

## CASE STUDY 1 Caudle ORCHARD Improving Irrigation Efficiency

Hot summers and cork spot in D'Anjous can be a significant challenge in Central Washington. Cork spot is responsible for an estimated \$7 to \$8 million dollars<sup>i</sup> in losses to Anjou production every year. In 2017, cork spot accounted for approximately 33% of Anjou culls. Irrigation frequency and timing, as well as good calcium programs can affect tree growth, productivity and fruit quality in pears<sup>ii</sup>. Fruit size is also critical for high returns.

### SITE CHALLENGES

- Run-off
- Small fruit
- Inability to conduct tractor work when sloping field stays wet.
- Lack of uniformity, variable weak trees.



Figure 1 Standard system created run-off in order to maintain sufficient moisture at the top of the slope.

**STANDARD SYSTEM** Impact sprinklers (Rainbird) on 36 foot by 36 foot spacing. Growers generally run 1 row at a time skipping a row as they go across the field and return taking 9 days to irrigate the five-acre field.

Caudle Standard: System Description per Acre				
sprinklers	GPM**	GPH**	Efficiency	Acre-inch*
34	4	8067	0.5	0.15

\* Takes into account irrigation efficiency.

\*\*Per sprinkler head.

**NEW SYSTEM** R10 micro sprinklers were installed every row on a 20 by 20 foot spacing in a five-acre field encompassing one half of the sloped field in spring 2018.

Caudle Upgrade: System Description per Acre				
sprinklers	GPM*	GPH*	Efficiency	Acre-inch**
134	0.43	3469	0.7	0.09

\*Per sprinkler head. \*\*Accounting for efficiency.



Figure 2 R10 micro-sprinkler system upgrade.

### GROWER OBSERVATIONS

“Zero run off in the new system.”

“Leaf color was more uniform.”

“Before the quickest we could water was 9 days. Now if we want to we can water the whole block in 2 days (20 lines at a time).” = more flexibility “If we need to push water it is a lot easier.”

“Good to have less water more often.”

### IMPACT ON WATER USE

Year	Per Acre Water Use				Savings
	Standard		New		
	hrs	gal	hrs	gal	gal
2018	144	1161600	216	749232	412368
2019	156	1258400	156	541112	717288

### IMPACT ON FRUIT QUALITY

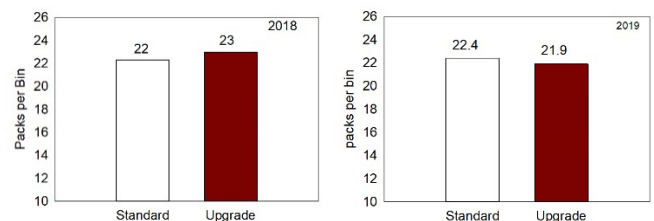


Figure 3. Fruit quality

In 2018 the packout for the upgraded block was 95.6% compared to 92.7% for the standard system resulting in 23 vs 22 packs per bin. In 2019 the packout for the upgraded block was 92.1% compared to 93.7% in the standard block.

20% of the culls in the standard block were due to small fruit, and 8% to cork in the standard block compared to 10% to small fruit and 14% cork in the upgraded block.

**IMPACT ON FRUIT SIZE** In 2018 and 2019 fruit size was more uniform in the upgraded block compared to the block irrigated using the standard system.

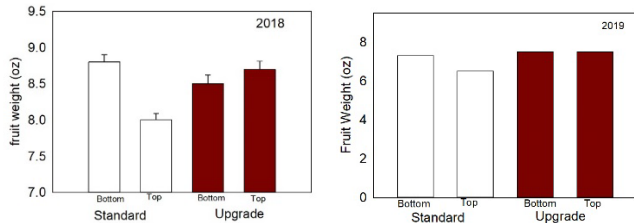


Figure 4. Fruit size in 2018 (left) and 2019 (right).

The upgraded block had more large fruit which impacted returns. Returns were estimated using average by fruit size from the Washington State Tree Fruit Association for Sept 2019 and January 2018 (months fruit was packed). Using the average

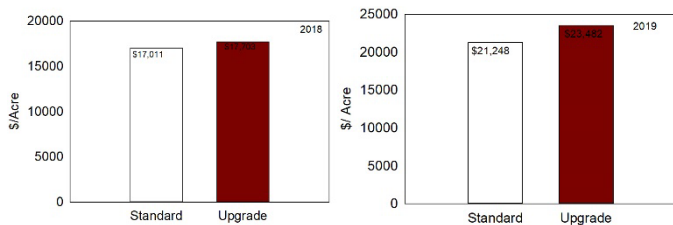


Figure 5. Returns per acre based on block packs and fruit sizes from a 56 bin run. Assumes 40 bins per acre.

price per box per size class (90s:\$22.48; 100:\$19.37; 110:\$18.21; 120-:\$21.88) revenue per acre in the upgraded block was \$17,703 compared to \$17,011 for the standard system in 2018. In 2019 assuming prices per box of 90s+:\$29.7; 100: \$27.2; 110:\$25.5; 120+:\$23 revenue per acre was \$23,482 in the upgraded block compared to \$21,248 in the standard.

**IMPACT ON TREE STRESS**

Tree water limitation is measured by using a pressure chamber to measure leaf water potential. Water within the plants moves through a network of cells (xylem) that act like pipes carrying water from the roots. When the soil dries and the roots cannot keep pace with evaporation from the leaves the water in the plant becomes under tension. Tension over 1.2 mpa is considered too high.

Water limitation measured by leaf water potential was lower in the upgraded block (0.79 to 1.13 mpa on July 17, 2018) compared to the standard block (0.81 to 1.7 mpa).

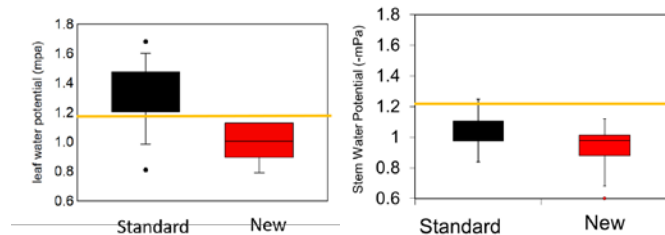


Figure 6 Tree water stress for 2018 (left) and 2019 (right).

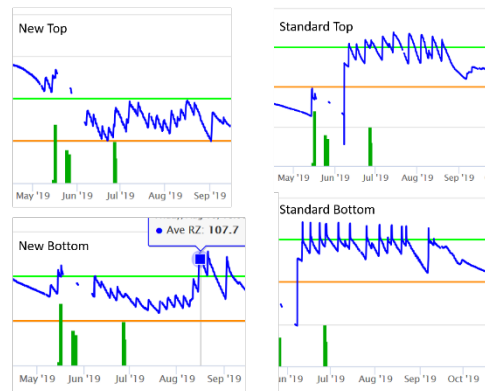


Figure 7 Soil moisture record from 2019. The soil in the standard system tended to stay too wet.

**Thank you to**

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Fresh Pear Committee



<sup>i</sup> This value was estimated using cull analysis and pack out data from packinghouses representing 33% of the pear industry

<sup>ii</sup> Raese et al. (1982).