.5 per cent of all boards graded having either gum veins, both tight and loose, or gum pockets. The next worst defect was borer damage with 15.8 per cent.

Table 4
Grading recovery results using W.U.R.C. grading rules

Grade	Volume (m^3)	Percentage recovery
Clear	0.740	20.7
Feature	0.616	17.3
Processing	0.650	18.2
Merchantable	1.540	43.1
Reject	0.025	0.7
TOTAL	3.570	100.0

One notable aspect was that while the face checking survey (Table 3) showed an average of 14.7 per cent of boards had face checks, only 7.5 per cent of the final planed product was affected severely enough by checking to be degraded. This could be explained by the removal of surface checks when planing, implying that the checks were shallow in the first place or that minor checks had closed up during high temperature kilning. Another possibility is that the allowance for checks in the grade rules (Appendix 1) is generous, resulting in minor checks not being recorded.

Table 5
Tally of defects causing downgrading

Defect	No. boards	Percentage boards
Gum	761	69.5
Borers	173	15.8
Surface checks	82	7.5
Stain	56	5.1
Shakes	34	3.1
Sapwood	32	2.9
Knots	26	2.4
Wane	22	2.0
Birdseyes	13	1.2
Pinholes	4	0.4
Bow	3	0.3
Cupping	2	0.2
Heart	1	0.1

Note: The total number of phantom docked boards was 1095 and any board could have more than one defect.

The other defects were fairly insignificant, and could often be found in associations. Consequently the number of defects is greater than the number of boards. For example, a number of the boards containing knots had borers associated with them, and most of the boards containing wane, sapwood and stain could be grouped together.

The above results show the advantages of drying selected marri boards to produce high quality seasoned timber, because very little of the degrade observed was due to seasoning. The seasoning of this timber must be slow, and undue stress must not be placed on the timber at the start of the seasoning process. However, the schedule used in this trial was too mild, and fungal attack in the early stages led to sapstaining which could be eliminated by reducing the relative humidity earlier.

Owing to the prevalence of kino in run-of-the-mill marri, the drying of this species will probably be limited to individual users seasoning their own sawn timber, but careful selection of boards reduces the incidence of kino to an acceptable level. The economic viability of drying marri would need to be proven, but with careful drying there should be a market for this light coloured, easily worked timber. The profitability of marri could be improved by the promotion of kino veins as a feature, which may lead to a greater demand for this material.

REFERENCES

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APPENDIX 1

SPECIFICATION FOR GRADING REGROWTH EUCALYPTS DRAFT NO 3

These grade rules are intended for use with regrowth eucalypts, particularly jarrah. However, material from mature trees may also be graded to these rules.

The rules are intended for use in the sorting of dry, pre-dressed boards into 1 of 4 grades. The sizes are based on the optimum metric size taking account of increased shrinkage, section and length requirements of the appearance grade markets. Also the ability of the log resource to produce these sizes.

The grades will be known as:

CLEAR GRADE
FEATURE GRADE
PROCESSING GRADE
MERCHANTABLE GRADE.

These grades will apply to sections dressed to +2 mm over the finished size of 10 mm, 30 mm, 40 mm, 60 mm, 80 mm 100 mm, 150 mm, 180 mm.

Lengths will range from 0.6 m up to increment of 0.3 m to a maximum of 3.6 m. Timber must be seasoned to 10 per cent MC or below.

Each piece will be free of:

* Compression failures and other fractures including brittle heart and shake
* Decay and included bark
* End splits.

CLEAR GRADE

Clear grade, as the name implies, will be clear of all imperfections excepting sapwood which may occur on the back faces and up to 3/4 of the width of each edge. Sapwood within these limits will be accepted for the full length of the piece.

FEATURE GRADE

Will carry features to the following limits:

* **Sapwood:** No limit on 1 face or 2 edges. Other face must by clear of sapwood.
* **Branch occlusions** or **Birds eye**: Sound, intergrown with seasoning splits up to 1 mm wide confined within the area of the feature.

* **Surface checks**: Length of individual checks not exceeding 200 mm. Width less than 1 mm. Only one check in any 50 mm width board face.
* **Knots:** Intergrown and sound not exceeding 1/2 the width of the face or 50 mm (measured at right angles to arrises). Separated in length by twice the width of the face.
* **Knot occlusions or holes:** Free from bark and decay.

Associated voids not to exceed more than 25 mm^2, frequency as for knots.

* **Tight Gum Veins:** As for surface checks.
* **Pin Holes:** Clean edge less than 1 mm diameter. Not more than 10 holes in 10 000 mm^2.
* **Grub Holes:** Clean edge up to 100 mm^2. Can occur on one face or one edge. Not more than 1/lineal metre.
* **Bow and Spring:** Maximum of 2 mm in any length up to 1.8 m.
* **Skip and Machine marks:** Less than 1 mm deep on either face or edge.

PROCESSING GRADE

Acceptable features.

* **Sapwood:** Unlimited.
* **Birds eye:** Unlimited.
* **Surface checks:** Up to 300 mm long. 1 mm wide. One check in any 50 mm width of face. Can occur on both faces.
* **Knots**: Intergrown from bark and decay. May contain fractures or voids up to 200 mm^2. Frequency unlimited.
* **Knots occlusions or holes:** Free from bark and decay not exceeding 200 mm^2.
* **Gum Veins:** 3 mm in width maximum of 500 mm in length intergrown.
* **Gum Pockets or Streaks:** As for knots and holes.
* **Bow and Spring:** 5 mm in any length up to 1.8 m.
* **Skip or machine damage:** On one face only not to exceed 2 mm.
  On two faces not to exceed 1 mm.
* **Pin Holes:** Up to 2 mm in diameter not more than 20 in any 10 000 mm^2.
* **Grub Holes:** Clean edge up to 100 mm^2.

MERCHANTABLE GRADE

May contain features in excess of the above grades but must maintain structural integrity.