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IMPROVING THE QUALITY OF WOOD PRODUCED FROM EUCALYPTUS TREES

By

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TABLE OF CONTENTS

SUMMARY

1. INTRODUCTION

2. COMMON DEFECTS IN EUCALYPTUS WOOD

2.1 End splitting and surface checking

2.2 Brittle heart

2.3 Shake

2.4 Springing

2.5 Tangential shrinkage & collapse

3. THE CAUSE OF END SPLITTING AND SURFACE CHECKING IN EUCALYPTUS WOOD

4. CONTROL OF END SPLITTING AND SURFACE CHECKING IN EUCALYPTUS WOOD

4.1 Reducing the growth stresses in living trees before felling

4.1.1 Decreasing the rotation age

4.1.2 Decreasing the growth rate of a tree

4.1.3 Girdling the standing trees

4.1.4 Girdling the trees after felling

4.1.5 Circumferential grooving of trees after felling

4.1.6 The Australian Method of dealing with growth stresses

4.2 Reducing the splitting and surface checking in logs

4.2.2 Fixing iron rings on the ends of logs

4.2.3 Painting the ends of logs

4.2.4 Storing the logs in water

4.2.5 Storing the logs under water spray

4.3 Controlling springing or longitudinal warping of planks

4.4 Controlling wood damages caused by pith and brittle heart

4.5 Controlling excessive shrinkage in planks

4.6. Decreasing wood losses caused by shake

5. TECHNIQUES FOR SAWING EUCALYPTUS LOGS, THEIR ADVANTAGES AND DISADVANTAGES

5.1 Flat sawing technique

5.1.1 Advantages

5.1.2 Disadvantages

5.2 Quarter sawing

5.2.1 Advantages

5.2.2 Disadvantages

IMPROVING THE QUALITY OF WOOD PRODUCED FROM EUCALYPTUS TREES

Summary

Eucalyptus camaldulensis trees are being grown on a large scale by the forest departments and farmers in Pakistan. The wood produced from these trees requires special processing for improving its quality and recoveries. In this technical note we present a summary of all the current information available about the treatment and handling of eucalyptus trees, logs and planks to ensure improvement in the quality of timber and lumber products.

It is, first of all, important to understand that we are addressing the problems of sawing and processing of trees larger than 15 inches in diameter or older than 12 years of age. Eucalyptus trees of younger or smaller classes are much less affected by these processing problems, although they will occasionally be of concern.

The basic conclusions presented here are that: (1) harvesting during the cool season of the year is best; (2) girdling of large trees before or after felling, circumferential grooving of butts after felling, painting the cross ends of logs, storing the logs in water or under water shower, and fixing iron rings on the ends of logs will help reduce defect caused by growth stress; and (3) quarter-sawing of logs improves the quality of wood produced from Eucalyptus trees.

1. INTRODUCTION

During the past decade in Pakistan, eucalyptus trees have been planted all over the country in arid, semi arid, rain fed and irrigated plantations on forest department and private farm lands. This widely adapted and versatile genus is producing wood fibre at a remarkable rate under widely variable conditions.

Eucalyptus wood has not yet achieved any significant commercial importance other than as fuel. This is mainly because the market has not had substantial experience with processing eucalyptus. Generally it is sold in the form of logs which are neither of proper size nor are cut properly at the time of tree felling and conversion. Furthermore, the logs frequently stay in the open air for long periods before they are sawn into planks. As a result the wood deteriorates very badly. The logs on one hand are difficult to saw and on the other hand huge quantities of wood are wasted before reaching specific end uses.

Most wood users in Pakistan are unaware of the special properties of eucalyptus wood, its drying behaviour and conversion techniques which demand proper attention and care. The world wide experience with this wood indicates that proper felling, conversion, drying and sawing techniques improve the wood quality and increase its value. This technical note is intended to serve as a handy guide to help wood users to produce good quality lumber from eucalyptus trees of more than 15 inches in diameter or more than 12 years of age.

2. COMMON DEFECTS IN EUCALYPTUS WOOD

2.1 End splitting and surface checking (Fig. 1)

Logs develop end splits and surface checks when they are allowed to stay in the open air unprotected. The intensity of these defects increases with the passage of time resulting in wood deterioration and causing heavy losses during sawing into planks. Serious end splits and surface checks also develop in planks if they are not properly dried.

2.2 Brittle heart and pith (Fig. 2)

Brittle heart is the weaker wood present near the pith of a tree. A plank having brittle heart is very weak at this place and deteriorates badly during drying. It has been observed that wood scants having brittle heart break while throwing down from a truck during unloading. Unlike many other wood species, the pith and brittle heart of eucalyptus need to be removed from timber and can only be used as a fibre source or for fuel.

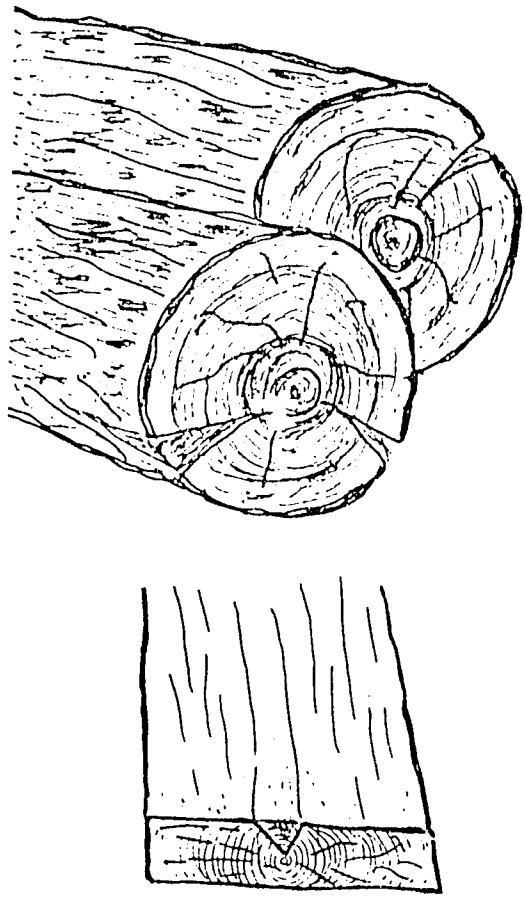

Figure 1: End splitting and surface checking in logs and planks.

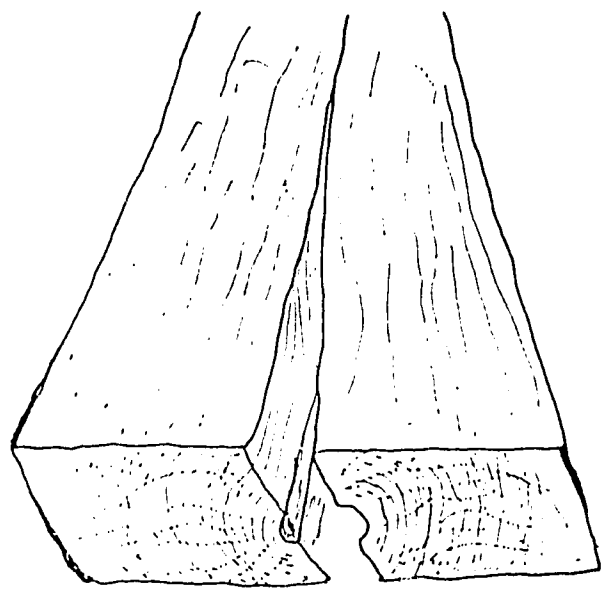

Figure 2: End splitting in a plank caused by pith and brittle heart.

2.3 Shake (Fig. 3)

Sometimes a star shaped split called shake develops on the cross ends of a log because of release of growth stresses and rapid drying. A shake has two or more splits emerging from a common base. The individual splits are wider at the base and taper toward their ends. If the logs containing shake are not sawn into planks properly, considerable quantity of wood is wasted, especially when the shakes at both the ends are not in line with each other.

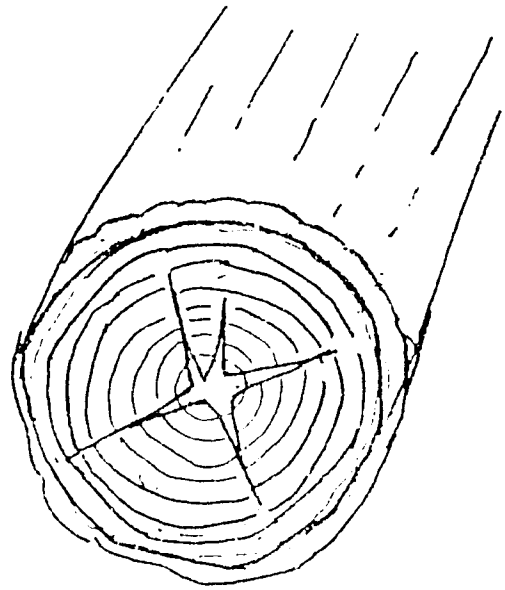

Figure 3: Shake or star-shaped end split in a log.

2.4 Springing (Fig. 4)

Sometimes the planks warp in the longitudinal direction right after sawing or during the drying process. This longitudinal deformity is called springing. If growth stresses in the tree or log are decreased in some way, springing is controlled or reduced. A plank having springing defect hinders proper planing of boards and results in considerable wastage of wood.

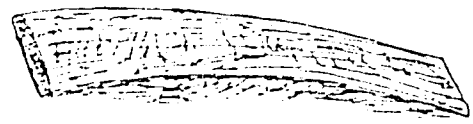

Figure 4: Springing (longitudinal warping).

2.5 Tangential Shrinkage and Collapse (Fig. 5)

Some planks shrink more than others. Flat sawn planks shrink more than quarter sawn planks. This is because in flat sawn planks tangential surfaces are exposed which shrink more than radial surfaces. Furthermore, the presence of pith and brittle heart in planks causes surface ruptures, surface defectss and unequal drying. The higher tangential shrinkage and collapse are serious defects which can only be controlled by removal of brittle heart and pith, and by using proper sawing technique.

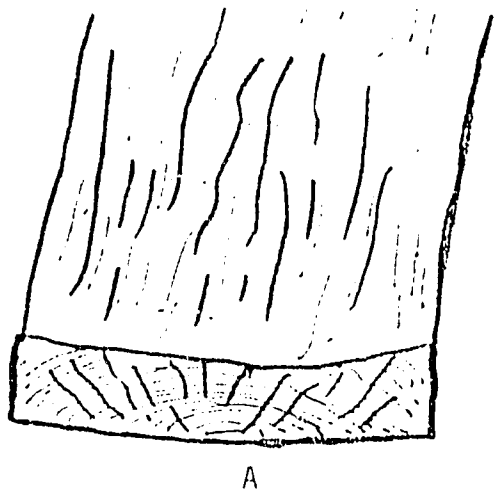

Figure 5: Tangential shrinkage (A) and collapse (B) in planks.

3. THE CAUSES OF END SPLITTING AND SURFACE CHECKING IN EUCALYPTUS WOOD

The main causes of end splitting and surface checking in logs are the growth stresses present in a living tree. Most of these growth stresses release abruptly when the tree is felled. However, some stresses are held within the log and cause damage when released through sawing. As a result of these stresses the outer portions of a log are under tension and the central portion is in compression. In between the tension and compression zones is a neutral zone. All these zones exist in circular forms in the cross section of a log (Fig. 6).

When a tree is felled and cut into logs these stresses start releasing. When a log is sawn into flitches or planks, the outer zone shrinks and inner zone relaxes or expands, causing end splits and longitudinal warping. The growth stresses in a tree are the result of fast rate of growth. Some individual trees have higher intensity growth stresses and some low. The higher intensity growth stresses are detrimental to the quality of wood. They are the cause of a high amount of sawing and seasoning defect. It is the interlocking nature of wood grain in addition to higher level of growth stresses which deteriorates the eucalyptus wood during drying.

Growth stresses are a natural phenomenon in a living tree and cannot be completely controlled or reduced. However, the damages caused by them can be controlled to some extent by applying certain techniques and the quality of lumber produced from eucalyptus can be improved.

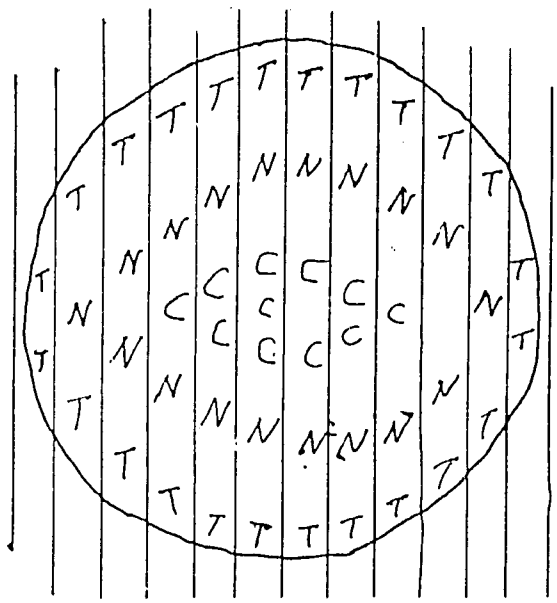

Figure 6: Points of growth stresses in a log;
C = compression zone
N = neutral zone
T = tension zone

4. CONTROL OF END SPLITTING AND SURFACE CHECKING IN EUCALYPTUS WOOD

End splitting and surface checking in eucalyptus wood can be partly controlled by reducing the growth stresses occuring in living trees as well as in logs. There are a large number of techniques for controlling growth stresses at different stages i.e., in a standing trees before and after felling, in logs during transit and storage, during sawing of logs and drying of poles.

4.1 Reducing the growth stresses in living trees before felling

A living tree which is to be felled for producing sawn material and poles should be specially treated for avoiding hazards of wood deteriorating defects such as end splits, surface checks, cracks and shakes, etc. Proper treatments reduce the rate of growth and in turn decrease the rate of stress release. When such a tree is felled and converted into logs, planks, etc., the damages are considerably reduced. Although there are several techniques for controlling stress release, the choice of a technique depends upon the age of the tree, intensity of growth stresses, species, etc. Some commonly used techniques for reducing growth stresses in trees are described below.

4.1.1 Decreasing the age at harvest

Reducing the rotation (harvest) age of trees helps in reducing the growth stresses, i.e., the younger trees have lower intensity of growth stresses as compared to older ones. Trees felled at the age of about 10 years produce better quality round timber as compared to older ones. To avoid end splitting in poles made from 10 year old trees, it is recommended to dry the poles slowly under shade after removing their bark.

4.1.2 Seasonal variation in the growth rate of a tree

The growth rate of a tree varies during different seasons in a year, e.g., in autumn and winter the growth rate is lesser than in spring and summer. So, trees felled in autumn and winter produce better quality timber than in spring and summer.

4.1.3 Girdling the standing trees (Fig. 7)

If the bark is removed from the trunk of a standing tree, in the form of a ring at the butt end, the growth rate is decreased in addition to partial release of growth stresses. This technique is called girdling. The girdled trees may die with the passage of time resulting in improving the quality of wood. This is because the trees die slowly and the growth stresses are released slowly. Eucalyptus trees 20-30 years old need girdling before felling for obtaining better quality wood. When

trees are girdled, felling is usually delayed until the leaves have turned brown and begun to fall away. This is an indication that the tree is dead and that some drying of the wood has already started.

The girdled trees may suffer from termite attack because of exposure of sapwood. This hazard increases as the tree dies away. After girdling, some insecticidal spray on the girdled portion can provide protection against termites.

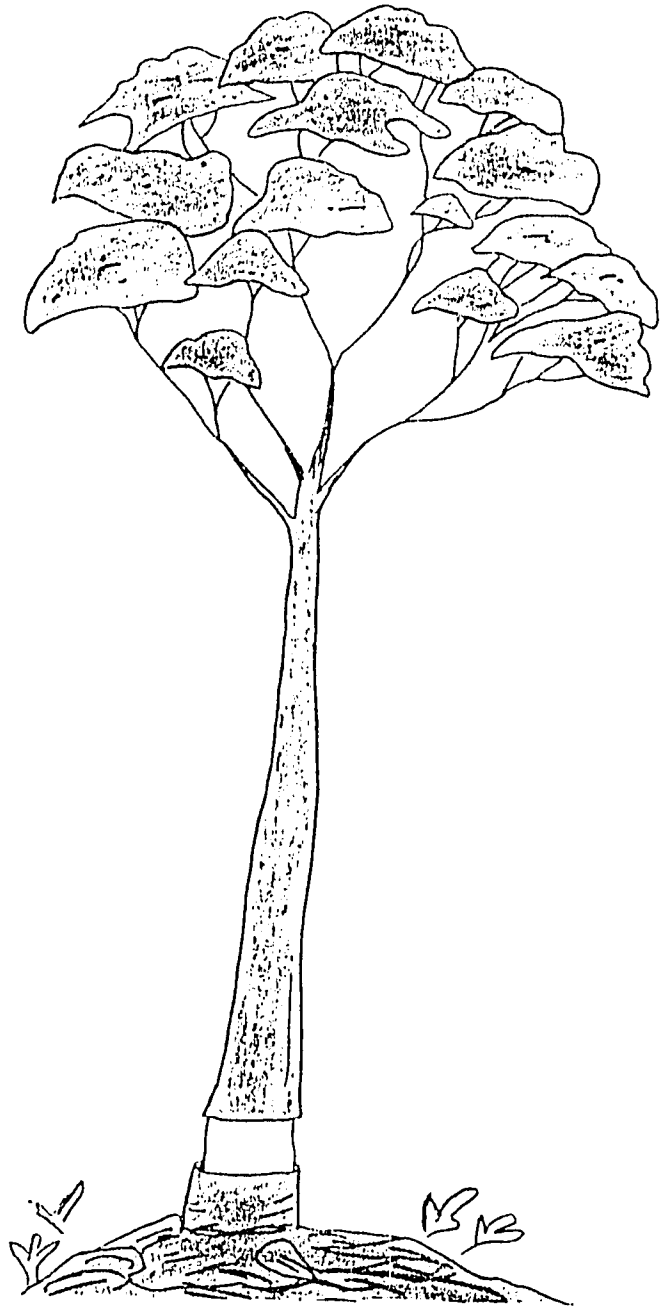

Figure 7: Bark girdling of a standing tree.

4.1.4 Girdling the trees after felling (Fig. 8)

If a tree is debarked after felling by leaving 30 cm long bark ring at the butt end, the growth stresses are released slowly. If such trees are dried under shade for at least six months before conversion into planks, the quality of timber is considrably improved.

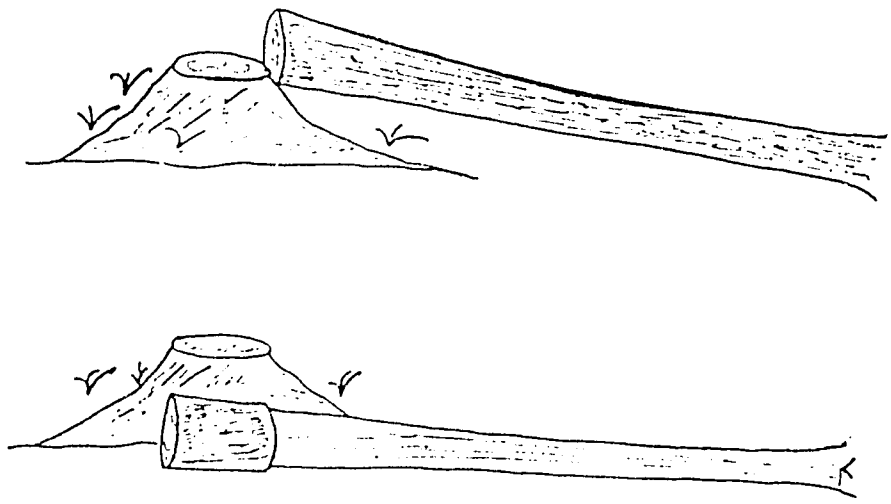

Figure 8: Bark girdling of a felled tree.

4.1.5 Circumferential grooving of trees after felling (Fig.9)

After felling a tree, if the trunk is grooved along its circumference at two or more places, end splitting is considerably reduced. The recommended specifications of grooves are:

a) distance of first groove from the end = 25 cm

b) distance between adjacent grooves = 25 cm and above

c) width of a groove = 25 mm and above

d) depth of a groove = 1/3rd of log radius

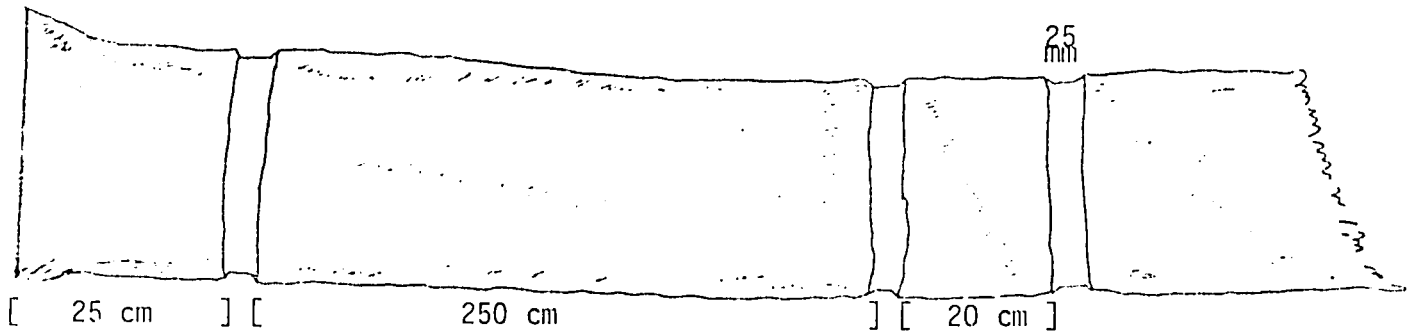

Figure 9: Circumferential grooving of a tree after felling.

4.1.6 The Australian Method of dealing with growth stresses

Years of practical experience with eucalyptus in Australia have shown that severe growth stresses cannot be seen in most trees prior to cutting and sawing. They have found that the most practical way of obtaining good quality lumber from eucalyptus is to split the log exactly through the center pith with the first cut on the sawmill. Logs with high growth stress will immediately twist or curve as a result of this release of the stress. If the amount of twist or curvature in the pieces produced is acceptable for making the kind of lumber you want to produce, then continue sawing. If the twist or curvature is too much, throw the log aside for chipboard or fuelwood, and try another one. You can't make good lumber out of bad logs.

4.2 REDUCING END SPLITTING AND SURFACE CHECKING IN LOGS

By applying certain treatment to logs, end splitting and surface checking can be considerably reduced.

4.2.1 Fixing C or S shaped iron pieces on the ends of a log (Fig. 10)

Fix C or S shaped iron pieces on the cross ends of logs as soon as possible after cutting them from a tree and dry them in open air. After drying, remove these metallic devices from the logs before sawing them into lumber. It has been observed that wood damages are considerably reduced. However, the technique may not be useful in some eucalyptus species.

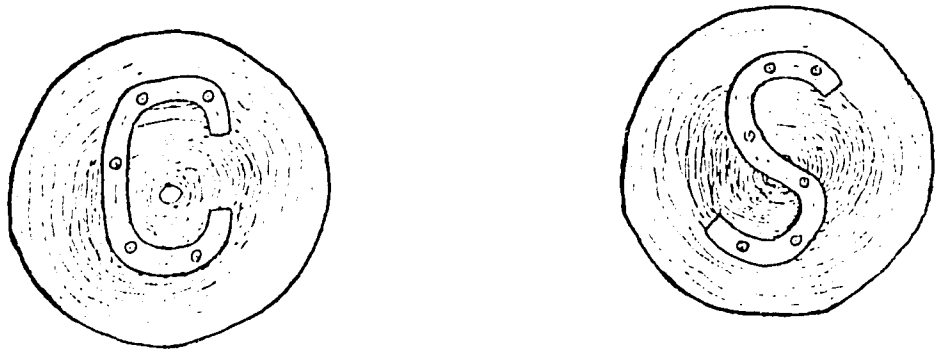

Figure 10: C or S shaped iron pieces fixed on the ends of logs.

4.2.2 Fixing iron rings on the ends of logs (Fig.11)

Immediately after cutting the trunk of a tree into logs, fix iron rings over the bark, on both ends of each log, at a distance of about 25 cm from each end. Allow the logs to dry slowly in shade for 4 to 6 weeks. When the logs dried this way are sawed into planks, end splitting will be considerably reduced. These rings can be made out of iron strap or iron rod and fixed with nails. They should be strong enough to hold the ends tightly.

The metal plates, nails, and rings should be carefully and completely removed prior to sawing to avoid hazards to machinery and workmen.

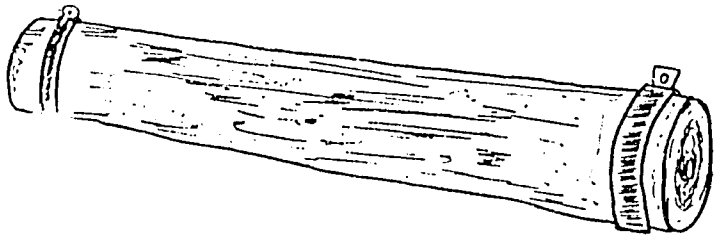

Figure 11: Iron rings fixed on the ends of a log.

4.2.3 Painting the ends of logs (Fig. 12)

Paint the cross cut surfaces of logs as soon as possible after they are cut and allow them to dry in shade. When the logs are sawed into planks, the wood damages are found to be considerably reduced. This happens because paint fills the openings on the cross cut surfaces, decreasing the rate of moisture evaporation as well as the rate of release of growth stresses.

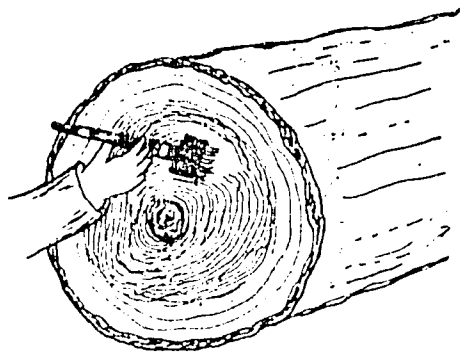

Figure 12: Painting the cross-ends of a log.

4.2.4 Storing the logs in water

If the logs are stored in water soon after cutting, for at least six weeks before sawing into planks, end splitting is reduced. This is especially helpful if the logs are cut during hot weather and would otherwise suffer from rapid and uneven drying.

4.2.5 Storing the logs under water spray

Storing the logs under water spray for at least three to six months before sawing into planks reduces end splitting.

4.3 Controlling springing or longitudinal warping of planks

When planks are sawn from a log, they have the tendency to warp in longtitudinal direction because of growth stresses. The intensity of this defect increases as the planks dry. Such planks are difficult to plane and cause considerable waste while straightening during planing. This defect can be minimized if the log length is decreased.

4.4 Controlling wood damages caused by pith and brittle heart

Planks containing pith and brittle heart show great damages during drying. The only way to avoid these losses is to remove and discard these portions during sawing.

4.5 Controlling excessive shrinkage in planks

The tangential surfaces in planks shrink more as compared to radial. The tangential surfaces are exposed in flat sawn boards and radial surfaces in quarter sawn boards. The excessive shrinkage and movement in eucalyptus timber can be reduced by using quarter-sawing technique.

4.6 Decreasing wood losses caused by shake

If the shakes or star shaped splits are located on both ends in line with each other, the first cut should pass through their base sawing the log into two halves. Then both the log halves are sawn into planks either by flat sawing or quarter-sawing. The ends of the planks may be cut off to remove broken edges.

5. TECHNIQUES FOR SAWING EUCALYPTUS LOGS, THEIR ADVANTAGES AND DISADVANTAGES

There are specialized techniques involving costly and special equipment and machinery for producing good quality sawn products and better recoveries from eucalyptus logs. Owing to the non-availability of such specialized machinery with Pakistani sawmillers, only the techniques suited to the locally available machinery and equipment are described below:

5.1 Flat sawing technique

This is a very simple traditional technique for sawing logs into planks and is understood and used throughout the country. Unfortunately this technique is not useful for sawing wood species like eucalypts because the flat sawn material of this species suffers damages during drying. In flat sawing, a common vertical band saw or a horizontal band saw equipped with trolley is used for converting logs into planks. For sawing large size logs, the horizontal band saw is preferable to the vertical band saw. While sawing a log with the vertical band saw, it is first flattened on one side by sawing off the first outside cut the full length of the log. This flattened side is then turned down to provide a guide surface, and the log is then sawed into planks of the desired thickness.

While sawing with the horizontal band saw, the log is fixed on the trolley. The saw blade height is adjusted according to the desired thickness of the plank to be cut. The trolley is moved forward after the saw starts running. After the first plank is cut, the trolley is moved backward and the height of the saw blade is again adjusted and further sawing is done accordingly. The outline of different cuts during flat-sawing of logs on vertical band saw and horizontal trolley band saw is shown in Fig. 13.

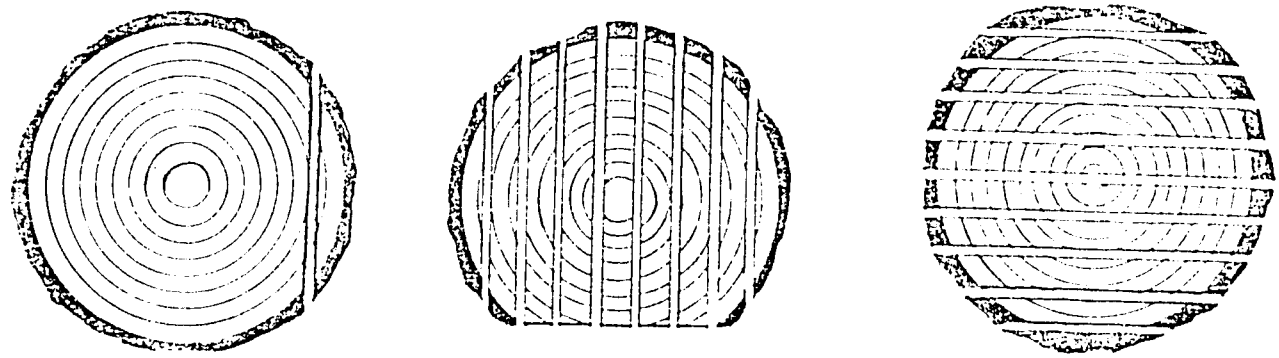

Figure 13: Flat sawing of a log;
(a) line of first cut to flatten log (vertical saw),
(b) remaining vertical cuts after turning log,
(c) line of cuts (from top) using horizontal saw.

The advantages and disadvantages of flat sawing technique and flat sawn material are given below.

5.1.1 Advantages

-It is easy to cut flat sawn boards

-The process is quick and does not involve any complications for handling timber.

-Flat sawn boards are wider than quarter sawn boards.

-They contain attractive figures caused by the alignment of grains.

5.1.2 Disadvantages

-The boards have tangential surfaces which swell and shrink more than radial surfaces.

-The flat sawn boards suffer from excessive shrinkage causing damages like end splitting. Hence lesser recoveries from a log are obtained.

-Because of greater movement in flat sawn timber under the influence of weather changes, different fixtures in a stucture move excessively resulting in some damages.

5.2. Quarter-sawing technique

This technique is not commonly used as it is slow, difficult, and complicated. But it is very useful in problematic species like eucalypts. The same machinery used in flat sawing is used in quarter-sawing.

While quarter-sawing a log, it is cut into two halves each of which is then again cut to make quarters. Each quarter is then converted into desired thickness planks with a vertical band saw. In case of small size logs, both halving and quartering operations can be carried out on a vertical band saw. In case of larger size logs, the first two halves should preferably be cut with horizontal band saw to avoid accidents and discomforts, and quartering and further conversions done with a vertical band saw. The outlines of different cuts during quarter-sawing of a log on horizontal and vertical band saws are shown in Figure 14.

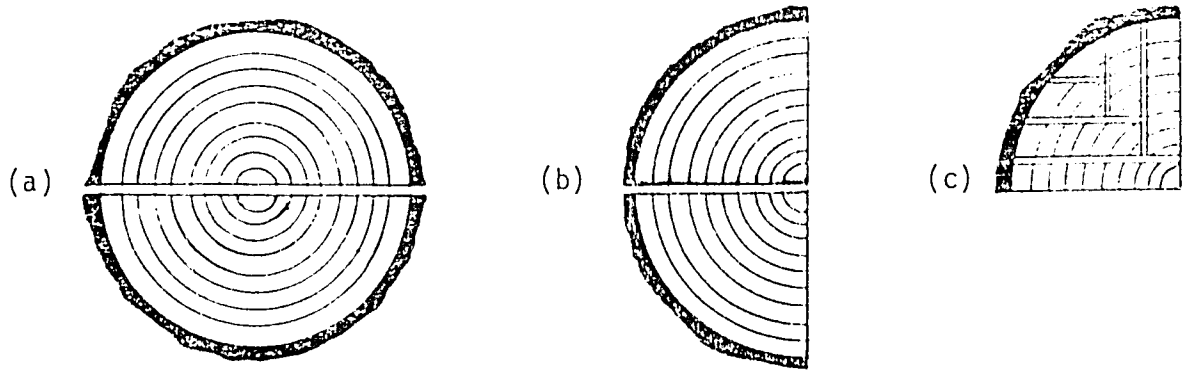

Figure 14: Quarter sawing of a log;
(a) line of first cut (horizontal saw),
(b) line of second cut,
(c) line of quartered cuts.

The advantages and disadvantages of quarter-sawing are given below.

5.2.1 Advantages

-The quarter sawn boards have radial surfaces which shrink less as compared to flat sawn boards during drying.

-The quarter sawn boards suffer less quality degrade because of less shrinkage.

-A structure made from quarter sawn material is expected to have less damages during service. This is because the seasoned lumber is more stable and less affected by variations in moisture.

-Quarter sawn boards develop lesser number of end splits and surface checks as compared to flat sawn boards during drying. Hence better recoveries are obtained from a log.

5.2.2 Disadvantages

-Quarter-sawing is slow, difficult, complicated and may be more costly because it involves frequent turning and re-turning of logs and flitches.

-Quarter sawn boards are narrower than flat sawn boards from the same log.

-Unlike flat sawn boards, quarter sawn boards do not offer attractive figures/surfaces and hence cannot be used in places where surface attraction is needed.

-Quarter sawn boards take longer time to dry because of low rate of moisture evaporation from radial surfaces.

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