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MECHANICAL TREE SELECTION IN THINNING

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INTRODUCTION

In New Zealand thinning, the most common tree selection method is based on tree condition. Smaller or poorly formed trees are removed, leaving the better formed dominant trees for the final crop. Tree position is also considered so that final crop trees have adequate space for growth and there are no large gaps left in the stand.

This selection method of final crop trees ensures that only the best formed trees are grown on to clearfell age. However, what may be best in silvicultural terms may not be suited to the harvesting system used in thinning. High residual stockings and random spacing often restrict extraction machine movement. There may also be the cost of marking these final crop trees and the difficulty of supervising to ensure that marked trees are not harvested.

To improve machine access to stands during production thinning, outrow thinning methods were developed. These methods remove a row, or a strip of trees, creating a corridor for machine movement. In the past, there have been two main approaches taken :

- (1) Pure outrow thinning : Only the outrow or strip of trees are removed. This system does not allow for any selection based on tree quality and removes trees solely due to position.
- (2) Combined outrow and selection thinning : Suppressed and poorly formed trees in between the outrows (in the bays) are felled and extracted working from the outrows. This second type of thinning pattern caters to both harvesting systems and silvicultural requirements by improving machine access and allowing for selection of better formed final crop trees to remain in the bays.

In Australia, APM (Australian Paper Manufacturers) who have, in the past, carried out up to five thinnings before clearfelling, have taken the approach one step further. Selection in the bays is based on tree position and tree size. This approach was taken to facilitate felling for forwarder extraction, to eliminate the high cost of marking and to make field supervision easier.

APM feel that the genetically improved seedlings that they plant yield reasonably uniform stands. This factor combined with at least three thinnings ensures that final crop trees are generally those of good size, form and quality. Consequently, both the silvicultural goal of producing good quality sawlogs at clearfell age, and the harvesting goal of facilitating felling and extraction during thinning are met.

THE SELECTION PRESCRIPTION

APM plants 1800 stems per hectare and uses three or four thinnings to reduce stocking levels down to 300 to 400 stems per hectare. First thinning takes place at age 14 and later thinnings occur every four to five years. Clearfell is scheduled between age 27 and 30.

First thinning - 1800 to 1200 s/ha, Age 14

APM's old woodroom was designed for shortwood (1.2 to 1.8 metre). Consequently, 1st thinning operations have been based around forwarder extraction of stacked shortwood. To provide access, a 1 in 3 outrow selection technique has been used. With this type of thinning, every 3rd row is removed thereby creating a corridor for machine extraction. Another reason was the use of mechanised harvesting. Because mechanised harvesting machines need to be able to reach each tree, outrows were used to provide access to the stand.

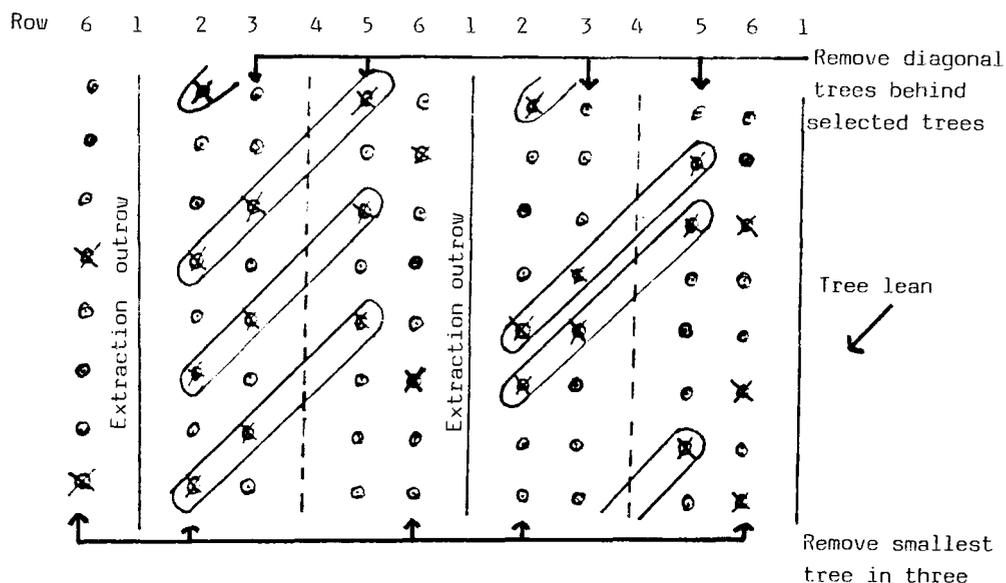
Second thinning - 1200 to 650 s/ha, Age 18-19

APM's new woodroom uses a long length drum debarker. Consequently, the harvesting systems have been altered. The following prescriptions describe the thinning patterns used following the 1 in 3 outrow pattern. The patterns were developed for manual felling and processing pulpwood to 3.0 to 5.5 metre lengths for forwarder extraction. Trees less than 12 cm diameter are considered non-usable.

- (1) Every second outrow (row No. 1) is used as an extraction row.

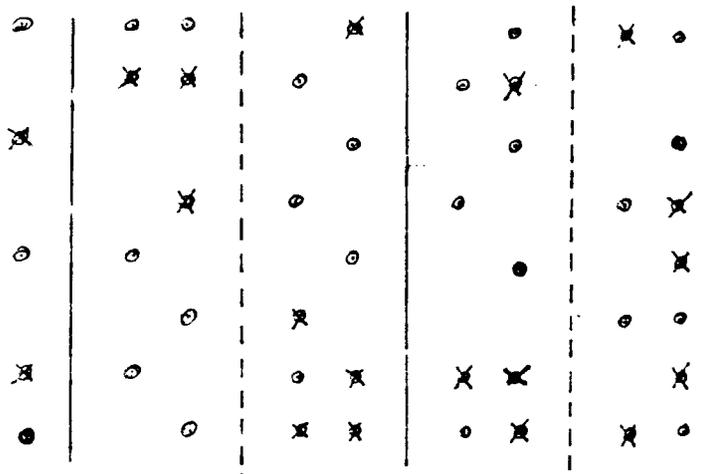
The following steps occur systematically as the cutter works down the outrow. For clarification, they are stated as separate steps :

- (2) In rows 2 and 6, remove the smallest tree in a group of three, i.e. when starting look at 1st three trees and remove smallest tree. To re-orient, the cutter stands on the stump of the tree just felled, recounts the next three trees and removes the smallest of them. Repeat the procedure down the row.
- (3) If 3 consecutive trees in a row come up for felling, one after the other, bypass the 3rd tree and recount. This ensures that no more than 2 trees are cut together thereby avoiding large gaps.
- (4) To one side of the outrow (depending on predominant lean) cut a diagonal rib (rows 3 and 5) beyond the smallest tree selected in row 2.



Third and later thinnings - 650 to 390 s/ha, Ages 22-26

- (1) Each row is treated independently.
- (2) The smallest tree in a line of three is felled in each row, using the same counting method used in the selection rows for second thinning.
- (3) This is possible because there are more gaps in the stand than there are at second thinning, and so trees can be directionally felled easily without the risk of hang-ups.



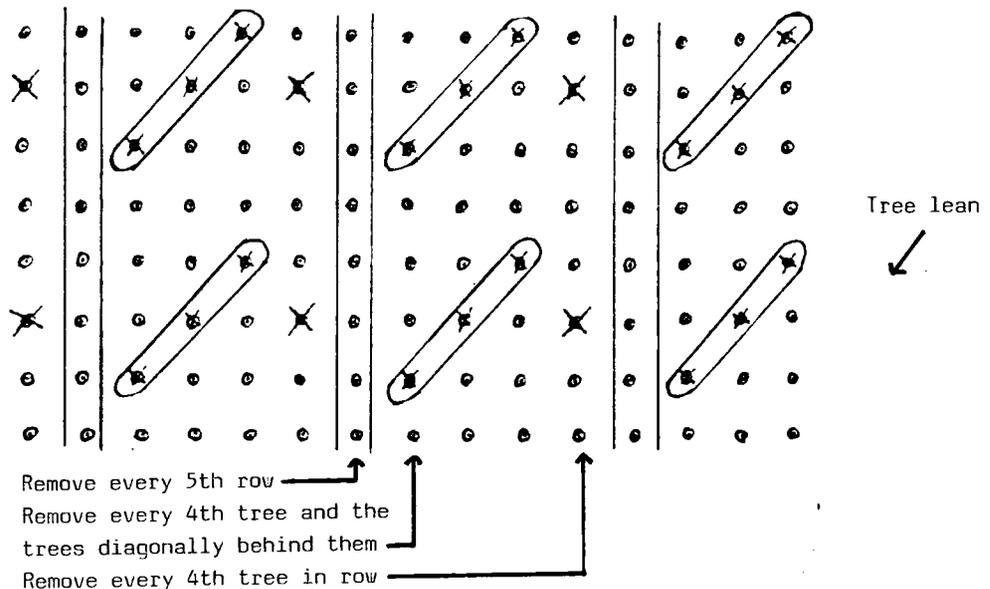
Remove smallest tree in three, working each row independently

Future Patterns

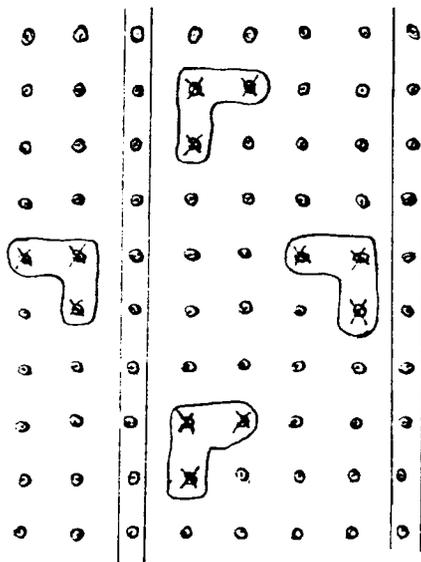
Now the APM harvesting systems will be producing longer length pulpwood, the 1 in 3 outrow prescription has been abandoned. The new approach for 1st thinning is purely mechanical and combines a 5th outrow with mechanical selection in the bays. When these stands are ready for a second thinning, new patterns for later thinnings will be developed. There are two 1st thinning patterns - one for manual felling and one for mechanised harvesting.

First thinning - Manual felling - 1800 to 1080 s/ha, Age 14

- (1) Every 5th row is felled as an outrow, giving access to the stand for extraction machines.
- (2) To one side of the outrow one row is thinned by selecting every 4th tree if it is of commercial size. Planting gaps are included in the count.
- (3) To the other side of the outrow, three rows are thinned using a diagonal rib pattern. These ribs should occur every 4th tree in the same fashion as stated in No. (2).



First thinning - Mechanised harvesting - 1800 to 1080 s/ha, Age 14



- (1) Every 5th row is felled as an outrow, giving access to the stand for the harvester.
- (2) The harvester uses a systematic approach to felling :
 - (a) Cut two outrow trees.
 - (b) Then cut a clump of 3 trees from the adjacent two rows on the right.
 - (c) Then cut three outrow trees.
 - (d) Then cut clump of 3 trees from the adjacent two rows on the left.
- (3) In this manner, a pocket is cut out leaving a place for the harvester to deposit a bunch.
- (4) Machine direction of travel.

DISCUSSION

The use of mechanical selection rather than silvicultural selection can facilitate smallwood harvesting systems in thinnings. The use of extraction outrows provides machine access into the stand and can help reduce damage to residual trees. Diagonal rib patterns for thinning the bays allows for felling into the extraction row and reduces the likelihood of hang-ups. In addition, mechanical selection eliminates the need for costly tree marking and can be easily supervised.

As can be seen, apart from the first thinning, the APM system does give an increasing degree of selection as thinnings advance and, further, enables spacing to be reasonably uniform. It is also an easy system to supervise as the stump of the tree cut remains as evidence that the cutter has or has not complied with the "smallest tree in 3" prescription. First and second thinning falling patterns are tailored to the general lean of APM's stands, which is a result of the prevailing southwesterly winds.

APM currently plants genetically improved seedlings. This has led to stands of more uniform tree quality. With uniform stands the disadvantages of mechanical selection are reduced. From an outsider's viewpoint, it may be time for New Zealand organisations involved in production thinnings to further investigate the potential of a combined mechanical and silvicultural selection, such as an outrow with bay selection. This will improve access to the stand during thinning and allow the bay trees to supply the quality trees for the final crop.

Ultimately the decision on whether to go the direction of mechanical tree selection or not is dependent on the economic criteria used by the Forest Manager. If the initial economic gains in thinnings are more than offset by loss of product value over the rotation, then it should not apply. If, on the other hand, this is not the case, then mechanical selection must pay.

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