REGULATED DEFICIT IRRIGATION IN CIDER APPLES

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Seed Grant Project Preliminary Report: Evaluating regulated deficit irrigation in cider apple orchards for improved water use efficiency, reduced labor input, and improved fruit quality.

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Project Description and Methods: Irrigation efficiency is a priority for sustainable orchard management. Regulated deficit irrigation (RDI) is a management strategy that has been shown to conserve water, reduce vegetative growth and pruning costs, reduce leaching of agrochemicals into groundwater, and improve fruit quality attributes. Over two years, RDI was evaluated along with control irrigation (CI) at WSU NWREC on three cider apple cultivars, 'Dabinett', 'Golden Russet', and 'Porter's Perfection'. Stem and soil water potential (WP) were measured weekly over the course of the growing season to monitor water stress, and cultivars were evaluated for vegetative growth, yield, and fruit and juice quality. Vegetative growth measurements changed from shoot growth measurements in 2019 (based on length) to canopy profile measurements in 2020 (based on area) to capture a more wholistic measure of relative growth.

Results: Water stress as indicated by stem WP did not occur either year, and irrigation was never applied to the RDI treatment plots. All measured variables differed due to cultivar. RDI did not impact vegetative growth (shoot length in 2019, canopy area in 2020), fruit yield, fruit size, juice yield, or any juice quality attributes. RDI did decrease fruit weight both years and increase fruit firmness in 2020.

Table 1. End of season vegetative growth by increase in shoot length (in.) from 27 June to 8 Aug. 2019 and canopy area (%) in 2020 for three cultivars grown with CI and RDI treatments.

Cultivar	Shoot Growth (in.)	Canopy Growth (%)
Dabinett	5.2 a	54.5 a
Golden Russet	0.9 b	31.0 b
Porter's Perfection	1.1 b	22.0 c
P-Value	<0.0001	<0.0001

Table 2. Fruit yield (lb per plot), weight (lb per fruit), size (in.) and juice yield (mL/kg) for three cultivars grown with CI and RDI treatments.

	Yield		Fruit Weight				
Cultivar	**2019**	**2020**	**2019**	**2020**	**Fruit Size**	**Juice Yield**	**Firmness**
Porter's Perfection	55.9 a	11.4 a	0.15 a	0.12 a	1.98 a	558.0 b	43.5 a
Golden Russet	85.0 a	76.0 b	0.29 b	0.29 b	2.59 b	558.0 b	37.6 b
Dabinett	270.8 b	134.0 c	0.31 b	0.27 b	2.74 c	478.0 a	30.5 c
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table 3. Fruit yield (lb per plot), weight (lb per fruit), size (in.) and juice yield (mL/kg) for CI and RDI treatments.

Treatment	Yield	Fruit Weight	Fruit Size	Juice	Firmness
Control	109.0	0.244 a	2.46	522.0	36.2 a
Deficit	102.0	0.228 b	2.42	537.0	38.2 b
P-Value	0.70	0.02	0.13	0.17	0.04

Table 4. Juice quality attributes (% Tannin, Titratable Acidity, Specific Gravity, Soluble Solid Content, and pH) for three cultivars grown with CI and RDI treatments.

	% Tannin		TA				
Cultivar	**2019**	**2020**	**2019**	**2020**	**SG**	**SSC**	**pH**
Dabinett	0.33 ab	0.33 b	0.13 a	0.15 a	1.057 a	13.1 a	4.47 a
Golden Russet	0.24 a	0.16 a	0.50 b	0.46 b	1.077 b	16.4 b	3.43 b
Porter's Perfection	0.35 b	0.66 c	0.67 c	0.83 c	1.054 a	12.1 a	3.17 c
P-Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001