

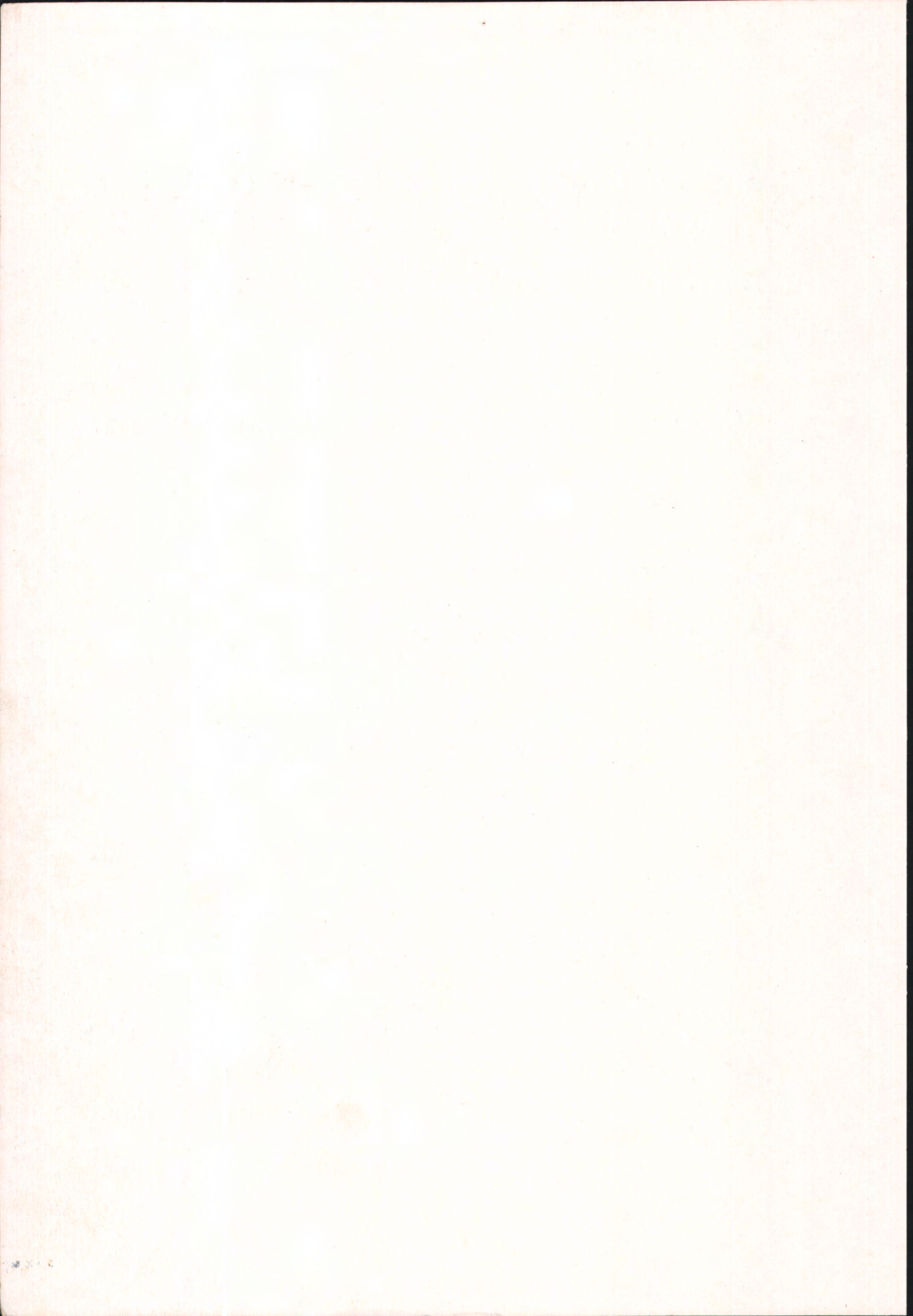
SAWING GUIDELINES

FOR SMALL - SCALE TIMBER PROCESSING



Kenya Forestry Research Institute (KEFRI)
Forest Products Research Centre- Karura

October, 2006



SAWING GUIDELINES

FOR SMALL - SCALE TIMBER PROCESSING

Specially developed

for

Chain Saw, Mobile Saw Bench and Pit Saw Operators in Kenya

By

George Muthike, Joseph Githiomi, and James Onchieku

Illustrations by:

Charles Nyogot

George Muthike

Illustrations on Cover Page:

Top Left: Chain Sawing

Top Right: Bench Sawing

Bottom: Pit sawing

Kenya Forestry Research Institute (KEFRI)

Forest Products Research Centre- Karura

P. O. Box 64636-00620

Nairobi, Kenya

Email: karura@kefri.org

2006

Copyright: © Kenya Forestry Research Institute (KEFRI)

Publisher: Forest Products Research Centre- Karura
P. O. Box 64636-00620
Nairobi, Kenya
Email: karura@kefri.org

ISBN: 9966-776-09-5

All rights reserved. No part of this publication may be reproduced or transmitted in any form or any means, electronically or mechanically, including photocopying, recording or by any information storage or retrieval system, without prior permission in writing from the publisher.

Designed and Printed by:
Downtown Printing Works Ltd. P.O. Box 1724-00100 Nairobi

ACKNOWLEDGEMENTS

The authors wish to thank all the people who were involved in one way or the other in shaping this work at various stages. Thanks go to the scientists at Forest Products Research Centre; Mr. Meshark Muga and Mrs. Nellie Oduor and Dr. Konuche and Dr. Kigomo of KEFRI Muguga, who reviewed the work and gave their invaluable inputs. Greatly appreciated is the KEFRI editorial committee, who reviewed the final draft and shaped it to its present form. Also to the many timber sawyers and forest extension officers throughout the country, who by attending our trainings in improved sawing techniques shared with us useful information which enriched this document. Mr. Charles Nyogot helped greatly in the illustrations.

This publication is an output from research work funded by the Government of Kenya through Farm Forestry Research Programme of KEFRI. The support given throughout the years that this work has been going on is appreciated.

FOREWORD

Small-scale on-farm timber processing is gaining widespread acceptance especially in Kenya as a means of producing timber in small volumes from trees grown on the farms. It is also an important source of livelihood for small logging operators, farmers and timber dealers. However, small-scale timber processing has often been dogged by controversy. Its association with illegal forest harvesting activities, especially in areas bordering government forest plantations and their relatively low timber recovery are the main problems facing the sector.

The main small-scale timber processing methods; chain saws, bench saws and pit saws are relatively inexpensive and portable, thus, timber can be sawn on site without having to transport the logs to the saw mills. They are also very useful in areas where access is limited by terrain and lack of saw mills.

This manual has been prepared not only as a guide for potential operators but also as a skill improvement tool for the current operators. It details step by step the techniques that need to be used when harvesting and sawing timber using the various sawing equipment available in the country, for higher recovery and better quality timber. It concludes by addressing issues related to safety when working with these equipments. It is hoped that this manual will provide useful information on techniques and skills needed in timber sawing.

November, 2006

P. K. A. Konuche
Director-KEFRI

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION.....	1
CHAPTER 2. TREE HARVESTING AND PREPARATION.....	2
2. 1 Felling.....	2
2. 2 De-branching (Removing Branches).....	3
2. 3 Crosscutting.....	3
2. 4 Moving Logs.....	4
CHAPTER 3. SAWING METHODS.....	5
3. 1 Taper Sawing.....	5
3. 2 Split Taper Sawing.....	5
3. 3 Through and through (Slabbing).....	5
3. 4 Quarter sawing.....	6
3. 5 Cant sawing.....	6
CHAPTER 4. USE OF SAWING EQUIPMENTS.....	7
4. 1 Chain Saws.....	7
4. 2 Bench Saw.....	7
4. 3 Pit Sawing.....	8
CHAPTER 5 SAFETY MEASURES IN TIMBER SAWING.....	9
5. 1 Personal protective equipment (PPE).....	9
5. 2 Basic safety Measures.....	9
5. 2. 1 Chain Saws.....	9
5. 2. 2 Saw Bench.....	9
5. 2. 3 Pit Saws.....	9
CHAPTER 6 FURTHER READING.....	10
LIST OF FIGURES	
Fig. 1 Part of tree showing position of sink and back cut.....	2
Fig. 2 Position for removal of branches.....	3
Fig. 3 Measuring and crosscutting of logs.....	4
Fig. 4 Marking Logs for crosscutting.....	4
Fig. 5 Logs Already crosscut.....	4
Fig. 6 Taper sawing.....	5
Fig. 7 Split taper sawing.....	5
Fig. 8 Through and through sawing pattern.....	5
Fig. 9 Quarter sawing.....	6
Fig.10 Cant Sawing.....	6
Fig.11 Tractor Mounted Bench saw.....	8
LIST OF PLATES	
Plate 1 Chain saw method.....	7
Plate 2 Pit sawing.....	8

GLOSSARY

Beam	A long, thick piece of sawn timber
Board	A long, thin flat piece of sawn timber
Cant	A thick piece of timber sawn from a large diameter log for re-sawing
Edge (to)	To remove the round ends of a piece of sawn timber to make it have regular, right angled ends
Pith	The white substance present along the central axis of tree stems
Quarter Sawing	Cutting a log into four pieces along its radius
Saw kerf	The path along which the saw passes when cutting through wood
Slab	A thick piece of wood material cut off the side of a log to make flat surface of the log
Slabbing	Cutting timber into thick flat pieces
Squaring	Cutting off the edges of timber to make regular sides
Taper	A gradual decrease in tree diameter towards the top

CHAPTER 1

INTRODUCTION

Timber sawing is aimed at producing sized timber from round logs. The process requires skill and the right machinery and equipment. Large-scale sawmills as well as small-scale set ups have been used with different levels of success worldwide. In Kenya, while large-scale saw milling found acceptance, small-scale timber processing faced lack of technology and skills. The most common opinion therefore has been that small-scale timber processing methods are wasteful and produce timber with very rough surfaces. These methods may however continue being used on the farms due to their advantages compared to the large-scale saw milling machinery.

Some of the advantages of small-scale timber processing methods is their ability to be used on the same site where the tree falls. This reduces the costs of extracting and moving the logs to a different sawing site. It also greatly reduces the potential environmental damages associated with timber logging practices in the large-scale sector due to the use of heavy logging equipment (Pasicznik et al, 2006). They are also relatively cheap to buy and maintain. There are three main small-scale timber-sawing methods in Kenya; chain sawing, mobile bench sawing and pit sawing. These are used in different areas in single and some times in combination.

Timber recovery is the amount of sized timber obtained from a given amount of logs and is sometimes referred to as sawn timber yield. Majority of the small-scale sawyers in Kenya have limited skills in sawing techniques used to increase timber recovery and quality. Thus, the average recovery is as low as 23% for chain saw operators and about 27% and 39% respectively for bench saw and pit saw operators at the sawing stage (Muthike, 2003a). The actual recovery from the available wood can also be controlled at every stage from tree felling to the timber handling before selling. Since about 50 to 80 percent of total saw milling costs are in terms of raw materials, it is important for the sawyer to recover as much of the raw materials as possible. This calls for a good understanding of recovery rates and the factors influencing it. It is therefore important that mobile saw bench millers, chain saw operators and pit sawyers are educated on how to improve timber recovery and quality.

This manual aims at making available useful skills to sawyers and trainers involved in small-scale on-farm timber processing sector. It offers guidelines on the important steps to take during felling and sawing of timber using the sawing methods available to the sawyers. Equipment maintenance and safety have been included due to their direct influence to timber recovery and quality. By following these guidelines, the sawyer is expected to recover more of the available tree resources into quality, merchantable timber. Training sawyers on these sawing guidelines has resulted in improved timber recovery and quality, hence increases financial gains for both the sawyers and tree owners (Muthike, 2004b). The number of trees cut for sawing at any particular time for sawing is also reduced.

CHAPTER 2

TREE HARVESTING AND PREPARATION

2.1 Felling

- Pre-determine a suitable direction for the tree to fall when cut. This is usually referred to as directional felling. Losses occur when trees fall on hard surfaces causing breaking or splitting of the log or by falling on existing establishments like buildings and overhead conductors (power and telecommunication lines).
- Cut the tree at the lowest possible stump height; maximum 6 inches (150mm) above the ground to maximise on the amount of wood material available for sawing into timber.

To achieve a safe and accurate felling, three cuts are necessary (Figure 1). The first two cuts 1 and 2 take out the sink, which controls the direction of fall. The third cut 3 is the back cut positioned to leave a hinge.

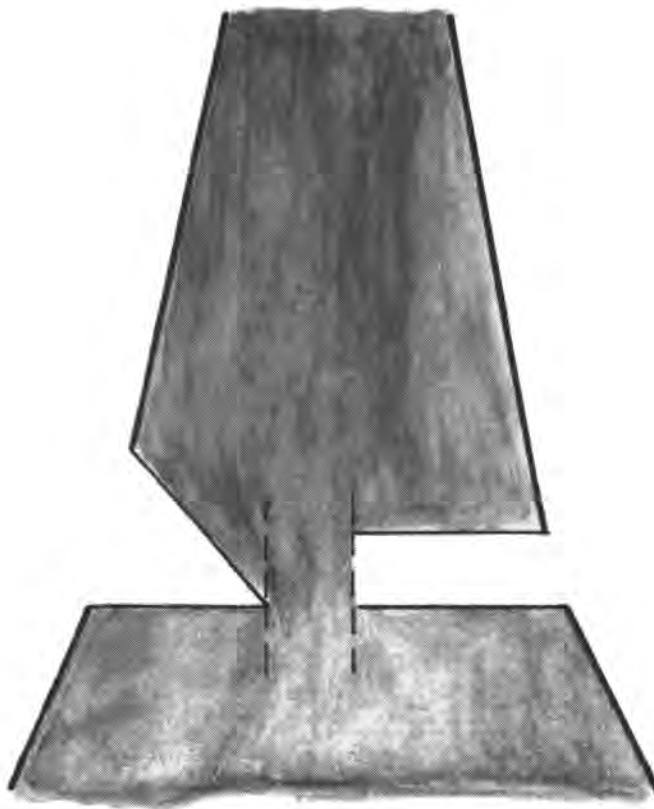


Figure 1. Part of tree showing position of sink and back cut

- Make the sink cut to about $\frac{1}{4}$ of the stem diameter. This limitation is made to leave the tree with enough strength to hold standing until the back cut is made leaving the hinge.
- Make the back cut horizontally or at most 25mm above the base of the sink cut. This should extend to leave an uncut area (hinge), about $\frac{1}{10}$ of the tree diameter, but not less than 25mm between the two cuts. The hinge controls the rate of falling of the tree to avoid sudden falling, which would lead to wood splitting and possible twist from the direction of fall and stem kicking back.

Direction of fall can also be greatly influenced by strong wind and weight of the tree crown (branches). Leaning trees are also difficult to change their direction of fall. The following can however assist if

done before felling the tree.

- Cut and remove heavy branches from the tree. This makes the tree crown lighter and easy to control its direction of fall.
- Tie one end of a rope to a strong branch near the top of the tree and the other end tightly to a tree in the direction of fall. Some times a number of people may pull the rope, but this has to be done with care to avoid the tree falling on them.

Caution: Ensure that all people and animals are as far as at least twice the length of the tree and in the opposite of the expected felling direction.

2. 2 De-branching (Removing Branches)

Poorly de-branched logs can easily roll in any direction, especially if it props on one branch.

- Cut branches at the base from the bottom to the smallest log diameter that can be sawn by the available sawing equipment. Most sawing machines can saw a diameter as small as 150mm.

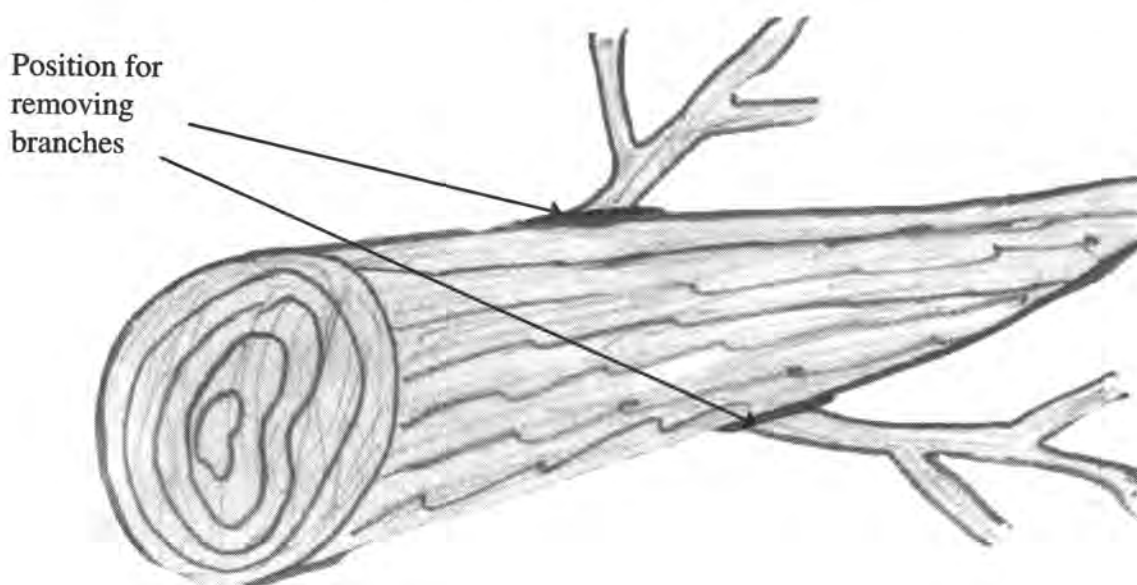


Figure 2. Removal of branches

2. 3 Crosscutting

To divide the tree into shorter logs for sawing, the following steps are necessary;

- Correctly measure the log length taking into consideration market requirements.
- Measure shorter logs if the tree has higher taper or there is a bend to control.
- Add to the required log length sufficient allowance to take care of any slight splitting of sawn timber and for squaring of the finished timber pieces.
- Make the necessary marks to guide the machine operator in crosscutting.
- Crosscut accurately guided by the marks.

Timber recovery increase with increasing log length up to 4 metres. Logs with lengths beyond 4 metres produce many short pieces of timber during sawing, especially in species like cypress and grevillea, which have pronounced taper. It is also important to remove bends to get fairly straight logs for ease of sawing (Figures 3, 4 and 5).

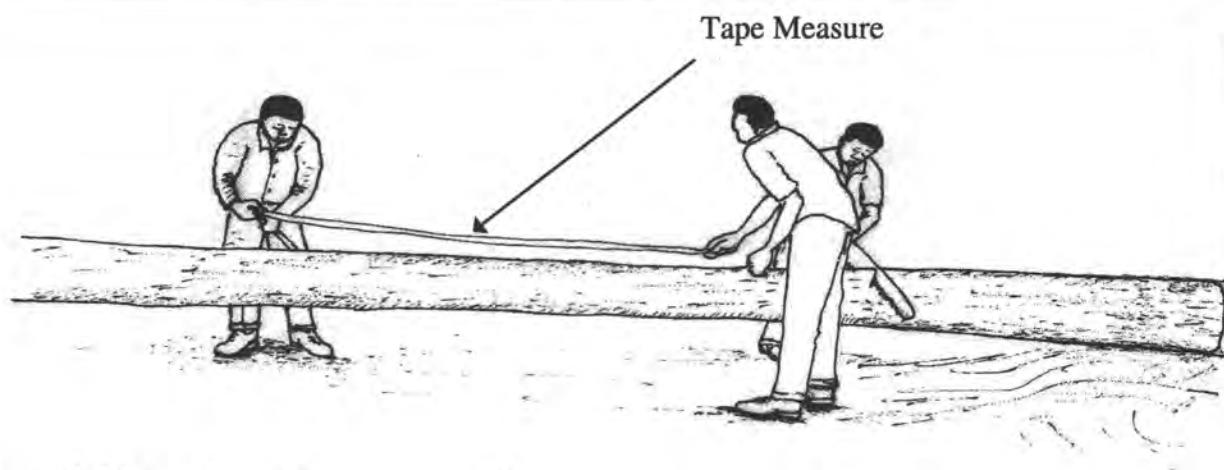


Figure 3. Measuring and crosscutting of logs

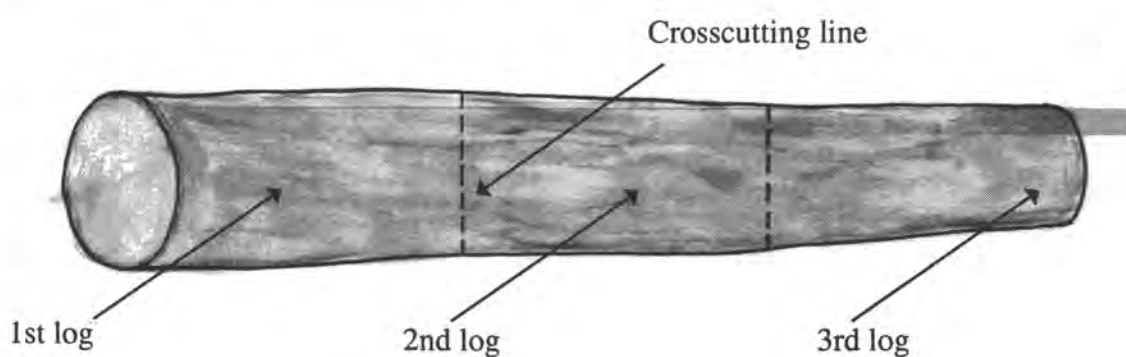


Figure 4. Marking Logs for crosscutting

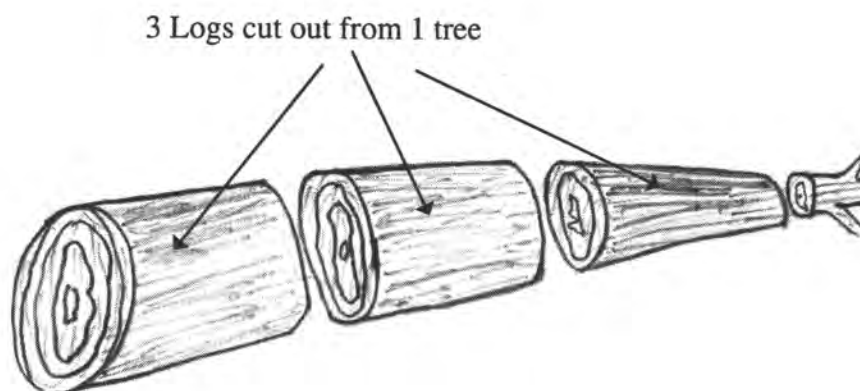


Figure 5. Logs already crosscut

2. 4 Moving Logs

- Move logs from the cross cutting site to an area, where the sawing equipments can be set.
- Carry logs off the ground instead of rolling or skidding. Off the ground carrying avoids getting logs dirty, muddy or sandy. Dirt, mud and/or sand lowers the sawing speed and recovery rate due to:
 - Damage and wear of saw teeth
 - Poor exposure of logs (making defects invisible)
 - Difficulty in handling, which leads to log wobbling during sawing

CHAPTER 3

SAWING METHODS

3.1 Taper Sawing

Taper sawing is the sawing of logs to reduce taper effects (Figure 6).

- Saw the log along the bark, to produce short side slabs and boards until a flat surface is obtained along the full log length.

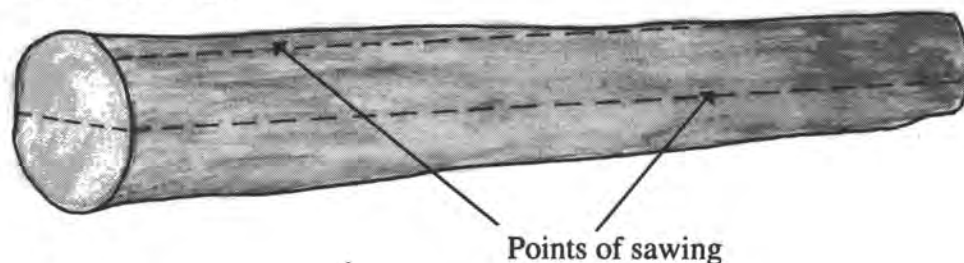


Figure 6. Taper sawing

3.2 Split Taper Sawing

This is the sawing of the log along the pith (Figure 7). It is mostly used if quarter sawing method is to be employed, especially when very large diameter logs are sawn (See Quarter sawing).

- Saw the log into two halves and re-saw each half separately

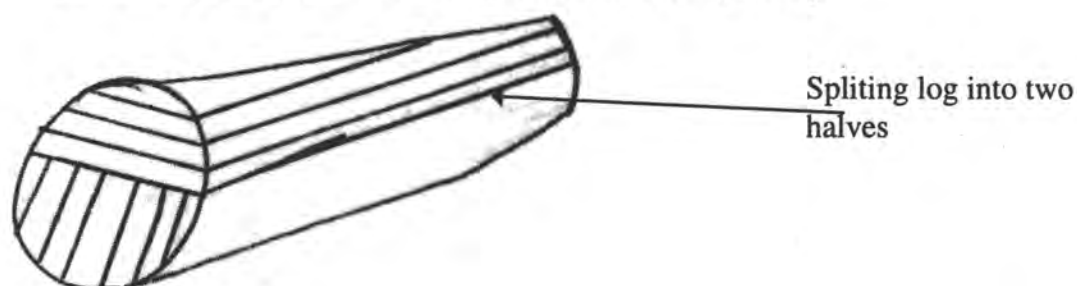


Figure 7. Split taper sawing

3.3 Through and through (Slabbing)

- Cut the first side slab from the log to produce a flat surface (Figure 8).
- Saw timber planks along the same plane.
- Edge and trim the boards to the required sizes and to remove wane.

This method is fast, has high yield and is commonly used in converting timber for furniture and joinery especially hardwoods due to good wood colour and grain matching.

This pattern is the best when sawing logs with almost zero taper.

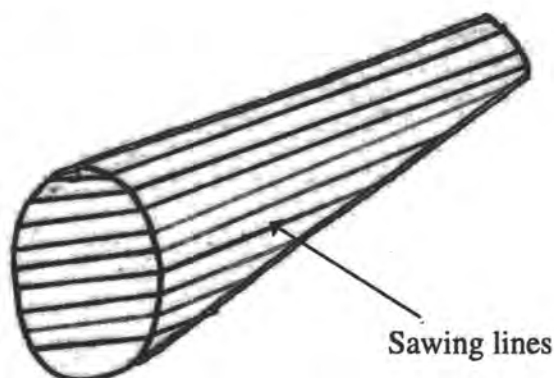


Figure 8. Through and through sawing pattern

3.4 Quarter sawing

To do quarter sawing, do the following;

- Cut the log into two halves along the pith.
- Divide each half again along the pith to get four quarters.
- Saw each quarter separately into the required timber sizes.

This pattern is commonly used when sawing extra large diameter logs or when converting timber for grain and figure appearance especially where aesthetics is the prime objective. Quarter sawing results in lower yield than through and through method, due to the many cuts that have to be done, which increases the wood lost as saw dust. In small-scale timber sawing, quarter sawing is only appropriate when handling very large logs. Figure 9 shows the quarter sawing pattern.

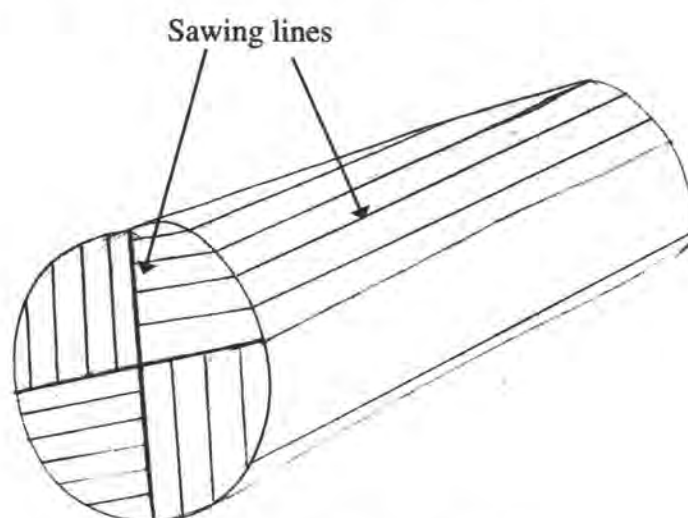


Figure 9. Quarter sawing; Quarters sawn with different patterns

3.5 Cant sawing

Cant sawing is when the log is sawn by either removing only the side slabs in small diameter logs, to make square beams, commonly referred to as cants or by cutting large diameter logs into large size beams. In both cases, the aim is to get regular shaped beams, which can be easily transported, for re-sawing into required timber sizes.

- Measure accurately the sizes of beams to be sawn
- Exercise care when sawing cants to produce square beams, to reduce the risk of squaring when re-sawing. Figure 10 shows cant/beam sawing pattern.

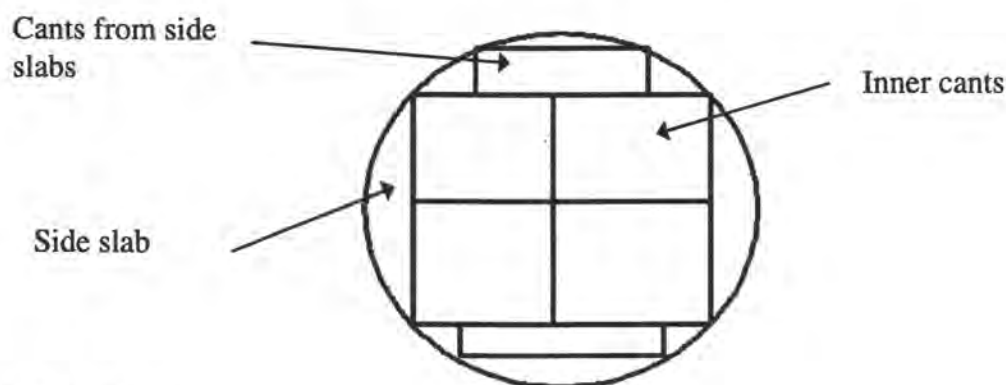


Figure 10. Cant Sawing

CHAPTER 4

USE OF SAWING EQUIPMENT

There are three main sawing equipments used in small-scale timber processing; Chain saws, Mobile saw benches and Pit saws.

4. 1 Chain Saws

Chain sawing uses an engine powered chain saw, operated by one person. Most chain saws have saw kerfs of between 7.5 to 10mm.

When using a chain saw for timber sawing;

- Choose a thin chain to reduce the saw kerf.
- Sharpen the chain correctly using the right file for the chain in use.
- Use the correct fuel/oil mixture. Chain saw manufacturers recommend 200ml of 2T oil to 5 litres of fuel. More oil tends to clog the engine compression chamber and spark plug, while less oil means inadequate lubrication of the engine, resulting to over heating and shorting of engine life (see your chain saw operator's manual).
- Measure timber sizes correctly with adequate allowances included.
- Draw sawing lines and follow them correctly, holding the saw firmly to ensure straight and regular cuts (Plate 1).

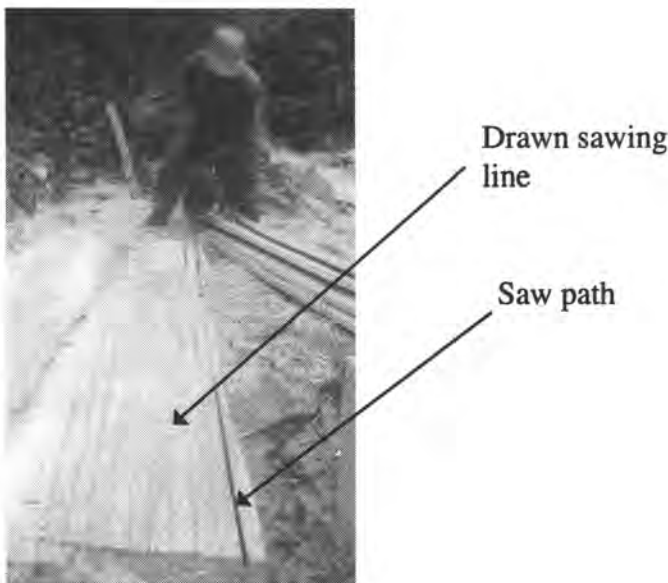


Plate 1. Chain saw method

4. 2 Bench Saw

This method uses circular saws of various thicknesses mounted on and powered by a tractor (Figure 11). The tractor provides the power used to drive the saw during timber sawing.

- Choose thin saw blades. Thin blades however require frequent tensioning.
- Sharpen and set the saw teeth correctly to minimise saw kerf and for ease of sawing.
- Determine and cut the opening slab as small as practically possible to reduce waste.
- Determine and set the sawing table gauge correctly with adequate timber thickness allowances included for subsequent sawing of the required timber sizes.

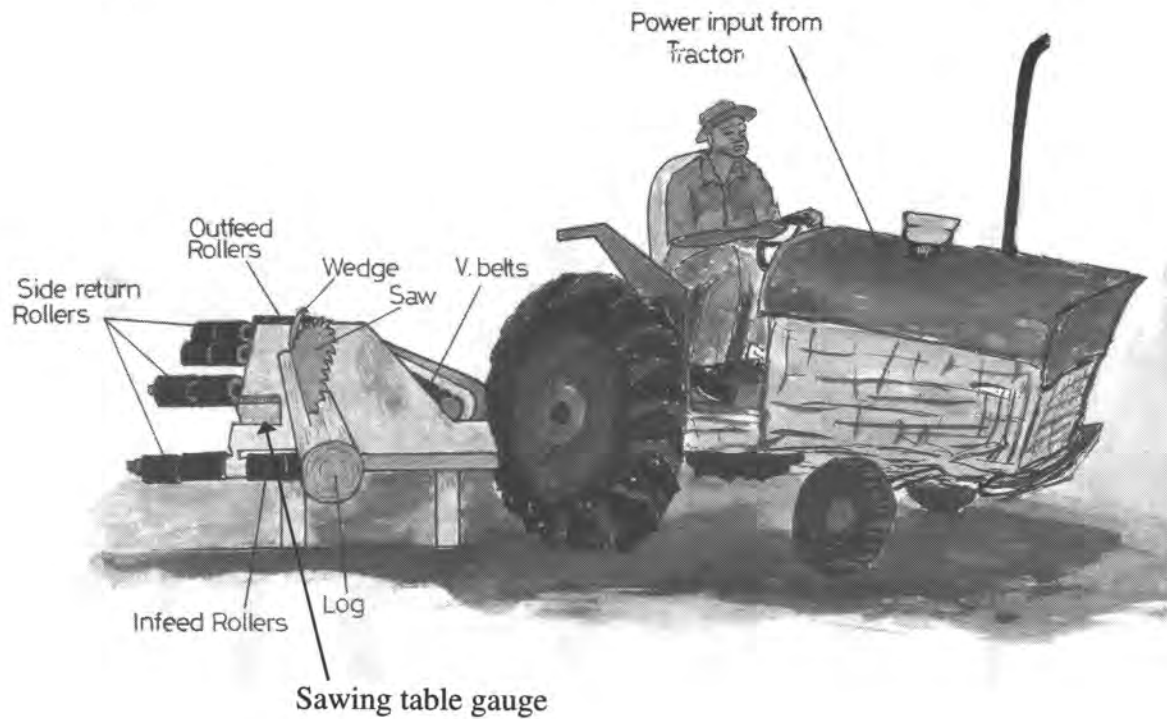


Figure 11. Tractor Mounted Bench saw

4. 3 Pit Sawing

Pit sawing method uses a long flat blade with handles on both ends and is operated by two people (Plate 2).

When using pit sawing method;

- Sharpen the saw to ease sawing and set saw teeth correctly to minimise saw kerf.
- Cut small side slabs to open the log.
- Measure, draw and cut accurately along the sawing lines.



Pit Saw blade sawing a log

Log platform

Plate 2. Pit sawing

CHAPTER 5

SAFETY MEASURES IN TIMBER SAWING

This section gives only basic principles and is not a substitute for workers proper training or using detailed guidelines on safe machinery handling practices. Having emergency procedures is strongly recommended and these should be communicated to the others in the team.

5. 1 Personal protective equipment (PPE) and Safe Working Regulations

- Wear protective equipment when working with a machine. The strongly recommended types are a helmet with visor (face protection) and ear defenders, steel toed boots, and gloves, trousers and jacket with clogging material (Ministry of Labour & Human Resource Development, 2006). However, realistically, the standard protective clothing is very warm and unbearable in tropical climates, expensive and possibly difficult to obtain. Therefore a relatively equivalent level of protection from different types of clothing should be considered. For example, industrial boots or any leather shoes will offer better foot protection than open shoes, sandals or bare feet. Any lather gloves can be good for the hands. Cotton wool in the ears and welding glasses will offer better ear and eye protection than nothing at all (Pasiiecznik et al, 2006).
- Tie up long hair, do not wear loose clothing or anything that could possible restrict movement or become entangled in the machine.
- Make available a first aid kit on site, but if not, have at least a large clean piece of material as a wound dressing if the worst does happen.
- Do not take alcohol, stimulants or other intoxicating drugs while at work.
- Do not smoke when working with petrol-powered machines like the chain saw.
- Avoid working when too tired, as fatigue increases chances of accidents.

5. 2 Basic safety Measures

5. 2. 1 Chain Saws

- Use a well maintained, tensioned and sharp chain.
- Ensure no one is near your working zone.
- When working alone, be sure someone knows where you are.
- Stand firmly on the ground with your legs well apart, one foot forward and do not over-reach to avoid losing stability.
- Place the left thumb around the front handle of the chain saw to keep a tight grip.
- Support the weight of the chain saw by keeping it close to the body or on the log.
- Operate the saw with two hands for optimum control.
- Always apply the chain brake when not cutting.
- Be extra careful when using chain saw on slopes where you could slip and fall.
- Do not use a chain with the depth gauges removed or reshaped (Fehr C., 2006).
- Stand to the side of the cutting path of the chainsaw.
- Do not cut above shoulder height.

5. 2. 2 Saw Benches

- Sharpen and set the saw teeth correctly before starting to work.
- Change saws when they become hot to avoid buckling.
- Use a push stick to move the logs when close to the saw to save the hands from the running saw blade.

5. 2. 3 Pit Saws

- Sharpen and set the saw properly for ease of cutting without draining energy.
- Ensure working decks/pits are firm and secure
- Secure logs properly onto the deck to avoid possibility of rolling out
- The operator working under the deck should be well protected against dust and other falling objects. A helmet is a good consideration.

CHAPTER 6

FURTHER READING

- Brown WH, 1989.** The Conversion and Seasoning of Wood. Linden Publishing, USA. 222pp
- Fehr C., 2006.** Dealing with the Realities of Chainsaw Milling in Uganda and Eastern DRC. Policy brief. HDRA, Coventry, UK.
- Lantra, 2003** Felling Small Trees Workbook. Technical Awards, LANTRA Awards, Stoneleigh, Coventry, UK. 32pp.
- Lantra, 2003** Chainsaw Maintenance and Cross-cutting Workbook. Technical Awards, LANTRA Awards, Stoneleigh, Coventry, UK. 40pp.
- Ministry of Labour and Human Resource Development, 2006,** Personal Protective Equipment (PPE). Factories and other Places of Work Act, Cap 514 (Revised). Government Printer.
- Muthike G. M. and Githiomi J. K., 2003a,** Recovery Rates for Mobile Saw Benches, Pit Saws, Chain Saws and Saw Mills Used in Sawing Plantation and Farm Trees in Kenya. A Research Report to Plantation Forestry and Farm Forestry Programmes in February 2003
- Muthike, G. M., and Githiomi, J. K. 2003c.** Harvesting and Processing Technologies in Farm Tree Utilization; Nurturing Capacity for Value Added Markets. A Paper presented at a workshop on Markets and Marketing of Farm Forestry Products in Kenya, Held at KEFRI HQ, Nairobi, Kenya on 18th September 2003.
- Muthike, G. M., 2004a.** Appropriate Technologies in processing and Value Addition of Cedar wood in Marakwet District. A paper presented during a one day stakeholders seminar on East African Pencil Cedar (*Juniperus procera*) held in Kapsowar, Marakwet District, Kenya on 11th May 2004.
- Muthike, G. M., 2004b.** Evaluating the Impacts of Skill Improvement on Small-scale Timber Processing On-Farm. Recent Advances in Forestry Research and Technology Development for Sustainable Forest Management. Proceedings of the 2nd KEFRI Scientific Conference, 1-4 November, 2004, Kenya Forestry Research Institute, Nairobi, Kenya.
- Pasiecznik NM, Brewer M, Fehr C, Samuel JH, 2006.** Turning Trees to Timber. A Chainsaw Milling Manual. HDRA, Coventry, UK.

