

Mechanical Pruning of Pink Lady and Kanzi Apple Varieties

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Abstract

In 2013, the project was launched to study mechanical pruning with a sickle bar machine system over the course of 3 years to identify blocks and tree architectures suitable for mechanical pruning. The goal of the project is to compare mechanical pruning to traditional hand pruning, or the combination of the two, and study the effects on yield, fruit quality, and tree physiology.

Introduction

At the Washington State University Tree Fruit Research and Extension Center the intention is to develop new knowledge and technology through groundbreaking programs and to transfer the findings in a way that strengthens Washington's fruit industry, promotes fruit quality, and enhances the quality of the environment. In the early 1970's there was a concern over the availability of labor, and a strong demand for mechanical harvest research on apples. Apples were one of the few crops still being harvested by hand. This has resulted in significant research investments in mechanical pruning over the last 10 years. I had the pleasure of working alongside Stefano Musacchi, Ph.D. and Sara Serra Ph.D. in the Department of Horticulture.

Methods and Materials

Pink Lady/M9-337

The conventional orchard was planted in 2012 with a planting distance of 10ft x 3ft in Mattawa, WA on a spindle rootstock. There were a total of 8 rows used in this trial, where 2 rows were selected for each treatment. The rows were split into 3 plots, with a total of 288 trees. Four treatments were applied to this orchard. The speed of the tractor carrying the sickle bar machine was 1.8 MPH. Times were taken from the beginning to end of each plot and wood, leaves, and fruit were collected. A sample of fruit was taken back to the lab to measure the diameter of fruit.

Kanzi/ M9

This organic orchard was planted in 2009 with a planting distance of 10ft x 3ft in Quincy, WA. Four treatments were applied to this orchard, with 4 rows participating in the trial. The rows were broken up into 4 plots with a total of 192 trees. The speed of the tractor carrying the sickle bar machine for this trial was 3 MPH. Data was collected from rows 2 and 5 in each plot. Times were taken from the beginning to the end of each plot. After all times were collected, wood, leaves and fruit were collected. A sample of fruit was taken back to the lab to measure the diameter of fruit.

Conventional
Pink Lady
Mattawa, WA

- Rootstock: M9337
- Year of Planting: 2012
- System: Spindle
- Planting Distance: 10ft x 3ft
- Treatments:
 - Winter Mechanical Pruning
 - Summer Mechanical Pruning 2014-2015
 - Hand+ Mechanical Winter Pruning + Summer Mechanical Pruning 2015
 - Traditional Hand Winter Pruning (Control)

Organic
Kanzi
Quincy, WA

- Rootstock: M9
- Year of Planting: 2009
- System: Spindle
- Planting Distance: 10ft x 3ft
- Treatments:
 - Mechanical Winter 2015 + Hand (Top by Platform; Bottom by crew)
 - Hand Pruning Winter 2015 (No Ladder) + Summer Mechanical Pruning 2015
 - Hand Pruning Winter 2015 by Ladder (Control)
 - Mechanical Winter 2015
 - Mechanical Winter + Mechanical Summer 2015

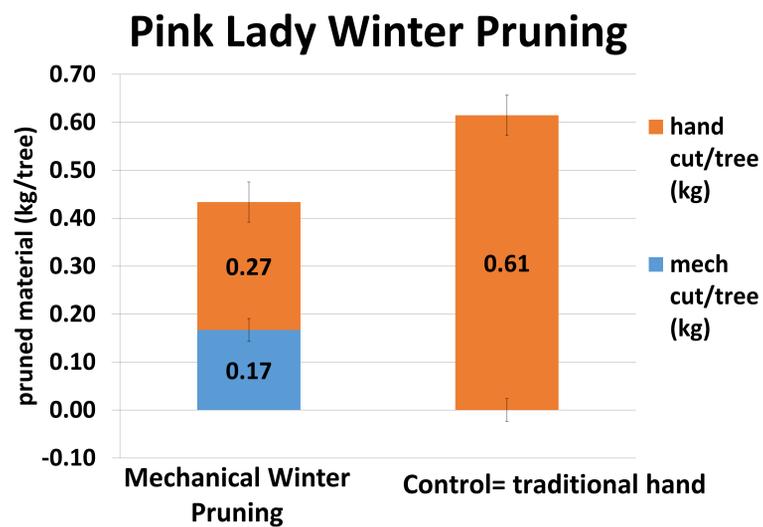


Figure A: Pink Lady apple variety winter pruning comparison between mechanical and traditional hand winter pruning treatments applied to measure amount of pruned materials removed from tree.

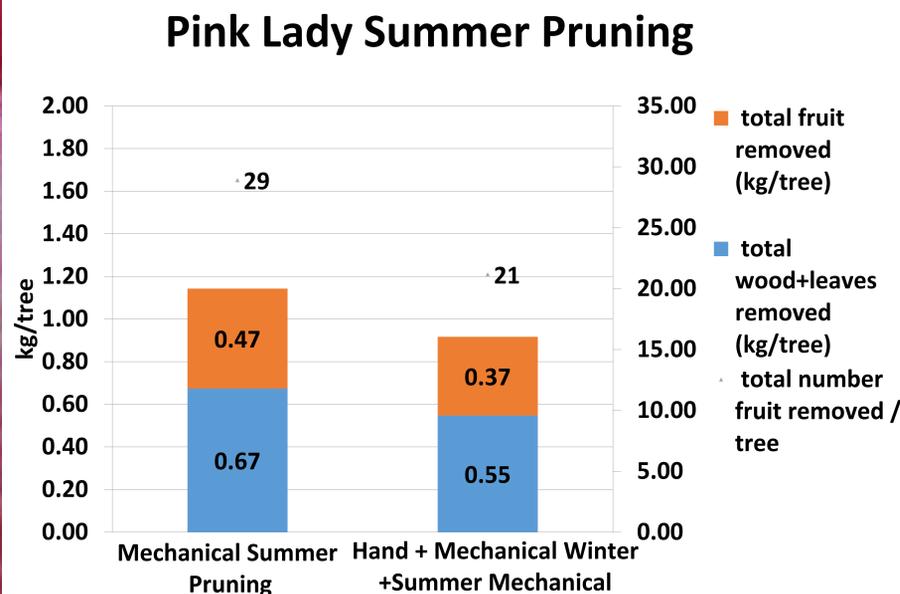


Figure B: Pink Lady apple variety summer pruning comparison to measure the difference of leaves, wood, and fruit removed from a tree with hand, mechanical winter and summer mechanical treatments applied.



Collecting leaves, wood, and fruit for data analysis from Sickle Bar Machine.



Tractor with Sickle Bar Machine

Responsibilities

- SPAD to measure chlorophyll levels in leaves
- Caliper measurements of fruit
- Timing of pruning
- Weighing cut materials for data collection
- Counting and collection of fruit, leaves, and wood.
- Manage fieldwork and data
- Light bar measurements
- Interpret data into writing



Pruned leaves and wood from Sickle Bar Machine.



Sickle Bar Machine. Summer Pruning May 29, 2015. Mattawa, WA

Results

Pruning and thinning in orchards is a labor and time demanding operation that can be a great expense for tree fruit growers worldwide.

- Significant findings in the trial showed that mechanical pruning was 2 times faster than hand pruning on average.
- Cuts were not always clean and precise. At higher speeds the risks for a "dirty cuts" could increase as the branches were scrapped or peeled by the machine.
- Winter pruning showed significantly more pruned materials removed from control than by mechanical methods.
- Summer pruning showed considerably more wood and leaves where removed from a tree (0.67 kg) in comparison to the amount of fruit removed (0.47 kg) with hand + mechanical winter + summer mechanical pruning treatments applied.
- Summer fruit diameter was 31 mm on average.

Conclusion

Throughout this internship I have gained more knowledge in tree fruit physiology, as well as the use of instruments in the field and laboratory setting to collect and measure data. This internship has allowed me to broaden my knowledge in the tree fruit industry, and to understand the potential value that mechanical pruning can bring to the industry to help in the reduction of labor costs and time. I believe that this internship has provided me with the necessary skills to interpret data effectively and understand the specific details that go into research projects so that I can continue on in a field of research and graduate program.

Acknowledgements

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References

Robinson, T., & Sazo, M. M. (2013). Advances in mechanization of the tall spindle apple orchard system: Part 2-Harvest mechanization prospects. *New York Fruit Qrtly*, 21(3), 3-7.