Session 5
Paper (b)

DEVELOPMENT OF MECHANICAL HARVESTING

Garry Leeson,
Logging Contractor,
A.P.M. Forests Limited,
Victoria, Australia.

History

Mechanical harvesting of pine plantations is not necessarily the only strategy that should be employed in dealing with the problem of producing round wood on truck at a competitive cost.

However, it is the direction that we and Amcor took back in 1978. This was in the form of imported machines from Sweden who's agents were already established selling Forwarders into the Industry.

The reason for the introduction of mechanical harvesting in Australia was that labour costs had risen to a point where machines could be brought in and operated at the same or reduced costs. Compounding this was the cost of supervision and the risk to potential accidents that workers were exposed to daily. Everyone here is aware of the savage damage chain saws can inflict, and the risks that are increased in bush operations. Workers Compensation costs became prohibitive.

Our work environment allowed for a smooth transition from a manual work force to a mechanised operation as we were working on undulating country that did not present problems for the machines.

Steep or broken country make it much more difficult and requires a fresh look at how, and what is the most satisfactory method of introducing some form of harvesting. It is extremely difficult to increase productivity in steep country, and up to now the introduction of skylines have been the only steps taken to harvest this country. There is still a place for the motor manual system in steep areas.

Early Days

Mechanisation of our Industry was started in 1976 and was helped along by the parent Company in A.P.M. Forests. This happened only after Contractors had spent much time and money exploring options both in Australia and overseas. Contractors realised the need for change and the Swedish system of Feller Bunching and Logma Slide Boom De-limber was added to the Forwarder to complete the harvesting group. This was a direct result of Contractors travelling to Scandinavia and examining different harvesting systems.

The results over the past fifteen years have been that A.P.M. Forests and ourselves have worked constantly to bring new ideas to our operations.

Recent examples of this have been the introduction of Slide Boom Delimbers mounted on excavator based machines. This was the result of two representatives from Forests and myself going to Canada and Southern United States looking at two problems that had developed in our harvesting system:

a. Equipment able to work in wet conditions with minimal soil disturbance.

b. Alternatives to the then costly Swedish system.

This tour saw the importing through Australian agents, of the first Koehring 266 De-limber and the first Hurricana De-limber. Unfortunately Hurricana have not fostered their presence in Australia but Koehring now have a presence of seventeen Delimbers and Feller Bunchers. The introduction proved timely as Kockums Sweden ceased production of the Logma machine. This would have left a large hole in the processing of radiata pine if the Koehring was not available as a replacement. The Feed Roll Harvesters that were heralded as the alternative have not proven to be satisfactory in handling our larger and rougher trees.

Prior to this there was some attempts by progressive contractors to adapt and modify skidders and use them as a basis for some experiments in de-limbing Radiata Pine. My step father was such a Contractor, and had built a de-limbing head that replaced the blade on a 230 C Series Timber Jack. I have included photos of this as Appendix A. The principle was to use the winch to pull the tree through the De-limber Head using the "A" frame attached to the rear of the tractor.

We have come a long way from there, which has seen the Windsor tree harvester introduced into first and second thinnings only to be phased out and replaced by harvesting heads like the Waratah, OSA 762 and Lako.

The solution was to produce more wood per man and as a result machines were the way to faulitate that end.

Currently in our area we have a mixture of small, medium, and large wood harvesting machines.

Current Situation

There are many and varied systems currently working in Australia and I do not profess to know them all, what I would like to do is explain the basic systems we have found to be cost efficient.

These fall into three main sections:

a. Small wood
b. Medium size wood
c. Clear falling

Although these three wood types are different there is naturally an overlap of machines between them. I have matched the most appropriate machine to its preferred tree size.

Small Wood: Tree volume between .12 - .20 m3 per tree

In small wood operations we use Feed Roll or Single Grip Harvesters. This operation is mainly on slopes under fifteen degrees.

The harvesters are either mounted on purpose built carriers (1) or modified existing carriers (2). Both these concepts have advantages and depending on Contractor preference he may choose either or a mixture of both types. These units coupled with a Forwarder (3) of about 12-14 t. capacity allows for a reasonably cost efficient system with the best mix being two harvesters to one forwarder. These machines working day work can produce around 50,000 m3 per year on single shift.

The Feed Roll Harvesters are restricted by large limbs and slope so it is advisable to look at more robust pieces of equipment to handle that rougher type of wood, perhaps a Waratah or Slide Boom Logma.

Medium Size Wood: Tree volume between .21 - .25 m3 per tree

The general system of handling this range of tree size is to use one of two systems:

Firstly, a machine like the 901 Valmet or 706/260 OSA (4) is appropriate. These machines are known as twin grip harvesters because they are designed to firstly grip the tree and directionally fall it (5), and then process the tree using the large feed roll processor mounted on the main chassis. These machines are very productive and in this tree size can produce about 25 m3 per hour.

Secondly, there is the system of Feller Bunching using a machine like a Kockums 880 or a Excavator base that has a purpose built boom coupled with an acknowledged felling head (6).

This prepares the wood for processing by either the twin grip harvester or a machine such as the Logma or Koehring, both having slide boom de-limbing and cross cutting abilities.

The second system, using the Feller Buncher is our preferred option. It allows for more production hours from the most expensive machine, that being the twin grip harvester. It also reduces the pressures on the operator of the large machine. If he is falling and processing then he has little or no rest time and these machines are very demanding mentally as their computerised sequences and automatic operations require continual monitoring (7). Our experience, and that of the Swedes, has shown that operators after two to three hours need to stop and have a break of about half to three quarters of an hour. If the wood is presented for them then they do not have the pressure of a dual role. The extra productivity covers for the additional machine and operator. This productivity rate increase is in the order of twenty percent.

Again in this operation a Slide Boom De-limber can be used quite successfully to process the bunched wood although production is reduced.

All of this wood in both small and medium tree size is prepared into lengths of approximately 5.5 metres long for forwarder extraction to roadside truck loading bays.

Our experience has shown that the feed roll processors are again limited by both tree size and slope where as the slide boom delimbers can adequately handle larger branches and perform safely on slopes up to eighteen degrees. Steeper country can be handled by specialised equipment such as the Timbco which has an adjustable slope compensating cab (8). Specialist forwarders can be used to extract this wood and they are also fitted with slope compensating crane based (9). Steep country harvesting requires a high level of experience and professionalism, and as production is down so costs go up making it more expensive to harvest. In many cases plantations are on steep country so this cost must be expected.

Clearfall:

Our clear felling tree size ranges from about .7 m3 - 1.0 m3 trees and at the moment the method of harvesting of this wood is under review.

In explaining our current operation we use a Bell Tracked Feller Buncher (10). This superseded the rubber tyre one as the tracked unit has the capacity to cross wet and uneven ground much better. The dolly wheel was found to cause bogging problems with the original unit. This tracked unit is used to fall and generally bunch two - three trees either across the outrows or along the outrow. Falling at an angle allows for the Koehring (11) processor to work across the face and if using the Logma it is best to operate along the outrows.

Once the wood is processed then it is simply a matter of forwarding (12) to roadside for loading onto trucks (13, 14, 15, 16).

This system has worked well but we are now finding that their is the need to harvest wood on poorer quality soil types, and as such the wet weather is concerning us more each year. The introduction of the logging Code of Forest Practice has also meant more constraints on wet weather activities, and our performance is watched from an environmental point of view as well.

To overcome these problems we have changed from our traditional position and looked at ways to log poor areas and still work within the Code. Other Contractors and ourselves have been working with Flotation Tyres on Skidders (17) and Forwarders (18) to reduce ground pressure. Last Winter we equipped a Cat. 528 Grapple Skidder with 44" wide Flotation Tyres and decided to skid the wood to roadside. This solved the problem of ground disturbance and allowed for more production from the Processors and Forwarders. It is intended that this productivity

increase would offset the cost of running the Skidder. In our case we reduced our Forwarders from two to one and put that operator on the Skidder.

A complication that developed was that the slash from the de-limbing had to be returned to the harvested site. To facilitate this we modified the blade and added grab arms (19) to enable the machine to doze into the slash and secure it to the blade with the grab arms. The slash is then dumped where necessary in the bush. Added to what can be taken back with the grab allows for the slash to be totally removed from the roadside and placed back where it is needed. If this was not done then the re-establishment of the block would require additional fertilizer and this added cost could not be justified.

We will again test the system this Winter and decide what is best as an ongoing option. Either systems must be adopted full time as it is too costly to have specialist equipment underutilised.

Steep country attracts more problems than flat and at the moment there is one Contractor working with a high lead. This is an area that Contractors will have to further address as there is a greater proportion of our future wood growing in country of greater then 15 degrees slope.

Cartage

This important area of the total logging operation is receiving a great deal of attention at the moment. Through necessity we have been using a varied number of cartage options.

Most of the work has been done in the make up of the trucks and the type of trailers.

Matching engine horsepower, gear ratios and differential configuration in the prime movers to produce the best torque range and at the same time conserve fuel is critical to todays transport operator. Fuel comprises a large percentage of truck costs and by achieving an extra 100 metres from each litre of fuel will result in a saving of $1500.00 per 100 000 kilometres. Accurate fuel records can result in close monitoring of fuel consumption (20).

Excessive over-revving or idle times is also detrimental to good fuel economy.

Trailer types have varied over recent years and we are running four types at the moment.

1. Conventional tri-axle

2. Drop deck tri-axle, this allows for a low centre of gravity and also maximum loading where short or light wood is carted.

3. Folding-Skel trailer is mainly used for either long distance hauls or areas where it is difficult to have a conventional skel trailer.

4. 'B' Double with Folding-Skel, this is our more recent attempt to cut transport costs. We are currently conducting a six month trial and so far the results are encouraging. The rear trailer is a conventional folding skel and this allows flexibility when returning to the bush.

The ultimate aim of all these changes is to produce a better return for both ourselves and the Mill owners.

Office Administration

From the office we have taken the attitude that our records and support information must be first class or we would lose any advantage that was gained in the field.

The proper costing of your equipment is vitally important. Today margins are low, and costs must be monitored to achieve the best from each dollar spent.

We have developed a very simple but efficient costing systems that is purely based on allocating costs to the appropriate plant when the invoice is received for the spare part. As the account is punched into the Computer the cost of various parts on that account are put against the relevant item of plant. Labour is identified separately and added when required, so a complete cost can be obtained for all units.

In calculating the labour costs we have added in all overheads connected to the employment of the mechanic, for example, holiday pay, sick leave, etc. To ensure that these costs are allocated correctly it is necessary that both workshop and field maintenance is recorded and set against the costs of running each piece of plant.

Outside contracted labour is normally specifically related to individual jobs and is allocated accordingly.

Fuel and oils are recorded when the tractors are fueled in the bush and trucks at the workshop bowser. Tractor and truck drivers are required to fill in a daily time sheet which is basic in its format but, supplies adequate information to allow for costings on fuel and oil usage. Pending maintenance can also be noted for the information of the mechanics (21).

Once the costs of parts, labour, fuel and oils is costed it is then a matter of allocating the appropriate amount of financial and insurance costs and a proportion of supervision and administration expenses to arrive at the total operating cost.

The information on these operator sheets and time sheets produced by the maintenance team (22) allows the administration to develop a mechanical and service history on the machine, and this is kept on computer record.

To determine the overall situation, all logging machines may be grouped together on a particular operation, and the contract rate used to determine the income. Of course preferably it is better to be able to segregate each item of plant and cost it individually. This can be done but requires a more intense breakup. The extra work will produce the correct performance of each machine.

The collecting of production information is the only way to properly determine the costs per metre or tonne to operate your machines. Our simple method is to take the volume produced per machine from our Logging System (23) and divide the engine hours recorded on the tractor time sheet into it, to arrive at an accurate production rate per hour.

Trucks require the same amount of attention as the bush tractors, and appropriate records will demonstrate the viability of running a transport operation. Too often trucks and tractors are traded through the one account. A Contractor with trucks must run separate accounts to allow both sides of his business to stand and trade profitably without any cross subsidies effecting the final figure. Making profits is the main aim but equally important is where those profits are made.

All new truck tyres are branded with a hot iron and this serves a number of purposes. It allows you to record the kilometres the tyres does and also to ensure that you receive your own tyres back after capping. It is too easy for tyres to be lost unintentionally in the system. Calculations on cost per kilometre for tyres and recaps are helpful when ordering replacement stock (24).

It must be remembered that the collecting of all this information will take time and money so good use must be made of it. The idea is to make each machine pay for itself and unless you are committed to improving your overall proficiency then it will be time wasted to implement costing procedures that are not used.

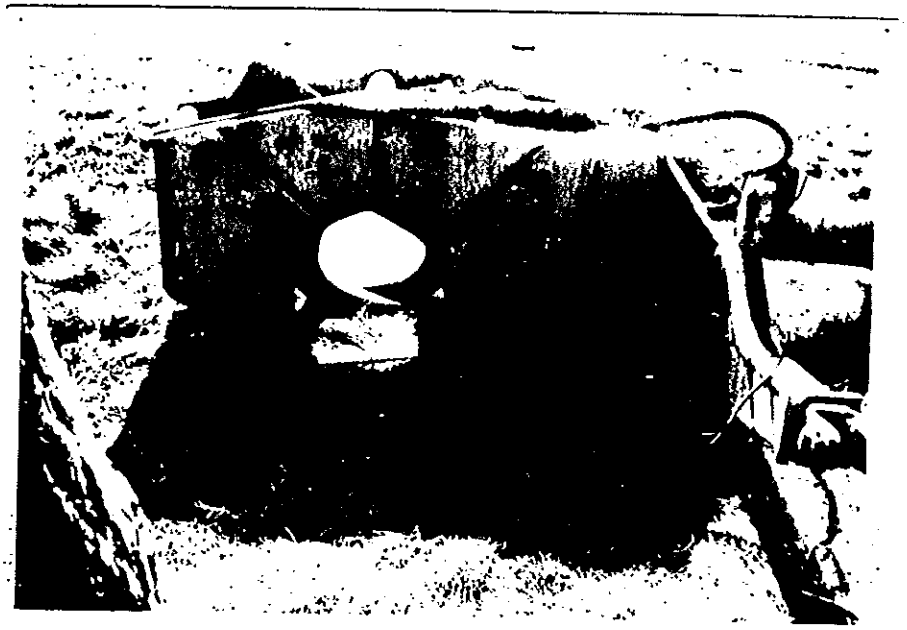
Summary

It must always be remembered that mechanisation must not be done because it seems popular at the time. To borrow many thousands of dollars requires exhaustive thought to determine its benefits. Our driving force was that workplace injuries and labour costs became too high. We have benefited from mechanising our harvesting by more efficiently producing the wood and employing less people per metre. This does not mean we are leaders, for to think that is dangerous, but we have continually tried to improve our performance and are always looking for new products and new systems.

APPENDIX A.

Early attempts to de-limb Radiata Pine approx. 1972

'A' Frame was attached to rear of Skidder and by driving over the fallen tree and attaching the winch rope to the butt and then reversing to pick up the butt in the de-limb knives you could pull the tree through the knives using the winch.



Head altered to the front of Skidder, knife configuration is very similar to the present arrangements used on Slide Boom De-limbers.

REFERENCE NUMBERS FOR SLIDES

APPENDIX 20 : FUEL FIGURES

TRUCK SUMMARY - PERIOD ENDING: _____

NO.	TREE FARM	START KMS	END KMS	TOTAL KMS	O'ALL KMS TO DATE	TOTAL FUEL	KMS / LITRE	O'ALL TOTAL FUEL	O'ALL KMS / LITRE	M3 CARTED	O'ALL M3 CARTED	HOURS	HOURS TO DATE
10.													
13.													
16.													
19.													
20.													
22.													
27.													
29.													
31.													
32.													
40.													

APPENDIX 21 : TRACTOR DRIVER SHEET

PLANT NO. _____ **SHEETS MUST BE HANDED IN NO LATER THAN EACH MONDAY** OPERATOR: _____

DATE	CONT. NO.	MACHINE HOURS START	MACHINE HOURS END	TOTAL HOURS ON SITE	DISTILLATE	OILS		TYRES, MAINTENANCE, AND PARTS Note: All oils, filters, etc. used on services to be recorded
						HYDRA	OTHER	

WEEKLY MAINTENANCE SUMMARY	
	M.A. Date:
	J.F. Date:
	ADMIN. Date:

APPENDIX 21 : TRUCK DRIVER SHEET

PLANT NO. _____

SHEETS MUST BE HANDED IN NO LATER THAN EACH MONDAY

DRIVER: _____

ALL TYRE INFORMATION ON REVERSE SIDE

DATE	TREE FARM	KMS. START	KMS. END	HOURS START	HOURS END	DISTILLATE	OILS	MAINTENANCE and PARTS Note: All oils, filters, etc. used on services to be recorded

MAINTENANCE REQUIRED:	
	M.A. Date:
	J.F. Date:
	ENTERED Date:
	ADMIN. Date:

APPENDIX 22

WEEKLY JOB SHEET

NAME : _____ WEEK ENDED : _____

DATE	PLANT	JOB DESCRIPTION	HOURS

OFFICE USE ONLY

TOTAL HOURS : _____ RATE : _____

COMMENTS : _____

_____

SIGNED : _____ DATE : _____

APPENDIX 23

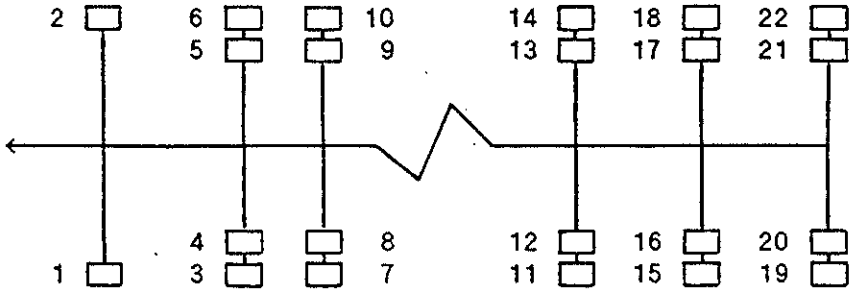
M A C H I N E L I S T I N G R E P O R T

Mach #	Description	Last Date Used	FTD m 3	YTD m 3	FTD $	YTD $
04	Waltanna Forwarder	13.5.91				
05	Cat. 215 Fell.Buncher	17.5.91				
09	Valmet Forwarder 1989	6.5.91				
13	1987 Ford LTL	6.5.91				
16	1989 Inter. S/Line	15.5.91				
17	762 Harvester	7.5.91				
19	1989 K100E Kenworth	15.5.91				
21	OSA 706/260 Harvester	15.5.91				
26	Cat. 518 Skidder	3.1.91				
29	1986 Western Star	7.5.91				
47	Tracked Super T. FB	6.5.91				

Machine Listing shows the volumes produced per machine on a fortnightly and year to date basis. It can also show the fortnight and year to date operator income. Truck indicate gross earnings.

DATE	PLANT	NO.	POSI.	KMS. ON	KMS. OFF	REASON

APPENDIX 24 a : MANUAL TYRE RECORDS



SUPER SINGLE TYRES USE NUMBERS 14 18 22 11 15 and 19

CODE:	
WO	WORN OUT
PR	PUNCTURE
BL	BLOWN
ST	STAKED

APPENDIX 24 b

N E W T Y R E H I S T O R Y

ANJ TYRE NO.	BRAND	PATTERN	SIZE	PURCHASE FROM	PURCHASE PRICE $	PURCHASE DATE	PLANT	POSI.	DATE ON YY-MM-DD	KMS. ON	DATE OFF YY-MM-DD	KMS. OFF	SUB TOTAL KMS	TOTAL KMS	COST / KM.	COMMENT
550	MICH	XHDT	11225	BULKD	540	15.01.90	13	7	15.01.90	266275	10.06.90	346500	80225	80225	0.006731	
550	MICH	XHDT	11225	BULKD			10	7								
550	MICH	XHDT	11225				10	14								
551	MICH	XDHT	11225	BULKD	540	15.01.90	13	8	15.01.90	266275	10.02.90	275602	9327			PUNCTURE
551	MICH	XDHT	11225	BULKD		10.02.90	20	4	10.02.90	468761	26.10.90	584156	115395	124722	0.004330	
551	MICH	XDHT	11225				29	9								

R E C A P P I N G H I S T O R Y

ANJ TYRE NO.	BRAND	PATTERN	SIZE	CAP BY	CAP PATTERN	CAP COST $	PLANT	POSI.	DATE ON DD-MM-YY	KMS. ON	DATE OFF DD-MM-YY	KMS. OFF	SUB TOTAL KMS	TOTAL KMS	COST / KM.	CAP COMMENT
550	MICH	XDHT	11225	LVB	HWT	130	10	7	16.11.90	319100	18.4.91	374000	54900	54900	0.002369	
550	MICH	XDHT	11225	LVB	HWT	130	10	14	18.5.91	381000						
551	MICH	XDHT	11225	LVB	HWT	130	29	9	04.12.90	484588	10.5.91	549000	64412	64412	0.002018	