Outline & Final Report

2013-14 Root Pruning Field Demonstration

MT View Ehmsens Orchard, Batlow

Report prepared by

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NSW Department of Primary Industries

& Future Orchards FLA (Batlow)
# Future Orchards Trial Outline

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<th>Project title:</th>
<th>Root Pruning Demo – MT View (Ehmsons) Orchard</th>
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<td>Region:</td>
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| Objective:               | 1. To build local knowledge and experience in the use of root pruning for vigour management  
                            2. Setup and observe and measure two demo plots which will be the focus of a future orchard meeting.  
                            3. Continue plots over two seasons 2012-13 and 2013-14 |

**Outline/method/ (what we will do did):**

Strong healthy soils and high rainfall mean that at times excess vigour management can become a key problem for Batlow apple orchardists. The issue is exacerbated in some seasons due to poor pollination, frost or hail damage resulting in insufficient crop and a shift in the balance between crop loading and growth.

In addition to pruning, girdling and chemical crop 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.

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.

1st August 2013  
Meeting of the Batlow COG (Dodds, McMahon, Wilson & Oag) and John + Ian Robson to re-confirm root pruning strategies for the demo plots in 2013-14

23rd September 2013  
Established demo plots in two orchard blocks at Ehmsons Orchard. Blocks and treatments as follows;

The 2012-13 plots have been re-ripped as per last season, with the addition of a fourth plot single ripped on the alternate side to last season. A mirror set of plots has been established in the adjacent row for both varieties in order to give some basis on which to compare 1 and two year impacts.

Block : Pink Lady(M9)  
Treatments :  
- a. Untreated control,  
- b. Single side  
- c. Double Side  
- d. Single side on alternate side from the routine 2012-13 ripping
Block: Red Fuji (M26)

Treatments:
   a. Untreated control,
   b. Single side
   c. Double Side
   d. Single side on alternate side from the routine 2012-13 ripping

Setup:
   Blade angle = 30° at top
   Length of blade inserted = 346mm
   Blade Tip-Trunk Distance = 300mm
   Blade\soil entry point to trunk distance = 473mm
   Travel Speed = 5km/hr

November 2013
Presentation to growers explaining the demo. Held in conjunction with the Spring Future Orchards OW.

November 2013 – Harvest 2014
Periodic fruit size measurement.
Pre-harvest average fruit size measurement
Through Season photographic record of tree growth and fruit quality
Shoot length assessment (in Early December)
Observations of any 2nd year impacts

June 2014
Final Report on two seasons of demonstrations. Visit demo plots during the June OW and present results to growers.

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<th>Milestones</th>
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<td>Records Measurement 1</td>
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<td>Records measurement 2</td>
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<td>Presentation growers</td>
<td>November 2013 and June 2014</td>
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MAP & Layout: MT View (Ehmsens) Orchard showing location of root pruning demo plots

- Fuji root pruning plots
- Pink Lady root pruning plots
Establishment photos

Boreco Root Pruner used in the demonstration plots.

Plots were all pruned with blade insertion depth of 346mm (Left) at an angle of 30° at the top (Right). Surface distance from tree trunk centre was 473mm, which equated to 300mm from blade tip to trunk centre.
Pink Lady (M9) showing marking for double side root pruning treatment on last years plots (Left) and a mirror set of plots in the adjacent row (Right).

Flowering stage of Pink Lady at time of root pruning.
Growth stage of Red Fuji at time of root pruning.

Red Fuji (M26) showing marking for double side root pruning treatment on last years plots (Left) and a mirror set of plots in the adjacent row (Right).
Plot Layout 2013-14

Yellow line indicates routine single side root pruning in 2012-13
Future Orchards Trial: Final Report

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Outline/method/ (what you did): Establishment of the 2013-14 Root Pruning Plots

The outcomes of the 2012-13 root pruning demo plots at MT View Ehmsens Orchard were very informative and extremely well received by growers. The plots were the subject of several orchard meetings, discussions and magazine articles. The results in 2012-13 were very visual and there was keen demand from local growers and the property owner Mr John Robson to repeat and even extend the demonstration in season 2013-14.

Accordingly, the existing plots were re-established in Spring 2013 and a replicate set of plots were established in the neighbouring row of each the two varieties (Fuji & Pink Lady). See “Plot Layout 2013-14” in the trial outline above.

The intention of the replicate set of plots in 2013-14 was to investigate possible differences between first year and second year impacts.

For details of root pruner setup, refer to the outline / method above.

RETURN BLOOM measured

At the conclusion of season 2012-13, there was much discussion about the possible impact that our root pruning treatments might have on return bloom (particularly in the Red Fuji which is known for its biennial tendencies).

On 23rd September 2013 (pink stage), flower counts (Total No. per tree) were conducted on all trees in the previous years root pruning plots to determine if there were any clear impacts of root pruning treatment on return bloom.

The results are outlined in the results summary below. These results were the subject of a presentation given by the FLA (Kevin Dodds) at the November 2013 Future Orchards OW in Batlow.

FROST impacts on trial

Severe frosts impacted the South West Slopes and Tablelands during flowering in October 2013. The most significant of these occurred on 18th October. It was estimated that the frosts caused losses totalling 30% of normal production at Batlow.
The frost damage at the trial site compounded the poor general return bloom in the Fuji Block and the Pink Lady block suffered reduced fruit set and significant russetting which would later be thinned heavily creating a confounding effect on fruit numbers across the demo plots which rendered any plans for fruit counts and size monitoring irrelevant.

**SHOOT NUMBER & LENGTH Assessment**

Following the impacts of the frost, the focus of activities in the trial plots switched to shoot number and length as a way of at least collecting information on vigour control.

On 31st March 2014, Kevin Dodds with the assistance of Mathew McMahon (Batlow Fruit Co-op) carried out a shoot count and measure of new shoots arising from the trunk or limbs between foliage wires 2 and 3 in five trees in each of the 5 Treatments that made up the 2013-14 plots.

The outcomes of these shoot counts are provided in the Results Summary below.

**Results Summary**

**Positive impact on return bloom – despite Off-Year in Fuji**

At the time of the September 2013 flower counts, it became apparent that the entire Red Fuji Block was entering a Strong Off-Year.

![Figure 1. Red Fuji Control Plot at full bloom. Notice the lack of flowers in this Strong Off-Year](image)
Figure 2. Red Fuji - Double Root Pruned Plot at Full Bloom, 12 Months after initial root pruning. Notice there are a few more flowers compared with the control (Figure 1) which was not root pruned in 2012-13.

Flower counts (although well below normal On-Year counts in all treatment plots), confirmed that trees in the root pruned plots had substantially more flowers than in the Control plot, with the effect increased with the severity of the root pruning treatment in the previous Spring.

Figure 3. Flower numbers were greater in the root pruned plots than in the control, indicating that root pruning in the previous Spring had a positive effect on return bloom.
Pinks confirm positive impact on return bloom

The return bloom trends in the Red Fuji were confirmed by flower counts conducted in the Pink Lady plots. The Pink Lady carried flower numbers considered more typical of a normal crop year and there was no real indication of a biennial habit in this variety.

![Figure 4. Pink Lady Control plot at Full Bloom.](image)

![Figure 5. Pink Lady - Double Root Pruned Plot at Full Bloom, 12 Months after initial root pruning. Notice there are a significantly more flowers compared with the control (Figure 4) which was not root pruned in 2012-13.](image)

As in the Red Fuji plots, the Pink Lady flower counts confirmed there was significantly more flowers in the root pruned plots compared to the un root pruned control and that there was a trend toward a stronger return bloom with increasing severity of root pruning treatment.
Figure 6. Flower numbers were greater in the root pruned plots than in the control, indicating that root pruning in the previous Spring had a positive effect on return bloom.

**Shoot count and length measurement results**

Shoot counts and measurements to determine impacts on vegetative growth yielded a somewhat mixed bag of results. In general, there were no clear differences between treatment plots for total shoot number (in the samples zone between 2nd and 3rd foliage wire), and there seemed to be no correlation of the plot results between varieties. This result was inconsistent with results for the Red Fuji collected in 2012-13 where shoot number appeared to fall in response to increasing severity of root pruning.

It is unclear why results for shoot number were inconsistent between seasons. This may be an area worthy of further investigation in future trial work.

Figure 7. Total shoot number for Red Fuji and Pink Lady as a function of root pruning treatment
Results for average shoot length were more consistent with observations and assessments made in season 2012-13. In general terms, it can be said that root pruning (regardless of treatment), produced substantially reduced shoot lengths on average compared with the un-root pruned control plots in both varieties.

![Avg Shoot Length x Treatment & Variety](image)

**Figure 8. Average Shoot Length for Red Fuji and Pink Lady as a function of root pruning treatment**

Field observation in the Red Fuji throughout season 2013-14 suggested that the impact of the first year double sided treatment was greater than the 2<sup>nd</sup> year repeat double sided treatment. At the November 2013 OW this led to discussions around the possibility that the shock of first year root pruning might be more significant therefore producing a stronger effect on vigour control. It was further speculated that the Fuji trees that were double root pruned in 2012-13, would have established a significant amount of new roots behind last years pruning sites thereby producing a strong growth response despite the repeat double treatment in 2013-14. Again in the Red Fuji, this theory was supported by similar results between the single side alternate row treatment vs the single side repeat treatment, where the single side alternate treatment produced a shorter average shoot length indicating a stronger response to root pruning.

Unfortunately, the theory of “first Year treatment shock” was not confirmed by average shoot lengths for the Pink Lady plots. It is unclear why the Pink Lady behaved differently to the Red Fuji in regard to average shoot length. This could be a result of variable crop load between the plots following the October frost and subsequent heavy thinning to remove russet.

Field observations in the Pink Lady in respect to canopy density were confirmed by the average shoot length results. The Double Sided Y2 treatment clearly has the most open / sparse canopy as it did in 2012-13. Crop load in year one of the trial was not adjusted by thinning and the stress of the double root pruning resulted in a very weak growth response particularly in the double sided root pruned plots. It is likely that the root pruning x crop load stress in 2012-13 has had an effect on the growth responses achieved in year two and this might (in-part) account for the differences average shoot length response between the Fuji and Pink Lady plots in this second season.
Implications

What did we learn?

The following is a list of key observations / conclusions made following two seasons of root pruning at MT View Ehmsens, Batlow.

1. Root pruning is an effective vigour management tool which offers the grower flexibility to control the level of impact in the tree.

2. Crop yield is not negatively impacted by root pruning, provided that normal thinning intensity is applied.

3. First year results indicate that root pruning has a positive influence on the level of return bloom in Apples.

4. Year 1 results indicated that root pruning results in a reduction of both shoot number and average length. In year 2, this statement is only confirmed for average shoot length.

5. Root pruning resulted in shorter shoots terminating earlier in the season.

6. Root pruning resulted in a more open canopy which should equate to better exposure of fruit and buds to sunlight.

How will this impact on the business?

The following is a list of key benefits that root pruning might offer the apple orchardist.

1. Cost effective and reliable method of vigour control.

2. Significant reductions in both Summer and Winter pruning costs.

3. Improvements in fruit colour and quality. The effects of exposing fruit to sunlight earlier in the season need further investigation. There may be benefits in terms of building fruit tolerance to sun related injury (sunburn, sunscald).

4. Positive impact on return bloom requires further investigation, but it could be that root pruning becomes an important tool in managing trees for consistent cropping year to year (particularly in Biennial varieties like Red Fuji).

5. Year 1 fruit size measurements suggested that there may be a size management / distribution benefit from root pruning, with more fruit in a narrower range of sizes. This observation was not confirmed in the Pink Lady (probably due to a lack of normal thinning). The frost in 2013-14 prevented subsequent observations on this kind in the second year. This could be an area of future study.

What will we change? What are the road blocks/obstacles to change?

Change in local orchards as a result of this work is already evident. When the work commenced in Spring 2012, there were only two BoreCo root pruners in the Batlow district. There are now at least 5 such units working in Batlow orchards. Root pruning is being carried out by owners of the equipment, but also under contract to grower who have chosen not to purchase their own root pruner.
The information and results generated by this project have helped to accelerate the rate of adoption and practice change in the area of canopy management and vigour control.

There are still many questions that could be investigated relating to issues such as;

- Possible effects on tree health
- Tree root responses
- Potential benefits in terms of new root development within the drip irrigation and fertigation zone.
- Effects on fruit size, size distribution and quality
- Root pruning as a tool to manage biennial bearing

There is no doubt that root pruning is a useful vigour management tool for apple orchards with many benefits. These benefits and the ongoing impacts of root pruning in the orchard are worthy of further investigation.

Acknowledgements

The Future Orchards FLA would like to thank the following people for their contribution to this study;

Ian & John Robson – MT View Orchards (Batlow) for offering to host the demonstration on the orchard and for providing staff and equipment to assist with trail establishment.

Matthew McMahon – Technical Services Manager (Batlow Fruit Co-operative Ltd) for his assistance with measurements and assessments of this demonstration.

The Batlow Future Orchards Community Orchard Group (COG) consisting of Ralph Wilson, James Oag, Steve Spark, Jesse Reader & Matthew McMahon, for their contribution to discussions and ideas relating to this demonstration.

For more information on this field demonstration please contact;

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