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FORWARDERS IN SMALLWOOD?

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Long bunk machine used in outrow thinning

INTRODUCTION

In the worldwide trend towards mechanisation in logging, the use of forwarder systems has increased, especially for the extraction of smallwood. To date, these systems have been little used in New Zealand but they do offer an alternative to other extraction systems in the thinnings of plantations.

While forwarders of various sizes are produced overseas, their popularity in New Zealand has been low due partially to their high cost. A less expensive alternative to these high priced imports is the conversion of a skidder into a forwarding unit. Two such conversions are currently in use in smallwood thinning in this country.

This report looks at forwarders and systems for their use. It briefly summarises features of purpose-built forwarders, compares forwarder with skidder systems and examines factors affecting the productivity of forwarder systems. Based on the work studies done, guidelines are given for improving forwarder productivity in thinning systems.

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MACHINE CHARACTERISTICS

Forwarders are designed to transport wood from the felling site to the roadside landing. Different manufacturers have developed various component and system designs. Apart from variations in size, most differences in machines are in the drive and suspension systems. Oscillation can be between either the frame and axle, the front and rear chassis or at the final wheel drives, where there is an option of a pair of bogey wheels or one large wheel.

Two types of drive systems are commonly used. Either a torque convertor acting through a power shift transmission, or a newer, but less common arrangement, a hydrostatic power transmission. In both systems final drive is mechanical. Basically, the hydrostatic method of drive gives a more rigid link between the engine and wheels than the torque convertor method, and allows more efficient transfer of power.

Listed below are some of the options in forwarder design compared with conventional features:-

FUNCTION	ALTERNATIVE CONFIGURATION over (Conventional Configuration)	ADVANTAGE
KNUCKLE BOOM CRANE CONTROL	DUAL JOYSTICK CONTROLS over (6 lever controls)	ERGONOMICALLY BETTER CAPABLE OF SMOOTHER CRANE MOTIONS.
REAR CHASSIS SUSPENSION	BOGIE WHEEL SET over (single rear wheel)	LOWER GROUND PRESSURE SO REDUCED SOIL DAMAGE. IMPROVED STABILITY, CHASSIS ONLY MOVES ½ THE HEIGHT OF AN OBSTACLE IT ENCOUNTERS.
WHEEL/CHASSIS DIMENSIONS	DISTANCE FROM CENTRE PIVOT TO FRONT AND REAR WHEEL CENTRELINES IS EQUAL. over (unequal)	IMPROVED TRACKING AS FRONT AND REAR WHEELS FOLLOW SAME PATH. LESS SOIL DISTURBANCE.
KNUCKLE BOOM CRANE MOUNTING LOCATION	MOUNTED ON TOP OF CAB over (mounted on rear chassis)	BETTER OPERATOR VISIBILITY TO REAR BUNK. ALLOWS REACH TO FRONT OF BUNK.
OSCILLATION	OSCILLATION POINT NEAR OR AT ARTICULATION POINT over (at front and rear axles)	IMPROVED STABILITY
HYDRAULIC POWER DIVERSION FROM DRIVE TO LOADING MODE	OPERATED AUTOMATICALLY THRU ROTATION OF OPERATOR'S SEAT over (manual operation)	ELIMINATES ONE MOVEMENT OF OPERATOR WHICH OCCURS MANY TIMES PER LOAD

ADVANTAGES	DISADVANTAGES
(a) Use their energy more efficiently by carrying their load, rather than dragging it along the ground.	(a) Cannot drop their load quickly in order to correct traction problems.
(b) Produce cleaner wood.	(b) Have less laterial stability than a skidder when loaded on rolling terrain.
(c) Provide a safe,weatherproof environment for the operator who is in the machine throughout the work cycle.	(c) They are more expensive than a skidder.
(d) They can load-out or stack.	(d) Require more skill to operate effectively.
(e) When using a forwarder, the landing can be relatively small.	(e) Require 100% limbing and bucking to be done at the felling site for best performance.
(f) Cause less soil disturbance than skidders.	(f) Must be able to drive close to the wood in order to get it (five metres as opposed to thirty metres for a skidder).
	(h) Greater complexity increases chance of downtime.

LOCALLY-BUILT FORWARDERS

Two forwarders have been built from Treefarmer C7D power-shift skidders in New Zealand. The first, built in 1978, has a 1.7 metre long bunk and a recent conversion (1982) has a 4.4 metre bunk.

Steel and Track Engineering built the machine shown below. The original front chassis was modified to have an enclosed cab with a Cranab 2510 crane mounted on its roof. The cab has removable sections in its walls to permit cooling air flow in the summer. The fairlead, winch and fenders were replaced with a bunk.

Small forwarder used in selection thinning

Ian Patchell Engineering converted the second machine (on front cover). On the front chassis a new cab and engine guarding were constructed. The rear chassis of the skidder was not used, only the drive train components and the centre joint parts. The new rear chassis carries the Cranab 5000 crane and the wheel base has been extended to accommodate the long bunk.

GUIDELINES FOR FORWARDER USE

Studies were done on two forwarder operations in eleven year old radiata pine thinnings. One system was a seventh row outrow, and the other a selection type. The wood was prepared motor-manually in both cases. Both studies indicated certain areas of forwarder use where improvements could be made.

In both systems, the loading and unloading elements combined, accounted for more than half of the machine's productive time. Any improvement in this part of the cycle would result in greater productivity. Wood presentation has the greatest influence on the loading element. The placement and size of wood stacks must be arranged in such a way as to minimise crane movements required during loading. Stacks should be positioned away from standing trees and slash piles. In the outrow system, stacks must be within reach of the crane as the machine travels in a straight line along a row. It is critical that stack orientation, at a loading stop, be towards the centre of a circle, centred on the king post of the crane and aligned radially within the crane reach. This allows the wood to be swung on to the bunk, requiring no grapple rotation.

In the outrow system, it was noted that the forwarder should be turned around prior to loading the bunk with wood, as this makes the turning process easier.

CONCLUSIONS

While forwarders only have limited applicability to New Zealand logging, they do have a place in smallwood harvesting. To be an effective system, the wood must be presented to suit the forwarder being used. The converted skidders currently in use are good examples of low cost machinery with good serviceability, being based on a common machine.

From these short studies, indications are that locally-made forwarders do have a future in harvesting processed wood from thinnings.

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