Focus Orchard Case Study: Root Pruning Trial

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Background

Strong healthy soils and high rainfall mean that excess vigour management can become a key problem for Batlow apple orchardists. This issue can be exacerbated in some seasons due to poor pollination, high rainfall, frost or hail damage, reducing crop load and in biennial bearing off cropping years.

In addition to pruning, girdling and chemical growth regulators, root pruning is a useful tool in the management of excessive vegetative growth. Root pruning has not been commonly utilised in the Batlow district in the past. Recently, several leading orchardists in the district have invested in root pruning equipment and are beginning to use the technique as one of their vigour management tools.

Objective

1. To build local knowledge and experience in the use of root pruning for vigour management.
2. Setup two demonstration plots which will be the focus of a Future Orchard’s meeting.

Method

This demonstration trial is designed to generate some practical hands-on knowledge and experience in the area of root pruning which can be extended to local growers via the Future Orchards field meetings.

Two blocks of high density plantings were root pruned on the 26th September 2012. One block was Red Fuji on M26 and the other Pink Lady on M9. Both blocks were twelve years old.
Three treatments were imposed; a control (not root pruned), a single side root prune and root pruned on both sides of the tree. The root pruner was set up with the blade angle at 30° from vertical, to a depth into the ground of 346mm. The blade entry point was 473mm from the trunk (where the tip of the blade was 300mm from root crown). The tractor travelled at 5km/hour.

Boreco Root Pruner used in the demonstration. Plots were all root pruned with blade insertion depth of 346mm at a 30° angle.

Below, the Pink Lady (M9) showing markings at 473mm from trunk for root pruning on both sides.
Results

The January fruit counts alerted us that the control Pink Lady plot had a lower crop load than the root pruned plots. This accidental bias will have had an impact on the amount of vegetative growth in the routine Pink Lady treatments and should be considered when comparing results.

Note: Sometimes root pruning treatments are known to improve fruit set and this is most likely what has happened in this trial. In future, root pruned trees would need the crop load adjusted down to ensure yield targets are not exceeded.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Red Fuji</th>
<th>Pink Lady</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (non-root pruned)</td>
<td>157</td>
<td>186</td>
</tr>
<tr>
<td>Single Side root pruned</td>
<td>172</td>
<td>215</td>
</tr>
<tr>
<td>Both Sides root pruned</td>
<td>154</td>
<td>207</td>
</tr>
</tbody>
</table>

*Table 1: Average fruit number per tree in mid-January.*

Shoot Length and Percent Termination

Measurements of shoot length and percentage termination carried out in December 2012 indicate shoots were shorter and terminated earlier in the root pruned plots compared with the routine plots. Shoot length reduction and % termination in December was greatest in the double root pruned plot for both varieties.

<table>
<thead>
<tr>
<th>Results</th>
<th>Control</th>
<th>Single RP</th>
<th>% change from Control</th>
<th>Both Sides RP</th>
<th>% change from Control</th>
<th>% change between Both sides and Single side RP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoot Numbers</td>
<td>183</td>
<td>149</td>
<td>-19%</td>
<td>136</td>
<td>-26%</td>
<td>-9%</td>
</tr>
<tr>
<td>Total Length (mm)</td>
<td>2399</td>
<td>2085</td>
<td>-13%</td>
<td>1773</td>
<td>-26%</td>
<td>-15%</td>
</tr>
<tr>
<td>Average Length (mm)</td>
<td>43.6</td>
<td>42.6</td>
<td>-2%</td>
<td>34.1</td>
<td>-22%</td>
<td>-20%</td>
</tr>
</tbody>
</table>

*Table 2: Shoot number, length and percentage change from control in Red Fuji plots December 2012.*

Compared with the control (un-pruned), both side root pruning in the Red Fuji resulted in a 26% reduction in shoot number and total length and a 22% reduction in average shoot length. As expected, root pruning on both sides of the tree resulted in 9% reduction in shoot numbers, 15% reduction in shoot length and 20% reduction in average shoot length compared to the single side root pruned trees. Root pruning on both sides of the tree is more aggressive than single side root pruning.
Further measurement will be taken before winter pruning to record the final difference in shoot growth between the plots.

Graph 1: The graph above highlights the differences in shoot termination between the treatments by early December.

In early December there was a clear shift in percentage of shoots terminated in the root pruned plots (Graph 1). At this time nearly 80% of shoots were terminated in the trees root pruned on both sides compared with only 28% in the control un-pruned trees. The resulting terminated shoots in the trees root pruned on both sides were considered ideal for next season’s crop, being short in length and having more time to develop a strong terminal fruit bud. This will be monitored.

Pre-Harvest Fruit Size

The diameter of one hundred fruit were measured pre-harvest for each treatment and variety. The Red Fuji was one week away from harvest and the Pink Lady still had another 2-3 weeks remaining till harvest. Normally it could be expected that trees root pruned on both sides might have smaller fruit from increased fruit set compared to the other less aggressive treatments. This was correct for all treatments except the Red Fuji, which had the same crop load as the control (table 1) and similar sized fruit (Table 3). Sometimes aggressive root pruning can assist with setting the earlier flowers, which have the potential to grow larger fruit. This or another unknown reason might be the cause of the increase in fruit size for trees root pruned on both sides.
Table 3: Pre harvest fruit diameter measurements highlighting the difference in fruit size between the treatments.

<table>
<thead>
<tr>
<th>Pre harvest fruit diameter measurement</th>
<th>Red Fuji (mm)</th>
<th>Pink Lady (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>73.9</td>
<td>68.9</td>
</tr>
<tr>
<td>Single side</td>
<td>71.6</td>
<td>68.3</td>
</tr>
<tr>
<td>Both sides</td>
<td><strong>73.6</strong></td>
<td><strong>66.5</strong></td>
</tr>
</tbody>
</table>

Physical appearance of the fruit and the trees

The visual difference in canopy density between plots was very obvious. It is clear that the more aggressive the root pruning treatment was, the more open the canopy is. This has had an impact on the exposure of the current season’s crop and next season’s developing buds to the available light. Fruit colour seems to be better overall in the root pruned treatments. It is anticipated that fruit bud development in the root pruned plots will also be greater and this will be investigated in spring 2013.

Conclusions

This demonstration trial has successfully shown the key benefits of root pruning:

- Control of vegetative growth = Shorter shoots terminating earlier in the season.
- More open canopy = Better exposure of fruit and buds to sunlight.

Further follow up is required next season to monitor the progress of the treatments and management changes may be required to get the most from these. I will keep you posted.