

EXECUTIVE SUMMARY

CULLING RESIN BLEEDERS AT THE TIME OF SELECTION FOR PRUNING - DO RESIN BLEEDERS IDENTIFY THEMSELVES AT A YOUNG AGE?

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THE PROBLEM

New Zealand's 1.05 million hectare pruned radiata pine forest estate contains a component of trees with resinous defects. Ideally, such trees should not be selected for pruning because they have poor potential for producing quality clearwood end products. A national study carried out by the Plantation Management Research Cooperative showed that external bark lesions could be used to identify young trees containing resinous defects. This suggests that such trees could be selected and culled at time of pruning. However, the question is, do such resin bleeders always identify themselves at a young age, or is there a component of the population that develop lesions at a later age, negating the opportunity of reducing this defect by culling at the time of selection for pruning. Confirmation that most resin bleeders do identify themselves at a young age would confirm that resinous defects could largely be removed from tomorrow's forests via culling at the time of selection for pruning. This could result in a substantial reduction of the No. 1 defect in radiata pine pruned logs.

COOP INITIATIVES

This joint Coop/WQI study extends earlier Coop work which confirmed that culling trees containing lesions at the time of selection for pruning substantially reduced the incidence of resinous defects on most New Zealand sites (Coop Report 93).

THIS PROJECT

Ten clean-stemmed butt logs and 10 butt logs containing stem lesions were obtained from Tarawera Forest, and a similar sample was obtained from the Canterbury Plains. Logs were cut into discs and each resin pocket assessed for resin pocket type, ring number of occurrence, and height up the stem. Analysis of this data was used to establish whether trees with resinous defects in their outer rings also tended to have defects in their inner rings.

RESULTS

- Re-affirms the strong relationship between bark lesions and incidence of resin pockets.
- Trees with 'clean' & 'low' bark score ratings contain a nil to very low incidence of resinous defects, including wet resin pockets.
- *Wet* Type 1 resin pockets (not associated with bark lesions) are closely associated with *Dry* Type 2 resin pockets (that are associated with lesions) meaning that culling of trees with lesions at the time of selection for pruning, results in removal of both resin pocket types.

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- Trees that have a propensity to produce lesions, do identify themselves at an early age making culling at the time of selection for pruning feasible.
- As a by-product of this study, it was shown that logs containing resinous defects can be segregated following de-barking on the basis of a pitting characteristic present on the debarked stem. Potentially this method could allow segregation of pruned radiata pine logs for resin defects either at a merchandising yard, sawmill or plymill.

IMPLICATIONS FOR THE COOP

Culling resin bleeders at the time of selection for pruning requires implementation of this additional selection criteria into pruning prescriptions. This is not likely to add to the cost of pruning, and since release of the earlier study commissioned by the Plantation Management Research Cooperative, several forest companies have successfully implemented this new requirement into their pruning prescriptions. Detailed implementation into the prescription requires pre-assessment to determine: current stocking, target crop stocking, crop tree acceptability, and number of acceptable trees per hectare without lesions.

Segregation of pruned logs displaying pitting on debarked surfaces in the merchandising yard, sawmill or plymill, could result in considerable cost savings from the reduction of logs containing resinous defects from appearance grade processing streams. While there can be little debate that segregation of logs displaying gross pitting incidence is advantageous, further detailed investigation to determine the relationship between lower levels of pitting and interior resinous defects to determine the best break point for segregation may be warranted.

INTRODUCTION

Aim

To confirm whether the resin bleeding/lesion population identifies itself fully at a young age, or whether a component of the population commences bleeding later in the rotation, negating the opportunity of reducing the incidence of resin pockets by culling at the time of selection for pruning.

Background

A strong relationship has been shown between external bleeding/lesions and resinous defects within stems of older trees (McConchie, 2003). A further study was carried out by the Plantation Management Cooperative relating to young trees, with the following results (Cox et al., 2005):

1. A strong relationship exists between young trees displaying lesions and incidence of internal resin defects.
2. In the four sites intensively sampled (including Canterbury), trees displaying no lesions, contained no resin pockets or a very minor incidence of Type 1 resin pockets.
3. Coastal BOP, Central BOP and Hawkes Bay sites contained predominately Type 2 resin pockets.
4. Culling trees containing lesions at the time of selection for pruning should substantially reduce incidence of resinous defects on most New Zealand sites.

These results confirmed the relationship between external bleeding/lesions and resinous defects within young trees, and concluded that culling such trees at the time of selection for pruning should result in very large reductions of resinous defects throughout NZ. However, the question remains as to whether the resin bleeding/lesion population identifies itself fully at a young age, or whether there is a component of the population which commences resin bleeding at an older age, negating the opportunity of reducing this defect by culling at the time of pruning.

METHODS

Twenty mature *P. radiata* pruned butt logs were selected from each of Tarawera Forest and Shemmings block, Canterbury. These sites were chosen as they contained the highest incidence of resin pockets of the 12 sites previously studied (Cox et al., 2005). At each site, 10 of the logs chosen were clean and 10 contained a high incidence of bark lesions as classified by McConchie (2003). Log lengths were approximately 5.5m. Plantation ages were 26 and 22 years for the Tarawera and Canterbury sites respectively.

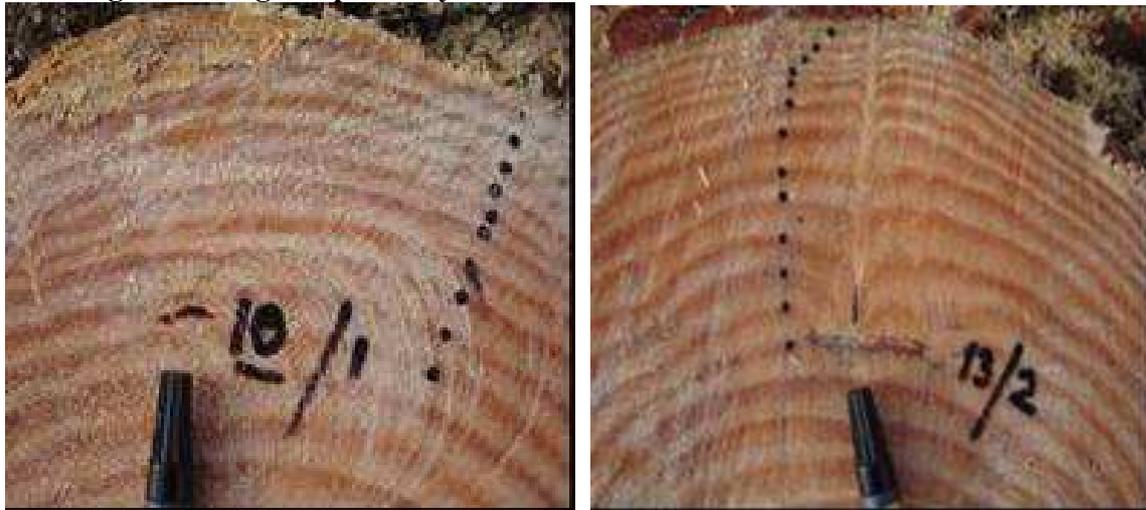
Both clean and bark lesion logs in Canterbury and clean logs in Tarawera were selected and destructively sampled in the forest. The bark lesion logs from Tarawera were selected from the full stem KFL Processing Yard located at Kawerau. This was necessitated because of the low incidence of such logs in the locations being harvested in Tarawera Forest. However the logs were mainly from the same location as the clean sample as verified by the gang ID No. shown on the log ends in the processing yard. While much of the bark had been removed from these logs following de-limbing and subsequent handling, sufficient remained containing bark lesions to allow selection of a suitable sample.

Each log was destructively sampled by cross-cutting at 30 cm intervals. On the top face of each disc, resin pockets were counted, and assessed for type and ring number from bark (as shown in Figure 1), and height up the log. The ring number was used to estimate the age of formation of

the wood adjacent to the resin pocket. Analysis of this data was used to establish relationships between resin pockets by age.

Resin pockets were typed according to the recognised classification developed by Somerville (1980). However, it has often been found difficult to distinguish between Type II and Type III defects. In practice, the main difference between these two types is their size, with Type III defects being smaller than Type II defects but otherwise similar. For this reason, Type II and III defects were grouped into one class. For simplicity, the grouped Type II and III defects are referred to as Type II defects in the remainder of this report.

FIGURE 1: Type 1 (left) and Type 2 (right) resin pockets located on the 10th and 13th annual growth rings respectively from the bark.



RESULTS

The incidence of both Type 1 and Type 2 resin pockets in the 10 clean-barked logs from Tarawera Forest was shown to be very minor as shown in Figure 2. Note that each point shown in the following graphs may represent one or more defects. The incidence of Type 1 and Type 2 resin pockets in the 10 logs with bark lesions assessed at Tarawera Forest are shown in Figure 3. Type 2 resin pockets associated with bark lesions were well distributed up the butt log, and commonly present from ages 5 to 20 years. Type 1 resin pockets had a lesser incidence than Type 2 resin pockets, but a similar distribution up the stem and by age.

FIGURE 2: Incidence by height and formation age of Type 1 (left) and Type 2 (right) resin pockets in Tarawera clean bark logs. Points may represent one or more resin pockets.

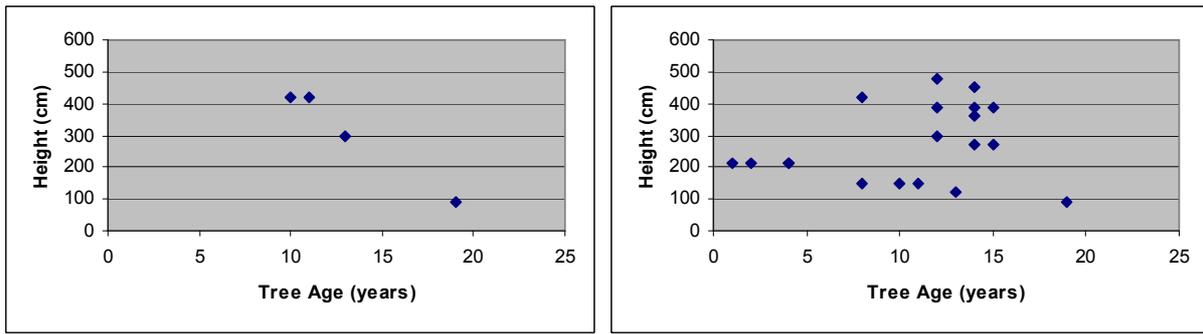
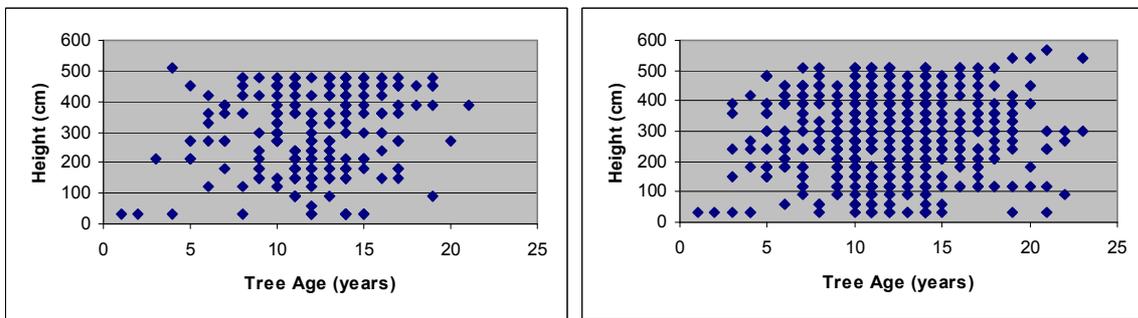


FIGURE 3: Incidence by height and formation age of Type 1 (left) and Type 2 (right) resin pockets in Tarawera logs with bark lesions. Points may represent one or more resin pockets.



The incidence of resin pockets in the 10 clean-barked logs assessed at Canterbury was also shown to be relatively minor although there was a sprinkling of Type 1 pockets in these logs (Figure 4). The incidence of Type 1 and Type 2 resin pockets in the 10 logs with bark lesions assessed at Canterbury is shown in Figure 5. As with the Tarawera logs, Type 2 resin pockets associated with bark lesions were shown to be well distributed up the butt log, and commonly present from age 5 to 18 years. Type 1 resin pockets, although not associated with bark lesions, had a lesser incidence than Type 2 resin pockets, but a similar distribution up the stem and by age.

FIGURE 4: Incidence by height and formation age of Type 1 (left) and Type 2 (right) resin pockets in Canterbury clean bark logs. Points may represent one or more resin pockets.

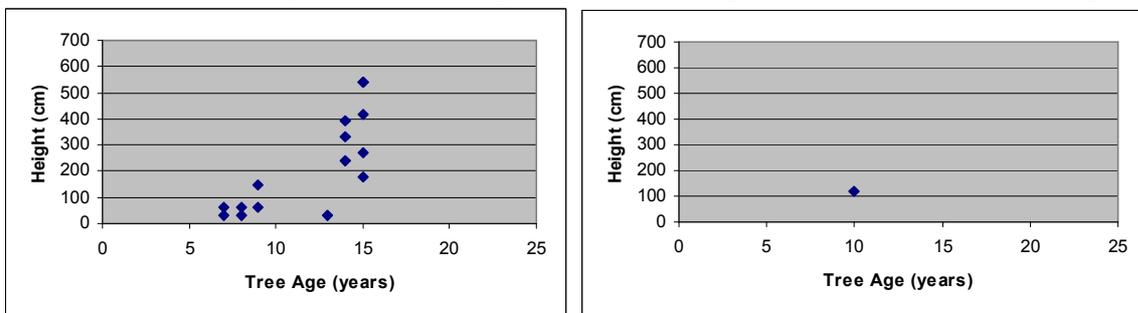
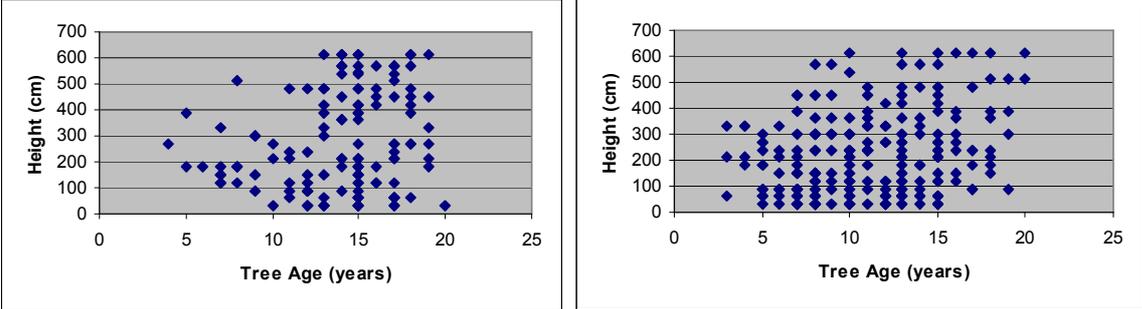


FIGURE 5: Incidence by height and formation age of Type 1 (left) and Type 2 (right) resin pockets in Canterbury logs with bark lesions. Points may represent one or more resin pockets.

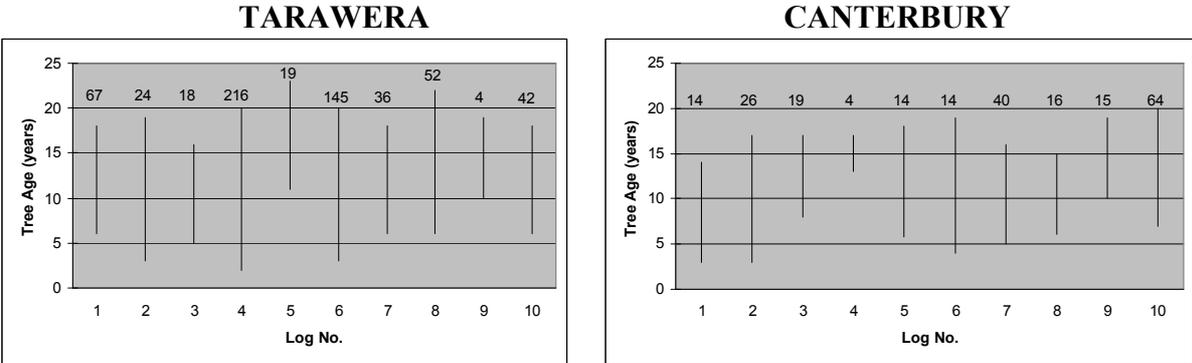


The occurrence of Type 1 resin pockets was shown at both Tarawera and Canterbury to be closely associated with the occurrence of Type 2 resin pockets, and therefore indirectly with bark lesions, confirming findings from Cox et al. (2005). The high incidence of resin pockets across all ages in trees with bark lesions strongly suggests that resin bleeder/lesion trees should identify themselves at a young age. In contrast, the very low incidence of resin pockets in clean-barked stems strongly suggests that they would have had no external resinous symptoms at a young age.

The youngest and oldest Type 2 resin pocket for each of the 10 butt-logs assessed at Tarawera and Canterbury are shown in Figure 6. Given selection for first lift pruning commences at ages 4 to 6 years, and further selection for the second lift pruning occurs at ages 5 to 8 years (in Canterbury), bark lesions and associated Type 2 resin pockets would need to occur at these early ages if selection based on bark lesions is to be applied successfully at pruning. Assuming each Type 2 pocket has an associated lesion at the time it is being formed, at the Tarawera site, 8 of the 10 trees would have had lesions present at the time of first lift pruning at approximately 5 years of age. No Type 2 resin pockets were detected younger than age 10 years in the remaining two trees.

However, it should be noted that the sampling procedure used in this study would not have detected all defects in each log, and it is therefore probable that the logs could have contained undetected Type 2 defects formed earlier than the ages shown. A companion WQI study on defect resin pocket dimensions (Kimberley et al., 2005) suggests that this method of sampling would have detected about 20% of the defects present in these logs.

FIGURE 6: Youngest and oldest Type 2 resin pockets recorded for each of the 10 bark-lesion logs at each site.



Note : The number above each bar is the total no. of Type 2 resin pockets /log

The average number of Type 1 and Type 2 resin pockets detected per log for the clean and bark lesion logs at both sites is shown in Table 1. At both sites, clean logs had a dramatically lower incidence of both Type 1 and 2 resin pockets than logs with bark lesions. The resin pocket incidence in clean logs compared with logs with bark lesions was only 3% at Tarawera, and 5% at Canterbury. At both sites, logs with Type 2 lesions also had a greatly increased number of Type 1 lesions. This association between the two types of resin pockets accords with the observation of Somerville (1980) who noted that Type 2 defects often originate as Type 1 defects which rupture the cambium layer.

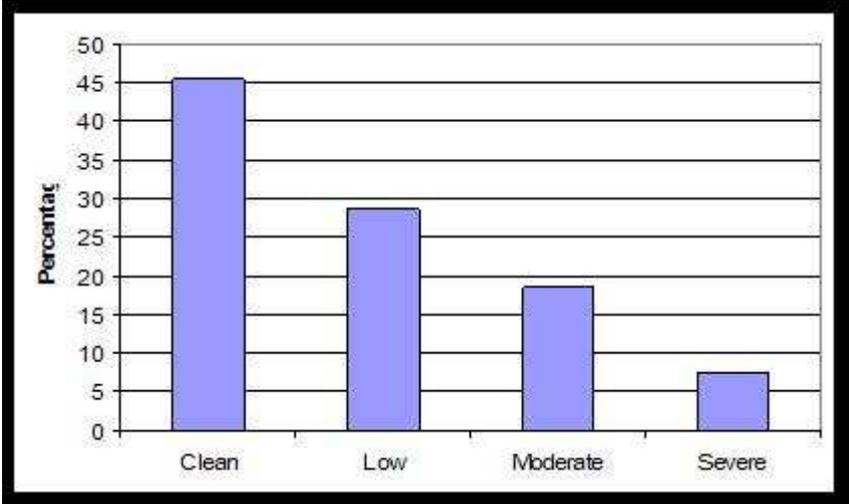
The Tarawera logs with bark lesions contained almost three times the incidence of resin pockets as the Canterbury bark-lesion logs. However, the Tarawera logs were substantially larger in volume than the Canterbury logs, and the incidence per cubic metre may have not been greater. At both sites, there were two to three times as many Type 2 as Type 1 resin pockets in logs with bark lesions. However, there was a higher incidence of Type 1 than Type 2 defects in the clean logs from Canterbury.

TABLE 1: The detected incidence per log of Type 1 and Type 2 resin pockets by site and log type.

	Average Resin Pockets detected per Log	
	Type 1	Type 2
Tarawera Forest		
Clean Logs	0.4	2.0
Lesion-based Logs	21.4	64.1
Canterbury		
Clean Logs	1.7	0.1
Lesion-based Logs	13.1	22.6

To put into perspective the incidence of bark-lesioned trees and associated resin pockets, a bark score assessment was carried out at the Shemmings Canterbury plantation, which was considered to be a high resin pocket site for the Canterbury Plains. The bark score assessment was based on the categories developed by McConchie, 2003. Results showed that approximately 75% of the trees either had clean or a very minor incidence of bark lesions, 18% had a moderate incidence and only 7% displayed a high incidence of bark lesions and associated resin pockets (Figure 7).

FIGURE 7: Bark score assessment for trees from Shemmings block, Canterbury Plains.



Selection of partially debarked logs at the KFL processing yard located at Kawerau, clearly showed that stems containing bark lesions also contained pitting on the de-barked stem (Figure 8). Destructive sampling of these logs showed the association of Type 2 resin pockets with this pitting characteristic. Surprisingly the smallest of such resin pockets, despite having occurred at a young age were often associated with pitting (Figure 9).

FIGURE 8: Example showing a high incidence of pitting on a debarked stem associated with bark lesions and Type 2 resin pockets.



FIGURE 9: Example showing that even small Type 2 resin pockets produced at a young age are commonly associated with pitting.



FIGURE 10: Further examples of Type 2 RP's associated with pitting.



Two Type 2 RP's, showing associated occlusion scars & traces to stem circumference



Side view of debarked stem and same RP's, associated with pitting

DISCUSSION

At the usual age of selection for pruning, commonly of 4 to 5 years, trees displaying bleeding and associated lesions will generally contain only a small number of lesions compared to the same trees at mid rotation. This simply reflects the smaller stem circumference and volume of younger trees. The overall incidence of resin pockets in the inner four or five annual rings identified by crosscutting is therefore likely to be lower than in outer rings.

Given the incidence of resin bleeding and associated lesions and Type 2 resin pockets appears to be influenced by stress, e.g., high temperatures, low soil moisture content, wind, etc, the age of selection for pruning could coincide with low or high stress years making selection more or less difficult. Observation of the occurrence of resin pockets in crosscut discs indicates that they are often grouped around certain rings, suggesting that their incidence may vary greatly from year to year.

Because of this, culling resin bleeders at the time of pruning will most likely be of greatest benefit when in periods when the trees are under stress. Conversely culling in periods when trees are not under stress, may result in fewer susceptible trees being detected, and the consequent pruning of trees that may bleed in a later year when under stress.

Despite these potential problems, this study strongly suggests that the presence of bark lesions or resin bleeding on stems should be a prime criterion for not selecting trees for pruning. Furthermore, stands with a high incidence of trees showing these symptoms may not be suitable for pruning and the production of appearance grade products.

CONCLUSIONS

- Clean-barked trees contain a nil to very low incidence of resin pockets, both Type 1 and 2.
- In contrast, trees displaying resin bleeding or bark lesions generally contain high levels of Type 1 and Type 2 defects.
- Trees with high levels of Type 2 defects tend also to have high levels of Type 1 defects.
- Trees that have the propensity to produce lesions and associated resin pockets generally do so from a young age.
- Culling of trees displaying resin bleeding and lesions at the time of selection for pruning has the potential to largely eliminate resinous defects in radiata pine nationally.
- It appears feasible to segregate logs containing resinous defects following de-barking based on the pitting characteristic present on the debarked stem.

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