TIMBER PROPERTIES AND MARKET POTENTIAL OF KARRI OAK (*Allocasuarina decussata*)

J.A. Pitcher and G.R. Siemon

1996

Department of Conservation and Land Management

CALM Timber Technology

Weir Road
Harvey WA 6220

Phone (08) 9729 1913
Fax (08) 9729 2063

630.
81
(941)
PIT

TIMBER PROPERTIES AND MARKET POTENTIAL OF KARRI OAK (*Allocasuarina decussata*)

J.A. Pitcher and G.R. Siemon

1996

SUMMARY

Assessment of karri oak (*Allocasuarina decussata*) indicated that sawmilling recoveries were low using traditional methods, but fine kerf bandsaws increased the green sawn recovery significantly from 16.3 per cent with a circular saw to 29.3 per cent. Irregular stem cross-sections resulted in considerable docking of sawn boards being required. Drying can be done satisfactorily with acceptable seasoning degrade.

Wood density and shrinkage were measured. The working properties, gluing properties and visual appeal were assessed and showed good results. However, the major problem was wood quality, because only 18.5 per cent of boards graded for appearance uses conformed with the requirements of the FIF(WA) Industry Standard, equivalent to about 5 per cent of log volume.. The major reasons were knots, rot, heart and borers, with many boards having more than one defect.

These results indicated that economic commercial exploitation would be difficult to achieve unless a 'feature' grade is developed and accepted on the market.

INTRODUCTION

Karri oak (*Allocasuarina decussata*) grows in the south-west of Western Australia. It is a common understorey species in the karri (*E diversicolor*) forests, and also occurs on rocky areas in the South-west. The trees tend to be small with dark brown corky bark, and the logs generally have irregular shape.

The Executive Director requested the Wood Utilisation Research Centre (now Timber Utilisation Centre) to carry out an assessment of the species to consider its potential for specialty timber and other value-added purposes. This report discusses the initial assessment of timber properties, processing behaviour and market potential of karri oak.

METHODS

Sampling:

Seventy-five karri oak logs (about 30 $m^{3)}$ from trees grown in Giblett 8 Block (Pemberton District), and considered representative of the resource, were transported from the Southern Forest Region to the W.U.R.C., where they were stored under water spray for three months

prior to milling. Delivery was delayed because of winter logging restrictions to restrict the spread of dieback and minimise damage to the forest.

Sawmilling:

Log length and small end diameter under bark were measured to determine the log volume, and any irregularly-shaped log ends were recorded as this affected sawn recoveries. A standard quarter sawing pattern was used to emphasise the rays as a feature of the boards, while taking log shape limitations into consideration.

A comparison of green sawn recovery was made using three different sawmilling methods. The first two methods used the 'Forester 150' horizontal bandsaw (kerf of 3 mm) for log breakdown. Further milling i.e. resawing, was done in the first method by using the training bench circular saw, with the comparatively large kerf of 7 mm. The second method used the 'Jonsereds' vertical bandsaw, with a kerf of 3 mm. The third method used a 'Wood Miser' mobile horizontal bandsaw, with a kerf of only 2 mm.

Wherever possible, logs were milled by predominantly quarter sawing into 38 mm thickness timber with widths of 50, 75, 100, 125, 150 or 200 mm, and milling 25 mm boards as a recovery product. A small quantity of woodturning squares of 50 x 50 mm, 75 x 75 mm and 100 x 100 mm were also milled in the second and third methods.

Drying:

Because the sapwood of W.A. sheoak (*Allocasuarina fraseriana*) is known to be susceptible to attack by the powder post borer (*Lyctus* spp.), the sawn karri oak boards were dipped in a boric acid solution as recommended for W.A. sheoak as a precautionary measure.

The sawn timber was block stacked into bundles, dipped in a 0.5 percent (w/w) boric acid solution and covered for approximately two weeks for the chemical to diffuse, to reduce the risk of *Lyctus* attack of the susceptible sapwood. The timber was then strip-stacked into bundles, which were air-dried until space was available in the CALM solar-assisted kilns in March 1995. The drying schedule used in the kiln was the standard jarrah schedule, which initially uses floating temperature and high relative humidity, followed by increasing temperature and decreasing humidity.

Density and shrinkage:

Two sets of twenty-two specimens were prepared for assessment of the following parameters:
(i) Green and basic density.
(ii) Shrinkage and air-dry density.

Each specimen was 60 mm in length and ranged in width from 75 - 125 mm wide, being docked from randomly-selected boards.

Density was estimated using the following equations:

$$\text{Green density} = \frac{\text{green mass}}{\text{green volume}} \ (\text{kg.m}^{-3})$$

$$\text{Basic density} = \frac{\text{oven - dry mass}}{\text{air - dry volume}} \ (\text{kg.m}^{-3})$$

$$\text{Air-dry density} = \frac{\text{air - dry mass}}{\text{air - dry volume}} \ (\text{kg.m}^{-3})$$

The relationship between shrinkage and moisture content was assessed using data from regular measurements of dimensions by Vernier callipers and from weighing. Moisture content at any time is estimated from mass at that time and oven-dry mass of the specimen.

Working behaviour:

Sawing, planing sanding and routing behaviour were assessed qualitatively by inspecting boards, and a rating of 1 = very poor to 5 = excellent applied.

Nailing behaviour was rated on 18 mm thick boards, using 30 mm long 2 mm diameter steel nails which were hammered in 20 mm from the end of the board (i.e. a distance equivalent to ten times the nail diameter).

Gluing properties:

Two laminates (one 2.4 m and one 1.5 m) were produced by edge-gluing boards using urea formaldehyde adhesive ('Grasp') in an 'Orma' glue-press (vertical pressure 10.3 MPa, and pressing time of 15 minutes). Six other laminates were glued with a pressing time of seven minutes.

Dry cleavage tests were carried out to assess gluelines, using the specifications of Australian Standard AS1328-1987 (Standards Association of Australia 1987).

Visual appeal:

The timber was rated for colour by using the Methuen 'Handbook of Colour', using two observers.

Wood quality:

Dried dressed boards were graded using the FIF(WA) (1992) 'Industry standard for seasoned, sawn and skip-dressed W.A. hardwoods', which separates 'Prime' and 'Standard' grades.

RESULTS

Sampling:

As discussed previously, the material came from a single block (Giblett 8 in Pemberton District), but log quality was considered representative of the karri oak resource in the Southern Forest Region.

Sawmilling:

The green sawn recoveries of karri oak milled by the three different milling methods were as follows (Table 1):

Table 1
Sawn recoveries of karri oak using different milling methods

Method used	No. logs	S.e.d.u.b. (mm)			Σ log volume (m^3)	Green sawn % recovery
		Mean	S.D.	Range		
Circular saw	8	360	85	240-490	3.752	16.3
Vertical bandsaw	22	330	80	200-510	5.812	16.6
Mobile horizontal bandsaw	45	295	75	170-460	11.28	29.3

Irregular shape of logs of any species is obviously a problem when sawmilling, because sawn recoveries are consequently reduced.

Drying:

The mean initial moisture content of 22 specimens was 85.1 per cent (S.D. 5.7 per cent).

During the air drying phase, the strip-stacked bundles of boards held in the storage shed until drying space was available in the CALM solar-assisted kiln had some problems with degrade occurring. The thicker boards developed some surface checking, and those containing heart tended to have severe end-splitting.

Density and shrinkage:

The mean values of green, basic and air-dry densities for karri oak are given in Table 2.

Table 2
Mean green, basic and air-dry density of karri oak (kg m^{-3})

GREEN			BASIC			AIR-DRY		
Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range
1188.3	19.3	1152-1228	639.2	23.8	601-669	839.5	53.5	768-961

The shrinkage values given are based on measurements of specimens from the width and thickness of boards, where the orientation of the growth rings can vary. In addition, truly back-sawn specimens were selected to give true tangential and radial shrinkage values (Table 3).

Table 3
Shrinkage of karri oak

Specimens	Tangential		Radial	
	Mean	S.D.	Mean	S.D.
All	7.9	3.3	6.7	5.5
Selected	10.0	1.4	3.7	3.7

The data show that sawn boards would shrink by approximately the same percentage in both width (i.e. tangential) and thickness (i.e. radial), which would be the result of grain orientations varying relative to faces and edges.

The data also indicated that truly backsawn boards would have a tangential : radial shrinkage ratio of 2.7:1, compared with the standard ratio of approximately 2:1 which is quoted widely in the literature. These data confirm that quartersawing sheoak timber has the advantage of low shrinkage across the width as well as attractive ray patterns on that face.

Working behaviour:

The following subjective ratings were given to the major working properties of karri oak (Table 4).

Table 4
Working properties of karri oak
(Rating 1 = very poor to 5 = excellent)

Sawing	Sanding	Planing	Routing
4	4	3	3

Nine quartersawn and nine backsawn boards were assessed for nailing properties, and only one in each category showed minor splitting underneath. This is a 'very good' rating.

Gluing properties:

A strip was docked from each end of each panel for assessment of gluelines, with a total of one hundred and seventy-four gluelines. Only eleven had wood failure of less than 100 per cent, and there were no failures based on the requirements of AS1328-1987. This is an excellent result.

Visual appeal:

The sapwood of karri oak is pale in colour and heartwood is red. The backsawn grain is usually straight, and the quartersawn grain reveals very prominent rays which are a darker red colour. The Methuen 'Handbook of Colour' rating was 5C4 and 6C4.

Wood quality:

The appearance grade timber was assessed using the 'Industry Standard for Seasoned. Sawn and Skip-dressed W.A. Hardwoods' (FIF(WA) 1992). The results showed high incidence of defects, including: borers and associated kino, rot, knots, heart, included bark, cupping and twisting.

A volume of 4.28 m^3 was graded, resulting in only 0.79 m^3 (18.5 per cent) reaching the specification outlined in the Industry Standard (FIF(WA) 1992). The major factors resulting in rejection were included bark, borers, knots, heart, twist and rot (Table 5).

Table 5
Defects resulting in rejection of boards

Defect	**Percentage**	
Borers	17.5	
Bow and spring	1.6	
Cup	11.1	
Collapse	3.2	Clear boards 176
Twist	7.9	One defect 324
End splits, splits	1.7	Two defects 317
Gum	0.	Three defects 48
Heart	8.4	
Included bark	22.4	Total boards 865
Knots	16.8	
Rot	6.2	
Undersize	0.4	
Uneven shrinkage	0.4	
Wane	2.1	

General:

The trial was designed to assess processing and working behaviour of karri oak, and consequently its potential as a specialty timber, as well as to assess basic wood properties. The results showed that it was difficult to produce the longer lengths of sawn karri oak, owing mainly to the irregular shape of the logs and large quantity of decay. This timber is considered to have considerable potential for wood turning, decorative woodwork and small cabinet work, but the economics of production are doubtful because of the extensive occurrence of defects in the form of knots, rot, heart and borers. These defects result in considerably lower dried dressed recoveries using the Industry Standard (FIF(WA) 1992), and a 'feature' grade would be required to improve the economics.

ACKNOWLEDGMENTS

Appreciation is expressed to the Southern Forest Region staff who arranged log harvesting and transport, and to the T.U.C. staff involved in milling, drying and processing, and in some of the assessments.

REFERENCES

FIF(WA) (1992). Industry standard for seasoned, sawn and skip-dressed W.A. hardwoods.

Standards Association of Australia (1987). Glued-laminated structural timber. AS1328-1987.