SOME ASPECTS OF MECHANICAL HARVESTING IN QUEENSLAND'S SLASH PINE PLANTATIONS

A.V.WILLIAMS
Manager, Logging Division
WOODLANDS LIMITED

SUMMARY

In Queensland, harvesting systems traditionally have been Motor-Manual, but recent developments in the Slash Pine (Pinus elliottii) operations of Woodland Limited have aimed to mechanise sections of those operations which contribute mostly to depressed productivities and work fatigue.

In achieving this, several changes were necessary, not least of which was the need for a new approach to task and profit sharing. Certain Industrial Agreements have been modified to cater for this approach.

Whether or not the systems developed could be successfully used in other Forests is debatable, due to the peculiar branching characteristics of Slash Pine, making multi-stem processing a possibility.

Management, in encouraging these developments, was motivated by a desire for more economical harvesting systems. In addition, it was considered desirable to perpetuate the skills of the Motor-Manual contractor and make him as competitive as possible with other forms of mechanisation.

How mechanised is Mechanical Harvesting? In Queensland, the answer seems to be that the ultra mechanised operation has no greater place than the ultra manual and somewhere in between is an operation that is compatible with most points of view.

A BRIEF HISTORY

Thinning of indigenous Hoop Pine (Araucaria cunninghamii) plantations commenced in 1939 and early forest workers employed manual techniques which persisted until the mid 1960's, using hand saws for felling, axes for limbing and horses for snigging.

Modifications were made during the late 1960's with the introduction of light chainsaws and small crawler tractors.

These techniques remained in use for this period of time as a result of the steep and rocky terrain and the selective thinning policy of the forest owner. Light, frequent thinnings of approximately 25 cubic metres per hectare every four to six years were carried out. This policy aimed to maximise growth on an elite pruned fraction of the stand. Equipment used for harvesting, therefore, needed to be capable of negotiating the forest without the aid of a regular extraction track or outrow system. Several generations of forest workers developed with particular skills related to smallwood thinning.

Early pulp thinnings in the more extensive Slash Pine (Pinus elliottii) Plantations of the flat coastal plain near Gympie were carried out using the experience of the Hoop Pine workers but substituting light agricultural rubber tyred tractors for light crawlers.

Three mechanical systems subsequently emerged, each with advantages to suit varying logging conditions - the "Tractor and Grid", the "Feller Buncher and Grid" and the "Feller Buncher and Clever Hole Delimber". (Appendices 1 and 2).

DEVELOPMENTS - REASONS FOR ... RESULTS OF

The motivation for mechanisation in Woodland's case, apart from the obvious desire to obtain raw material at the most economical price, was an increasing volume of pulpwood needed to supply Particleboard and Sawmilling requirements, as well as a future Pulp and Paper Project.

At the same time, it appeared that labour pay rates would increase disproportionately to other costs. Recently however, this trend was moderated and the limiting factor now for contractors wanting to introduce new systems is interest rates on invested capital.

Woodland was reluctant to introduce the high cost harvesters and processors available from overseas manufacturers. Instead, a decision was taken to upgrade the productivities of the Motor-Manual techniques so that they were as efficient as possible before embarking on any programme of high cost mechanisation.

Forwarders were introduced and the productivities of the Motor-Manual operations were greatly increased by reducing their tasks to that of Fell and Bunch to outrow or corridor. Bunching for Forwarders was necessary due to the low volume removals resulting from a selective thinning policy and to the distances between outrows. Double Drum Winches significantly improved productivities, due to the ease with which bunching could be carried out simultaneously from each side of the outrow.

At about this time, a Director of Woodland observed Slash Pine in the Southern States of the U.S.A. being delimbed satisfactorily by the simple technique of pushing the stems, tip first, through a suspended metal grill. In this way the limbs were stripped from the tree boles.

This proved to be the most significant factor governing the success of future developments in mechanical delimbing in the local Slash Pine Plantations. Several enterprising contractors set about to construct and test the first Grid Delimber for use with their Rubber Tyred Tractors. Improvements have been made in the interim, and the Grid is now universally used in First, and often Second, thinnings.

The fact that Slash Pine could be successfully delimbed in this manner, led to the development of the Boschen "Clever Hole Delimber". Graham Boschen, a contractor to Woodland, coupled a Feller Buncher to the "Clever Hole" and developed a fully mechanised system to deliver delimbed stems to outrows or corridors.

W.O.L.F. Logging, another contractor, coupled a Feller Buncher with two Rubber Tyred Tractors, delimbing by Grid Delimbers. This is an impressive system with a high output and relatively low costs.

Both of the Feller Buncher based techniques are capable of production rates in the vicinity of 3,000 cubic metres per month on a one shift basis.

A feature of this delimbing technique is the ability to delimb several stems simultaneously. Most Processors using knife delimbing heads are restricted to processing single stems at a pass. As delimbing productivities appear to be almost geometrically related to piece size, these processors are compromised by small stem size from First Thinnings. Both the Grid and the "Clever Hole" can process up to 7 or 8, First Thinning stems, at a time.

Mechanical developments were one aspect of the introduction of mechanised and semi-mechanised harvesting systems. Of equal importance, in fact vital for the success of the Grid Delimber, were the changes which took place in the attitudes of the forest worker to task allocation, contract rate setting, and profit sharing.

Traditionally, tasks of faller and snigger were well defined and quite separate. In many cases, it was as though individual contracts had been let for each phase of the total harvesting system. In Queensland, Industrial Legislation has always provided for the Department of Forestry to assess tasks and set rates for fallers. New Agreements provided for systems to be assessed individually and contract rates set accordingly.

With the Grid Delimbing system, the Faller was relieved of the time-consuming and onerous task of delimbing by chainsaw. This was one distinct advantage of the system, particularly in view of the hot Queensland climate and the fatigue attached to full time chainsaw work. At the same time, sniggers required assistance, due to the heavier work load of delimbing. In many cases, fallers are now involved with most aspects of the total system.

Most contractors formed partnerships to simplify the inherent problems of task and profit sharing. In some cases, contractors found that single operators could work efficiently at felling, delimbing and bunching, with the aid of the Grid Delimber.

The "Clever Hole" system is currently being operated on a wage basis, however, the relatively low capital needed to finance this system puts it within reach of the Motor-Manual contractors, which has the advantage of perpetuating their skills at smallwood thinning.

FUTURE TRENDS

Intensive research carried out by the Queensland Plantation Harvesting Research Committee, a combined Industry and Government Body, has indicated the need for closer outrow spacings to allow mechanical harvesters to operate efficiently.

The present fifth row out, with selective thinning of the bays, generally in use with first thinning of Slash Pine Plantations, caters satisfactorily for the mechanised systems currently in use. It is not a satisfactory thinning regime however for many of the other orthodox harvesters which local contractors may be forced to use in the future.

Modifications currently being carried out on the "Clever Hole" Delimber, will allow for cross-cutting to log length after bunching to outrow and delimbing. The machine itself will at that time probably have reached its peak of mechanical performance. Whether or not changes to work procedures, outrow spacings, etc. will provide the means for increased productivities, as has occurred with the Motor Manual systems, remains to be seen.

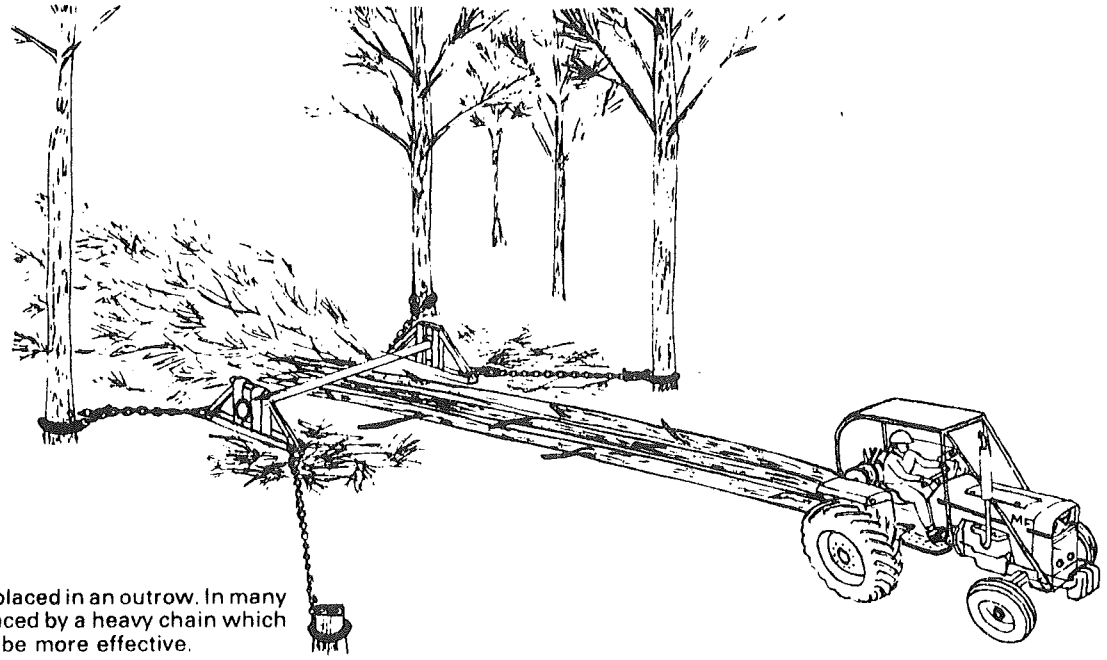
The Tractor and Grid appear to have limited lives in Slash Pine Plantations except where terrain and debris are barriers to larger mechanical harvesters.

One harvester at present being developed in the region is the Murdoch "Timber King". (Appendix 3) Andrew Murdoch, the designer and developer, envisages this machine in smallwood thinnings, felling, delimbing and cross-cutting to bunches on outrow. Certainly there is no such machine available, off the shelf, which is singularly capable of carrying out all these functions. Of relatively low capital value, this machine shows promise as a real alternative to the expensive systems which are in use in other areas.

Forest Chipping is also being seriously considered for those products which can utilise the chip produced by the present breed of Field Chippers.

There is a need to continually review work procedures and mechanical systems to keep pace with increasing costs, providing the philosophy of protecting the status of the forest worker, and considering the requirements of the Forest Grower, is maintained.

TRACTOR AND GRID APPENDIX 1



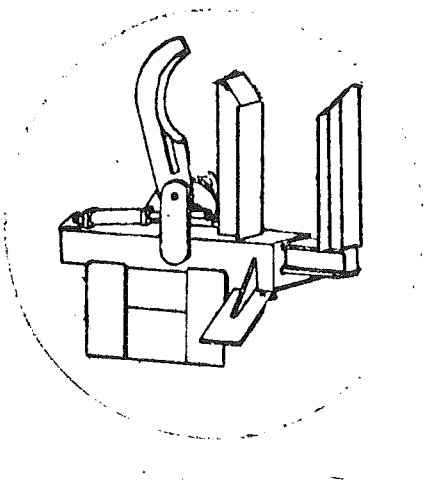
The grill delimber placed in an outrow. In many cases the bar has been replaced by a heavy chain which has been found to be more effective.

Used in conjunction with normal chainsaw felling and tractor snigging operations, the Grid Delimber consists of an angle iron rectangle placed horizontally on the ground with the long axis at right-angles to the extraction track or outrow.

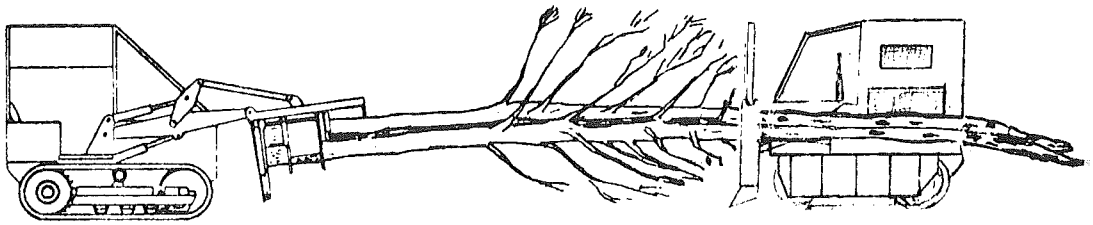
The small tractor, with the aid of a double drum winch or snigging grapple, collects a bundle of stems which has been previously felled by the faller, and snigs them over the grid rectangle, stopping when the butts of the trees are just past the centre point. To a vertical post at the centre of one short side is attached a length of chain which can be thrown over the snig of logs and attached to a corresponding post at the centre of the other short side. The tractor then strips the limbs from the bunch by moving forward and reversing the snig over the rectangle and under the chain. The abrasive action of the chain and the rectangle breaks the limbs off flush with the stem bole. The delimbed stems are then able to be stacked in readiness for subsequent cross-cutting and forwarder extraction.

BOSCHEN "CLEVER HOLE" DELIMBER

APPENDIX 2



Basic principle of the "Clever Hole" - an orifice that can be hydraulically adjusted to conform to the shape of the tree or bunch.

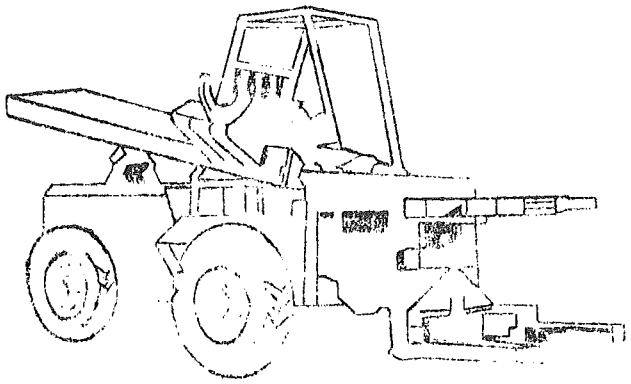


The Boschen system uses a Feller Buncher, consisting of a standard tracked loader equipped with an accumulating shear head, to fell and accumulate stems prior to combining with the "Clever Hole" for delimbing.

The "Clever Hole" can be adjusted and the standard of delimbing is good.

Once delimbed, the stems are carried along the outrow by the "Clever Hole" to be bunched with previously delimbed stems into stacks to maximize the performance of the subsequent forwarder operation.

MURDOCH "TIMBER KING" APPENDIX 3



Prototype of a 'complete harvester' capable of feller bunching, delimbing and cross-cutting two stems simultaneously.

The unique design of the felling head holds two stems in a precise position, one directly in front of the other, before delivering them to the double knife profile delimbing head. This is accomplished by way of an 180 degree turn of the shearing head across the front of the prime mover.

Limbs are removed as a result of the combined action of the stem being forced through the felling head and the reverse stroke of the delimbing head up the stem.

After delimbing, the predetermined length of stem is left protruding from the front of the shear head. The stem can be cross-cut by the main shear at any point selected by the operator.