

MECHANISED DELIMBING IN AUSTRALIA

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INTRODUCTION

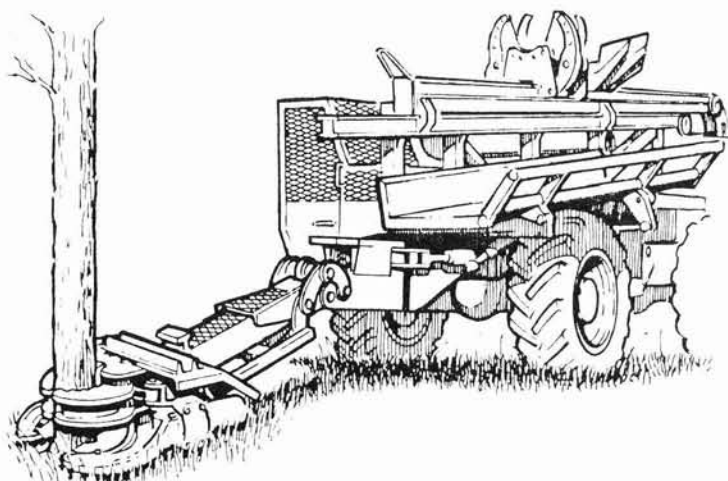
At the 1983 LIRA seminar there was a recommendation to conduct a review of mechanised delimbing machines. Australia has had considerable experience with mechanised delimbing and much of that experience is with radiata pine. The shift from chainsaw delimbing to mechanised delimbing in Australia has been for a number of reasons, including :

1. High cost of skilled labour.
2. Shortage of skilled labour.
3. High accident rates with chainsaw work
4. High workers' compensation rates (up to 70% of cutters' wages in some States).
5. To improve working conditions.

For these reasons, there has been a trend towards partially or fully mechanised harvesting systems, especially in early thinnings. The majority of effort has been placed on delimbing, which is considered the most labour intensive aspect in thinning. This report summarises the more common delimbing and harvesting machines used in Australia.

WINDSOR HARVESTER (Timberjack RW-30)

This unit was originally designed by Windsor and Sons of Australia in the early 1970's and the concept has since been purchased by Eaton Yale. This harvester is based on a Timberjack 330 skidder and incorporates a felling shear mounted on a low-slung boom. Trees are felled and laid back over the machine on to a horizontal delimbing boom. Delimbing is carried out



by four wraparound knives and one fixed knife mounted on a winch-driven carriage, which rides along this boom. The carriage incorporates a topping shear and on completion of processing, logs are placed on to an accumulating bunk.

The felling head is designed to shear butt diameters up to 30 cm (inside bark). Delimber stroke capacity is 13 metres at a design speed of 1.5 metres per second and can handle a diameter range from 35 cm down to 8 cm. The accumulating bunk can hold up to 25 logs (2.3 tonne) and tilts to deposit the bunched load of logs.

At Australian Paper Manufacturers Ltd. in Victoria, the Windsor was being used in a third outrow radiata pine first thinning. Tree size ranged from .1 to .17 m³. Productivity was reported at 9.8 m³ per machine hour in tree size of .13 m³. APM is phasing out the units because of the new woodroom requirements. Delimbing quality was not high and the machine could not delimb the bottom 1.2 metres. Malformed stems and multiple leaders further reduced delimbing quality.



JOHN DEERE 743 TREE HARVESTER

This harvester is based on a John Deere 740 skidder chassis. The unit has a knuckle-boom crane with a felling head attachment. Trees are felled and placed into the delimbing head. Delimbing is achieved by two movable wraparound knives and one fixed knife. The lower knife is designed to automatically top at 6-7 cm diameter. Trees are fed through the knives by two mechanically driven spiked rollers. Delimbing can be carried out automatically to allow the operator to fell the next tree.

Felling boom reach is 5.3 metres and rotates through a 270° arc. The shear is designed to handle up to 47 cm butt diameters. Delimbing knives and feed rollers can be manually or automatically controlled, once the tree is placed in the delimbing head. Design delimbing speed is 2 metres per second. There is no bunching facility and trees are deposited behind the machine. Bunch size depends on how many trees can be reached from a stationary position.

There are twelve units working in South Australia, Western Australia and Tasmania, all in thinning of radiata pine. Productivity is reported to range between 9 m³ to 16.4 m³ per machine hour in tree size ranging from .1 m³ to .2 m³. Delimbing quality in radiata is acceptable for pulp, although the spiked rollers often damage the stem, break the top, or shear it off prematurely. To improve wood presentation for forwarder extraction, a hydraulic chainsaw has been added to some units for cutting short lengths.

KOCKUMS LOGMA 85-41 DELIMBER PROCESSOR

The Kockums Logma is a Swedish machine, originally developed in the late 1960's. It is based on a three-axle forwarder chassis with the delimbing unit mounted over the rear tandem bogey axles. Trees are delimbed by a pair of delimbing heads, each made up of two wraparound knives and one fixed knife. The delimbing heads are mounted on a winch driven sliding boom, with one head mounted on the rear fixed section and the other at the front end of the sliding boom. The rear knives are then loosened and the front knives clamp on tight to the log. The boom is then retracted, driving the tree past the rear knives. Hence, there are two knife passes over the log to ensure high delimbing quality. Tree lengths are measured with an electronic eye and a hydraulic chainsaw cuts the trees to length.



Delimbing knives can handle a butt diameter up to 60 cm and down to 7 cm. The cab and boom are mounted on a turntable which has a slewing arc of 300°. The boom has a maximum reach of 12 metres when extended and a 7 metre delimbing stroke. Design stroking speed is 2.5 metres per second.

The Logma is being used in thinning (fifth outrow) and clearfell of radiata pine. Hourly production ranges from 10-26 m³ per machine hour in tree sizes between .15 and .75 m³. Delimbing quality is high and can produce wood to sawlog standards.

The Logma boom can also be mounted to a Koehring 266 tracked excavator. The delimbing unit is the standard Logma model but is fitted to enable the machine to delimb and travel simultaneously. Early trials have indicated that the Koehring is faster than the Logma with up to 20% higher production levels. In Australia, the Koehring is also 10% cheaper than the Kockums Logma.



HARRICANA DELIMBER PROCESSOR

The Harricana delimber is very similar to the Logma, except for a sliding boom that is chain driven rather than winch driven. It can be mounted on any excavator capable of providing a flow of about 380 l/min (100 gpm) at 14 MPa (2,000 psi) and 115 l/min (30 gpm) at 28 MPa (4,000 psi), e.g. Cat 215 or John Deere 690B excavator models. The delimber knives can delimb stem diameters from 60 cm down to 7 cm. The 12 metre sliding boom has a delimbing stroke of 8 metres.

A unit working in Victoria for APM is mounted on a Cat 215 working in a clearfell operation with tree sizes of .8 to 1.2 m³. It has a hydraulically powered chainsaw for producing sawlogs and pulpwood. Delimbing quality is high. Although the boom speed is slower than that of the Logma boom, the unit's ability to simultaneously delimb and travel makes its production level similar to the Kockums Logma. The Harricana mounted on a Cat 215 is 20% cheaper than the Kockums Logma.

WARATAH DFB HARVESTER



The Waratah delimbing and felling head can be fitted to a variety of hydraulic excavators. It was developed in New Zealand for use in first thinning of radiata pine. However, due to management problems here, its use was abandoned. Machines have since been exported to Australia where they have had considerable success. The unit delimbs the standing tree to a height of seven metres then fells and bunches. Some units incorporate a topping shear. It was originally designed to work in early thinnings where merchantable height would be only seven metres.

The harvester head has a hydraulic shear for felling and two wraparound knives and one fixed for delimbing. It is capable of felling and delimbing stem diameters up to 40 cm. The unit is mounted on to the stick boom of an excavator and has a vertical reach of seven metres. For taller trees, the first seven metres is delimbed and the top is cut using the felling shear. Then, holding the top high in the air the felling shears are opened, allowing it to fall through the delimbing knives. The

top can then be sheared off or, if there is more merchantable wood, the procedure is repeated. After delimbing and bunching the top logs, the Waratah then returns, fells and bunches the butt log.

The Waratah DFB is working in first thinning of radiata pine producing 4-7 metre pulp logs. Productivity varies from 6-9 m³ per machine hour in tree sizes ranging from .1 to .25 m³. Both delimbing quality and wood presentation is high and the unit is relatively inexpensive. The concept is mechanically simple and reliable, therefore reducing maintenance costs.



SKOGSJAN DELIMBER PROCESSOR

The Skogsjan is an attachment grapple processor. It can be attached to most hydraulic excavators. The unit is comprised of two hydraulically powered spiked feed rollers mounted inside the grapple arms and three spring tensioned delimbing knives. There is a sprocket wheel sensing device that can measure log lengths within 2 cm. A hydraulic chainsaw is used for cutting logs to length. Trees are picked up by the grapple closing around the stem. The feed rollers then pull the tree past the delimbing knives.

The processing head can handle tree diameters from 6 cm to 40 cm and the chainsaw can be programmed to cut six different log lengths. Working in first thinning of radiata pine, production is reported to be 13 m³ per machine hour in .2 m³ tree size. Delimbing quality is high on lightly branched trees, but malformed or multiple leaders reduce quality and machine productivity. The manoeuvrability of the excavator boom allows for excellent log presentation for forwarder extraction.

DISCUSSION

It is difficult to compare Australian logging conditions with those in New Zealand. The high labour cost and limited skilled labour availability in Australia has, in some cases, forced the use of machines for harvesting trees. The high cost of machines compared with low labour costs in New Zealand often makes a high degree of mechanisation uneconomic. Another important factor is the difference between Australian and New Zealand radiata pine. New Zealand's faster growth rates result in larger branch size and considerable stem malformation that create difficulty when trying to mechanically delimb. However, the time may come when there is a requirement for mechanised delimbing and New Zealand must investigate the machine options to ensure that the most suitable types are identified.

Suggested reading :

- (1) Kluerder, Richard "New Generation of TJ-30 Harvester Operated in Louisiana" APA Technical Release 77-R-29, 1977.
- (2) Melmoth, Allan "John Deere 743 Tree Harvester" CSIRO Harvesting Research Group Machinery Evaluation No. 9, 1978.
- (3) Perkins, Glenn "Koehring 620 SDL Delimber" APA Technical Release 83-R-68, 1983.
- (4) Giguere, Pierre "Roger, Harricana and Logma Delimbers : Long Term Evaluation" FERIC Technical Note TN-42-1981.
- (5) Wells, G.C. "Evaluation of Waratah DFB Harvester" Economics and Techniques of Thinning Plantations in Australia and New Zealand Canberra 1981 Preprints Pages 71-76
- (7) Twaddle, Alistair "Development of Mechanisation in Australian Pinus Radiata Harvesting" LIRA Logging Machinery Seminar Proceedings, 1983.

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