



WASHINGTON STATE
UNIVERSITY
EXTENSION



MECHANIZATION OF ORCHARD PRACTICES

BY THE NUMBERS

- The Washington tree fruit industry contributes \$10 billion of activity annually to the state's economy.
- 17 to 18 billion apples are individually hand-picked in Washington annually.

Man-hour requirements:

- Apple – 210 to 250 / acre
- Cherry – 350 to 400 / acre
- Pear – 250 to 300 / acre
- Labor costs account for 45% to 60% of total annual variable costs in apples and pears and up to 78% of total annual variable costs in cherries.

2016

ISSUE

The production of tree fruit crops is labor intensive and labor-related risks are high. The top labor-related risks include getting the job done, getting the job done correctly, and getting the job done on time. Manual production tasks include pruning (winter and summer), tree training, green fruit thinning, and harvest. Every apple, pear, apricot, peach, nectarine, and sweet cherry in the fresh market was picked individually by hand. Currently the industry needs large numbers of semi-skilled employees for short periods of time. This demand scenario can be disruptive for families, communities, and industries.

With few exceptions, trees in PNW orchards are grown to a height of 10 to 11 feet. This means that roughly 1/3 of the work requires the use of a ladder or mobile platform to reach the work space. Ladder injuries can be life changing for the employee and compensated claims are expensive for employers. Narrow fruit canopies (fruiting walls) open opportunities for the adoption of labor/human assist and automated technologies. Narrow canopies are machine and human friendly, maximize sunlight interception and distribution, produce a uniform canopy and crop load, and result in fruit and canopy that are accessible for precision application of inputs. Expertly managed narrow systems produce high early yields and high mature yields of premium fruit. An estimated 95% of all new apple acreage planted since 2010 is trained to narrow tree architecture and at a spacing that allows for mechanization of some or all tasks. There are some limitations with cherry and pear, but where the rootstock is available and the management is able, high-density, narrow canopies are being experimented with on a large scale in pear, sweet cherry, and stone fruits.

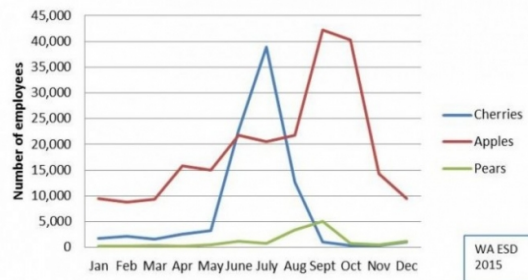
With the productivity and profitability achieved in high-density, narrow canopies in apples and to a lesser extent cherries, the industry is seeking opportunities to mechanize some of the tasks that currently require large pools of employees for short windows of time and where a ladder is required to complete the task.

RESPONSE

Europe leads the world in tree fruit orchard mechanization. In collaboration with the Washington Tree Research Commission, key producers have traveled with WSU Agricultural Engineering and Extension faculty to Europe to look at machinery on the manufacturing floor, the Expo floor, and in the orchard. We studied successful and failing operations in terms of selection, maintenance, and operation of equipment and integration of orchard system, task, machine, and people.



Seasonal On-Farm Employment Washington
State Tree Fruit Production
2013



QUOTES

"We have succeeded with the high-density, narrow orchard system and we have done so with significant financial investment. We now need engineering solutions to optimize both the horticultural system and our financial investment." - Scott McDougall, McDougall and Sons, Wenatchee, WA

"Platforms have helped us get the job done. Not just correctly and on time, but done at all." - Dan Plath, Washington Fruit and Produce

"Investment in technologies must make you money either with increased productivity that results in a lower per unit cost or increased quality that results in a greater per unit dollar return." - Karen Lewis, WSU Extension Regional Specialist

COLLABORATORS

- Washington Tree Fruit Research Commission
- WSU CPAAS
- Tree Fruit Producers
- Equipment Manufacturers and Dealers

For several reasons, Washington and the United States should not be dependent on European machinery to meet our needs. Our tree fruit industry has set a high bar for reliability and serviceability that would be challenged with equipment and parts purchased off shore.

Working with local and foreign manufacturers and WSU economists and engineers, WSU Extension has been actively involved in evaluating equipment in the field, providing feedback to manufacturers on needs, design, and function. In addition, we have worked directly with end users on integration issues and total system optimization. Large-scale field studies have evaluated prototype and commercially available mobile platforms, harvest assist platforms, string thinners, mechanical pruners, bin dogs, and, in some cases, specific on-board components.

IMPACTS

- Apple orchards planted in the last 5 years are designed for high early and high mature yields of premium fruit. The training system is designed to mitigate labor-related risks and to allow for the adoption of currently available and horizon technologies, including mechanization and automation.
- Five U.S. companies have designed, built, and marketed labor assist harvest platforms in the last 3 years. Of these, 2 companies are in Washington and 1 is in Oregon.
- One equipment manufacturer moved its operation to Moses Lake, Washington, in 2012 and currently employs 16 full-time skilled tradesmen.
- Sales of labor assist harvest platforms for one Washington company have climbed steadily from zero in 2012 to 121 in the first quarter of 2016. Eight machines have been sold overseas (China, Argentina, and Nova Scotia) and 12 have been sold in 3 states outside the Pacific Northwest.
- One equipment manufacturer moved its operations to Moses Lake, Washington, in 2012 and currently employs 12 full-time skilled tradesmen.
- The Darwin String thinner has been purchased by 45 farming operations in the United States and Canada.
- Five mechanical hedgers have been purchased in the United States.
- Mobile platforms and multi-use formats are built locally by 2 companies. Sales continue to climb and integration challenges are being met.
- A proof of concept project for a handheld thinner was funded by the Washington Tree Fruit Research Commission and conducted at WSU. The commercialization was picked up in 2013 by a local manufacturer and, to date, 62 units have been sold and utilized in stone fruit, apple, and sweet cherry orchards.