

TECHNIQUES AND EQUIPMENT FOR IMPROVING PRODUCTIVITY OF BUSHMEN

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INTRODUCTION

Figures from the National Planning Model, 1979, show a projected increase of 8229 for the required number of bushmen over the next 25 years. This is based on the reduction of piece size and the productivity remaining the same. There are two possibilities for increasing productivity; increased mechanisation, expensive and limited to relatively flat country; or improving our present motor-manual operations.

Our present manual operations centre around the chainsaw - felling, delimiting, and crosscutting. By improving techniques in these areas we may thus improve productivity. This area is also the most dangerous and accident prone. Productivity can thus be increased by a reduction in accidents. Finally, reducing fatigue contributes to better productivity and to reduced accidents, to say nothing of creating a better work environment.

All the techniques and equipment described in this paper are designed to make the bushmans job safer and less physically demanding, while ensuring improved and more productive extraction.

BACKGROUND

In a 1979 LIRA survey it was found that the felling techniques commonly used by bushmen gave limited control of the felling direction, and in thinnings resulted in a high incidence of hang-ups. Many scarfs were not aimed in the right direction, 57% of all scarfs were overcut, many scarfs were sloping, and there was a big variation in size, shape, and thickness of the hinge wood. All these factors contribute to a lack of felling control. Felling aids were not used and there were barbaric methods of dealing with hang-ups.

Trimming was in nearly all cases executed by walking down the stem using a 80 - 100 cc chainsaw with a long bar. This is undoubtedly very hard on the fallers back, leaves him vulnerable to accidents by kick-back or falling, and results in a rough trim standard. The only time a faller walked alongside a stem was if it was too small to balance on or if it was on steep country.

This survey was used as background information by the Swedforest Consulting team which LIRA contracted to investigate and develop a safer, more efficient felling and delimiting technique for New Zealand. A great deal of this paper is based on that research and development. I would like to point out here that it was not a straight transferal of Swedish felling and delimiting systems, but a combination development of techniques suitable for N.Z. conditions.

TECHNIQUES AND EQUIPMENT AVAILABLE

1. CHAINSAWS

Currently our smallwood operations use 80 - 100 cc chainsaws with varying bar lengths of 46 - 60 cm. The reason given for using this type of combination is that it is considered easier to walk on the log and trim using a longer bar, and that "the more power - the more timber".

1.1 Lighter Saws

As was mentioned above, the common saws used today are in the 80 - 100 cc range. The weight of these saws is 8.3 kg - 9.9 kg. The same job could be done using saws in the 60 cc range with a weight of 7.8 kg (40 cc for first thinnings, weight 5.40 kg). The weight difference may not appear significant on paper, but by the end of the day 0.5 to 1.1 kg can make a vast difference. (These chainsaw weights are based on Husqvarna chainsaw specifications.)

1.2 Chainsaw Design

Chainsaw manufacturers are placing a great deal of emphasis on better designed chainsaws, both ergonomically and engineeringly. Some of the aspects of this are listed below:

1.2.1 Better designed body to facilitate easier use, i.e. smooth body so it can be carried without digging into the operator.

Safety attachments for safer operation - chain guards in case of chain coming off or breaking, better balance saws to make them less fatiguing to use.

1.2.2 Anti-vibration mounts - over recent years these have come a long way. Most professional saws now have the motor and bar completely suspended on good rubber mounts.

1.2.3 Heated handles. Working in an 8° frost, the first hour is absolute agony. Many saws now have a means of combating Raynards disease and making life a bit more pleasant for the operator.

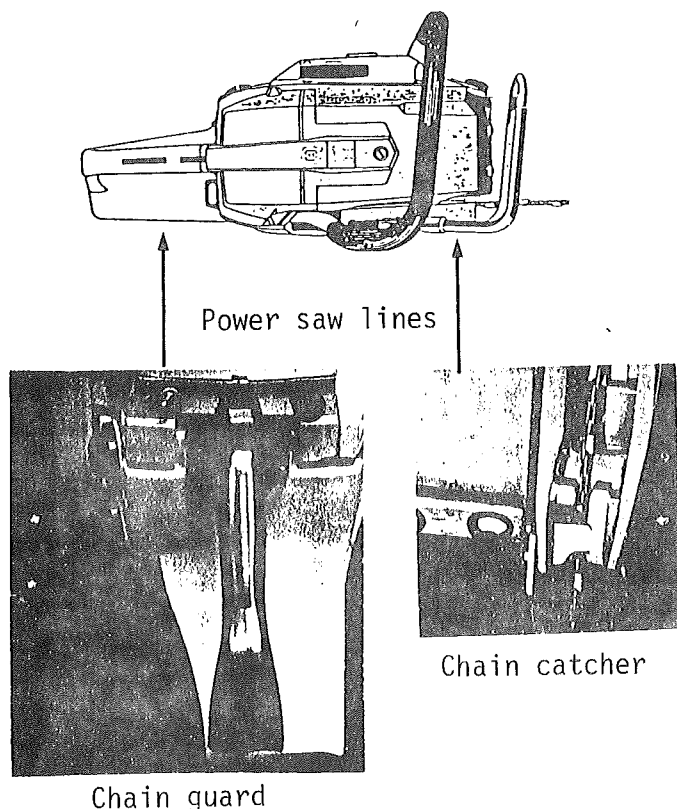


Figure 1 - The Chainsaw

1.3 Shorter Bars

In many instances there is no need to carry around a 46-52 cm, or even 60 cm bar when 38-40 cm will do just as well. Besides making the saw lighter it is also safer as there is less protrusion which, while carrying the saw, can get caught in undergrowth causing a fall with a possible cut.

1.4 Mitts Verses Chain Brakes

If a faller wishes to wear a pair of gloves to save the wear on his hands or to keep his hands warm, he finds it very difficult to do so with a saw equipped with a mitt. Also, a chain brake removes the chance of human failure i.e. often fallers forget to wear the mitt - on a saw fitted with a chain brake it is there all the time. Having the left hand free allows the trimming technique described later, easier.

1.5 In-Field Maintenance

Many fallers become frustrated when small breakdowns occur. Many of these can be avoided by better in-field maintenance, i.e. allowing $\frac{1}{4}$ of an hour each day to clean saws and check that bolts are tight. Chainsaw mixed fuel has oil in it which hastens the fouling of air filters, so a mixture of water and detergent should be used to clean the air filter. The condition of anti-vibration mounts, the chain, and the bar, should be checked and the bar turned each day.

2. FELLING TECHNIQUES

The top and bottom cut of the scarf and the backcut are the three most important cuts a faller makes. They determine the speed of extraction, the resulting damage to the residual stand, and whether or not he goes home at night. If they are executed properly it is reflected right through the operation. If they are poorly executed he becomes responsible for reducing the efficiency of the operation.

2.1 Scarf

This governs the direction in which the tree will fall.

2.1.1 Top cut or face cut of the scarf should always be cut first. The angle should be no less than 45° - this allows the faller to look down the cut and sight where the bottom cut should start. Also, by having a face cut steeper than 45° it allows the tree to be virtually on the ground before the scarf closes. This makes better directional control.

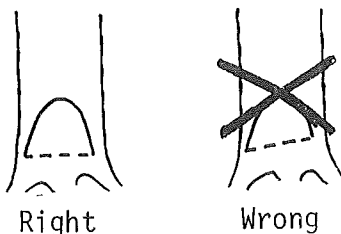
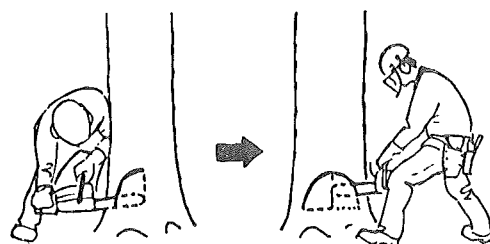
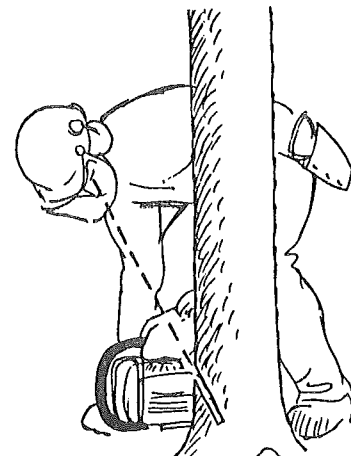


Figure 2



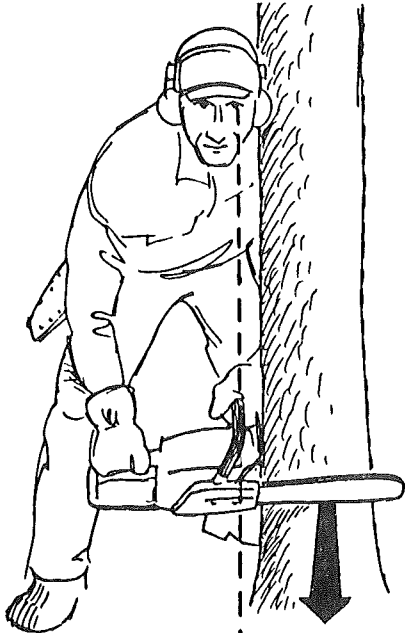
Cuttingscarf on a large tree

Figure 3.



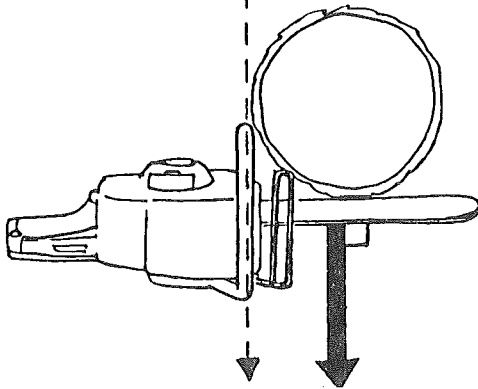
Faller sighting the bottom cut through kerf

Figure 4.



2.1.2 The bottom cut should be cut so as to meet accurately with the top cut. By looking down the kerf of the face cut it is easy to see when the bottom cut meets up. This removes the dangerous overcut situation.

The depth of the scarf should be from $1/5$ to $1/3$ of the tree diameter. Most professional saws are equipped with sights, and fallers should know how to use these sights, and use them all the time. This gives better directional felling. The faller can, if he wants to, lean against the tree while making the scarf cut, thus allowing him to partially rest. Further discussions on scarfing and the reasons for cutting narrow scarfs, occur later in the section of this paper dealing with felling aids.



2.2 Backcutting

The traditional method of backcutting is to have a bar longer than the tree diameter, put it against the tree somewhere behind the scarf, and cut. This is the standard method irrespective of tree characteristics. In this paper I will deal with five techniques of backcutting which should be known and used by bushmen. All these five techniques are appropriate when using a shorter bar.

Figure 5. Faller sighting the scarf while leaning against the tree

2.2.1 If the tree diameter is less than the length of the bar and if the tree only has a slight lean, the easiest method is to cut straight through from the back ensuring that an even amount of hinge wood is left, as shown in Figure 6 opposite.

2.2.2 If the tree diameter is less than the bar length but has severe lean in the direction of fall, the best technique is to bore in behind the scarf at the same level or slightly above, leaving even holding wood, and cut straight back out. This means that the tree falls only when the cut is completed and reduces the likelihood of the tree splitting up thus damaging the most valuable area of timber, the butt.

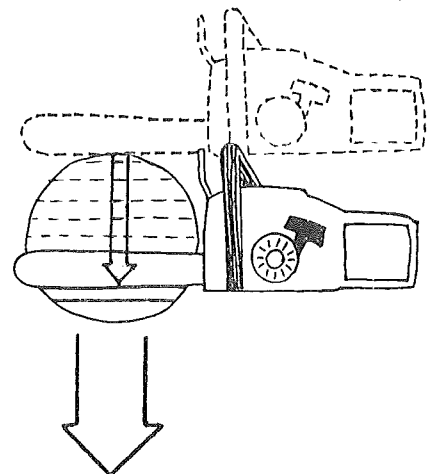
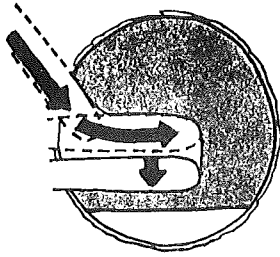
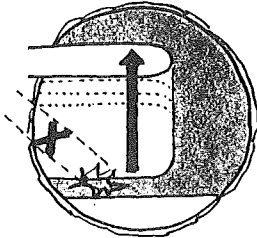


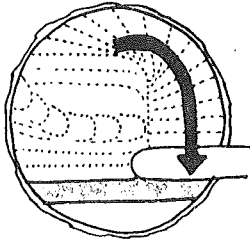
Figure 6. The backcut for a tree with a diameter less than the length of the bar



2.2.3 If the tree diameter is greater than the length of the bar but not greater than twice the length, the technique best suited is to bore in behind the scarf until slightly over half the tree is cut, then to move around the tree finishing on the opposite side to that started. This gives better control over hinge wood and reduces the chance of cutting too much off one side of the hinge wood. (See Figure 7.)



2.2.4 If the above tree has a severe lean, in the direction of fall, the best technique is to bore in behind the scarf cut slightly over half the diameter, then cut straight back until there is about 50 mm of wood left. Remove the saw and do the same on the other side. The last 50 mm can be cut from the back towards the scarf or from the inside out. The reasons for this are the same as for 2.2.2.



2.2.5 The last method of backcutting dealt with in this paper is the case where the tree diameter is greater than twice the length of the bar. In this case, the bar is inserted into the scarf cut and as much of the centre of the tree as possible is cut out. The bar is then bored in behind the scarf and leaving

Figure 7. Backcut for a tree with a diameter greater than the length of the bar

65 mm of the hinge wood, the cut is made the same as for 2.2.3. This technique is slower than any of the others and would possibly only be rarely used. (See Figure 8.)

The reasons for using these techniques for backcutting are; better control over hinge wood thus better directional felling; better recovery of butt wood, with practice a faller learns to know exactly how his saw cuts and how much wood he has cut (this is sadly lacking at present); reduces the chance of cutting through one side of the holding wood thus making it safer; by having better directional control it reduces the incidence of hang-ups and improves extraction.

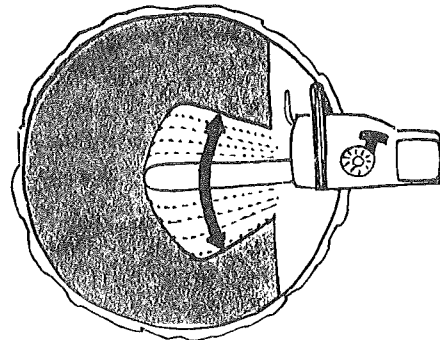


Figure 8. Backcut for a tree with a diameter greater than twice the length of the bar

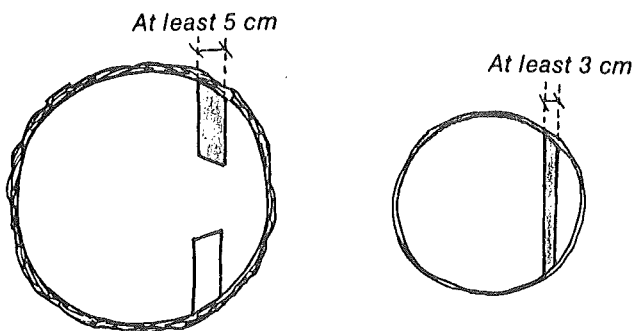


Figure 9. Resulting holding wood

One area which has not been covered here is the case of the tree that is leaning back. This will be dealt with in the section on felling aids

3. TRIMMING

With up to 65% of the fallers time in first and second thinnings being spent trimming, it is obviously an important area. Trimming by N.Z. bushmen, unless on very steep country, or working very small tree size, is carried out by walking down the stem using the tip (area most prone to kick-back) of a long, up to 60 cm, bar with the faller's back bent to resemble a staple. This is both physically demanding and extremely dangerous. The resultant trim quality usually necessitates employing an extra man to do a final trim on the skids.

3.1 Lever Technique

This technique of trimming employs a short bar, 38 cm long, with the faller walking alongside the log. The leverage principle is used, which means that the saw does the work rather than the operator. The saw is rested on the log or on the thigh, thus taking the strain off the operator's back. The legs are bent and the back kept as straight as possible. If done properly, this technique gives a far higher standard of trimming than conventional methods. All branches are cut off flush with the stem. To achieve the best results with this method, felling techniques have to be altered slightly. It is easier to undertake this system of trimming if the tree can be lifted off the ground. This can be done by felling trees across one another.

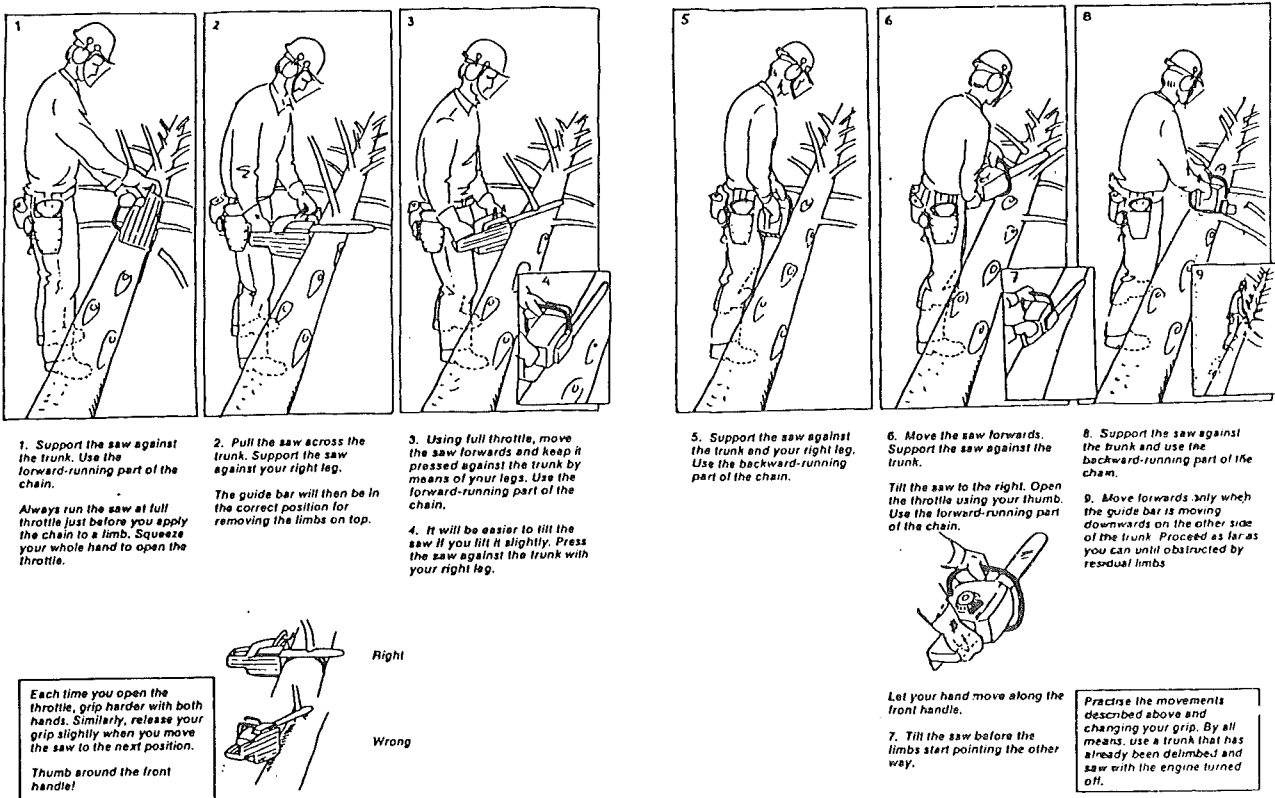


Figure 10. Delimiting Techniques

3.2 Felling Bench

The second technique discussed in this paper uses an artificial aid to achieve the required working height to facilitate easy trimming. The aid used is the felling bench, made of R.H.S. steel - a made up bench weighs 16 kg and costs approximately \$80. The bench is placed about 3 metres in front of the tree and the tree is then felled across the bench. Once the stem has been trimmed it can, to a certain extent, be bunched for extraction, by see-sawing it on the bench to the required position. The bench has certain limitations; slope can only be worked on 15° or less; the bench must be positioned correctly otherwise it loses its effectiveness; ground conditions must be even with as few hollows as possible. The bench is a popular aid in South Australia where the outrow system is employed and all timber is cut to length in the bush.

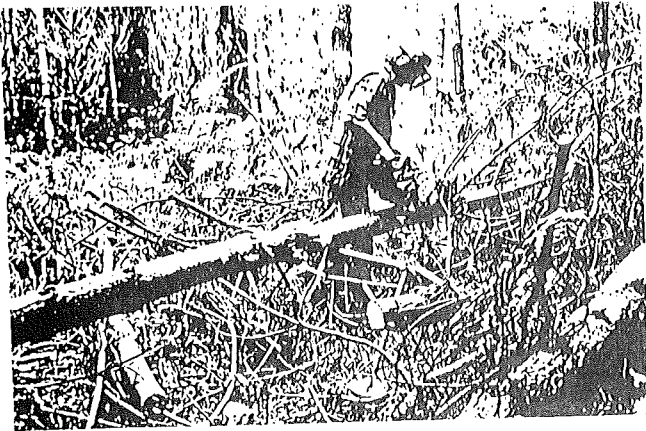


Figure 11. The Felling Bench

The important aspects of both of these trimming techniques is the emphasis placed on using shorter bars on saws (lighter units), protecting the fallers back by keeping it as straight as possible, using the thigh muscles (which are the strongest in the human anatomy), and making the saw work rather than the operator.

4. FELLING AIDS

This section deals with aids for felling difficult trees, or getting down hang-ups. Currently the technique employed for dealing with these situations is to drive the hang-up or difficult tree down, or in the case of a difficult hang-up, to cut short lengths off the butt of the tree until it comes down. Another commonly seen method is to leave the hung-up tree and get a machine to pull it down when the extraction is carried out - possible three weeks later. This means that the skiddy has to trim the log.

4.1 Felling Levers

There are many felling levers currently available overseas. However, in N.Z., only two can be readily purchased. One only recently arrived on the market.

4.1.1 Husqvarna felling lever - weight 1690 grams, length 790 mm.

This lever has a double section which gives a maximum lift of

3 tonnes when 100 kg is applied to it. The lever is ideally suited to both first and second thinnings, Douglas fir thinning, and minor species such as ponderosa pine, Corsican pine, etc. Special backcutting techniques are required and it is essential that the scarf is placed well forward on the stump to increase the lever's effectiveness, by altering the hinge point. The lever's primary use is to tip over trees that are leaning back. It obviously has a limit to the amount of lean it can cope with. It can also be used to get down hang-ups by using a cant-hook, or just the lever, as illustrated below in Figure 12. The lever costs about NZ\$45 and is available from Husqvarna agents or H.H.Shillings Co.Ltd., Auckland.

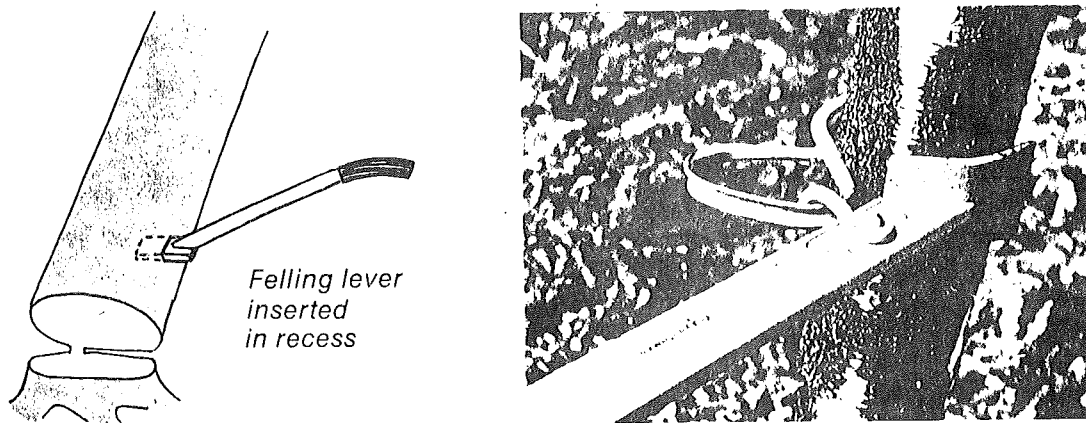
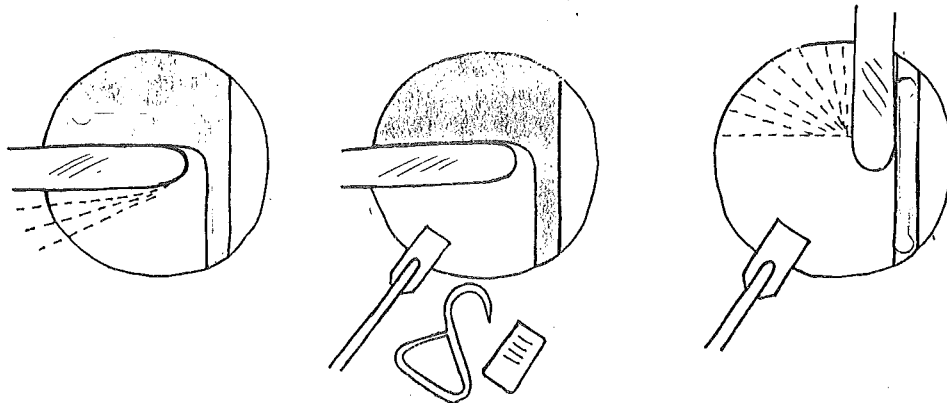


Figure 12. The felling lever and cant hook

4.1.2 Sandvik felling lever - weight 1580 grams, length 810 mm. This is a single acting lever with a capacity of 1 tonne. It is lighter and simpler than the Husqvarna. It is ideally suited to first thinnings only. Technique for using it and ability to get down hung-up trees are the same as for the Husqvarna. The lever costs NZ\$16.50 and is available from Sulco Distributors, Wanganui, or Jonsered Chainsaw agents.

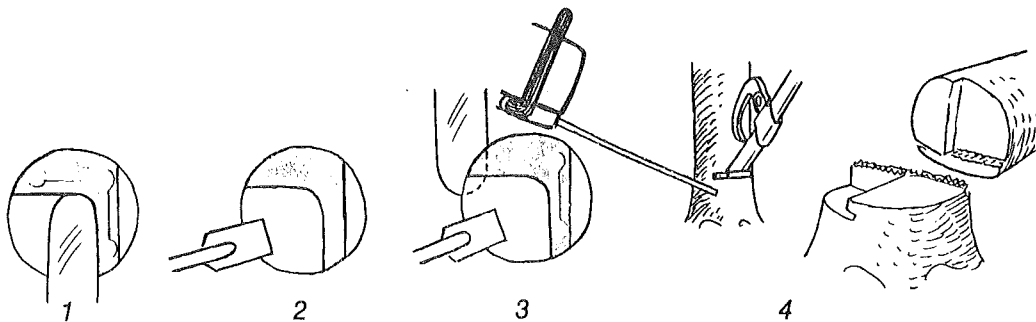
4.2 Air Bags or Felling Cushions

These are commonly used overseas and are available in N.Z. There are two bags available, one lifts 3 tonnes, the other 8 tonnes. They are used in the same manner as the felling levers. The advantages of the air bags over levers are that they can be carried on the faller's belt and are thus with him all the time. They are considerably lighter than levers, weighing only 360 grams and 600 grams respectively. The disadvantages are that the saw has to be equipped with a valve attachment which requires good maintenance and that they are more difficult to insert into the backcut. They are also more expensive, \$60-\$70 for the valve attachment and 3 tonne bag. They are made by Nordfor and are available from both Sulco Distributors and H.H. Shillings. The techniques for using levers and air bags are shown in Figure 13.



1. Move the saw along an arc, with the nose as the centre point, and stop when the saw is at the back. The tree will now be supported firmly on two sides of a square, with the holding wood being one of them.
2. Now, with plenty of time, you can insert the felling lever, or felling wedge or cushion in the case of larger trees. When using a wedge, use the felling lever to knock the wedge into position.
3. You now have a new side support for the tree and can calmly complete the felling cut and bring the tree down by means of the felling lever or felling cushion. Take care that the nose of the saw does not damage the holding wood.

In the case of small-diameter trees (20 cm or less), it is difficult to insert the felling lever behind the guide bar without incurring the risk of the chain striking the lever.



1. First, saw through one half of the tree until you reach the holding wood.
2. Remove the saw and insert the felling lever. The tree is now properly supported.
3. Next, when sawing through the other side of the tree, make the cut a few centimeters below the lever. The cuts should overlap, but do not insert the bar too low down, or you will remove the support for the lever.
4. Then all you have to do is use the lever to bring down the tree. Small trees fall faster than large ones.

Figure 13. Techniques for using levers and airbags

4.3 Wedges

Although not as great an application in smallwood as in larger timber, wedges are still the least expensive and easiest to use of all the felling aids. The use of a wedge to insert into a backcut before the tree finally sits back would make it easier to push over with a pole and thus reduce the chance of straining by attempting to push it over by hand. Wedges can also be used in conjunction with felling levers to obtain more lift.

4.4 Turn Band

This is used for rolling hung-up trees down. It is a low cost item,

(\$9.00), simple piece of equipment which has application in both first and second thinnings and minor species. The band is made up of seat-belt webbing, 1.77 m long, with a hook attachment on one end and an eye on the other. The hook is placed against the tree, the band is then wound around this, and a piece of wood is placed through the eye to act as a lever. The band weighs 310 grams and has a pouch which enables it to be carried on the belt. They can be locally made as I don't think they are available in N.Z. made up from Sweden.

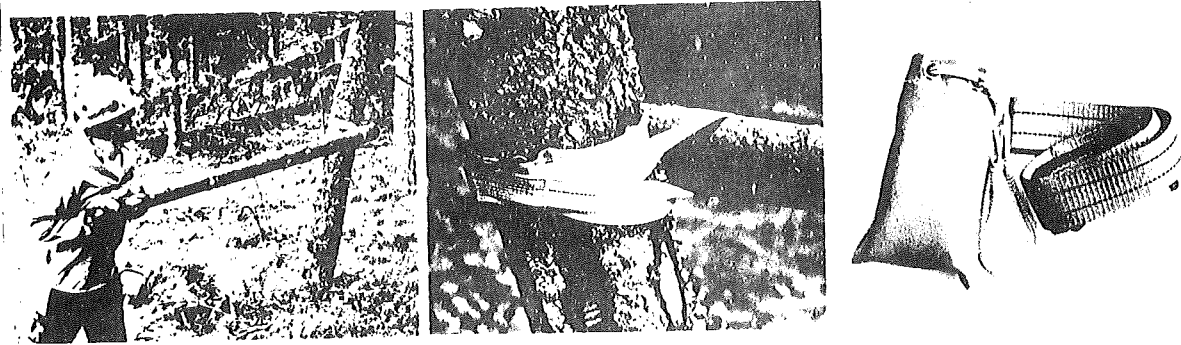


Figure 14. The Turn Band



Use a pole to lever the tree.

Figure 15. The Pole

4.5 Pole

The last felling aid dealt with in this paper is definitely the cheapest, least sophisticated, but still has a widespread application. To obtain one of these all the bushman need do is take his chainsaw, find a head of a tree approximately 2 m long, 60 - 80 mm at one end and 30- 40 mm at the other end, and trim it. The application of this pole is shown in Figure 15. As you can see it is mainly used for getting down hang-ups and pushing over the easy trees. These are available in most N.Z. forests!

These are a few of the felling aids available. There are many others, more expensive and sophisticated, as well as many that are cheap and simple. From those listed, the two I consider to be essential to any good faller, are the Husqvarna lever and the turnband. Not only does the use of these make felling safer, but it also makes the extraction and skid phase easier.

DISCUSSION

In this paper I have dealt with only a very small part of improving productivity, namely in felling and trimming. There are numerous other aspects of equal importance which form part of the overall picture. There are two which I consider to be quite important that are worth a mention here - safety clothing and helmets. This is a subject briefly touched on by the Swedish consultants and also one of which many people have spoken of in the past. LIRA obviously has to devote some of its time and resources in this area in the future. Such things as safety helmets, ballistic trousers, aprons or leggings need to be investigated. There are other items such as gloves, which keep hands warm as well as protect them from cuts, boots that are lighter and last longer than the ones presently available, etc.



Figure 16. Safety Clothing for N.Z. Bushmen - What do we need?

The other area which is of paramount importance is that of training. All the research time and money in the world is no substitute for getting the message across, as does a good training system achieves. It is all very well convincing management, but lets go to the bushmen that are working in the 8° frost etc., and help them.

Finally, what we need are bushmen that are smarter, not harder.