Project Title: Targets and tools for post-bloom thinning

Report Type: Continuing Project Report

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Cooperators: Haydn Farms

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Total Project Request for Year 1 Funding: $ 43,135
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Budget 1
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Item	**2023**	**2024**
Salaries	30,434	31,651
Benefits	4,678	4,865
Wages	6,146	6,392
Benefits	627	652
Equipment		
Supplies	250	250
Travel	1,000	1,500
Miscellaneous		
Plot Fees		
Total	43,135	45,310

Footnotes: salaries will fund M.S. student, wages for summer timeslip assistance with trial setup, fruit harvest, and fruit quality analyses; supplies for fruit quality testing and field trials, travel is to research plots in WA and to attend industry meetings for presenting results.

OBJECTIVES

1. Develop practical balanced cropping targets
2. Better understand the effects of timing of thinning
3. Investigate efficacy of Ethephon and Accede® as post-bloom thinners
4. Summarize and disseminate key findings to stakeholders

In the first year (2023) we were unable to recruit and hire a graduate student in time to lead the project. We did however complete three PGR trials, assessing the efficacy of Ethephon and Accede in 'Coral Champagne', 'Chelan', and 'Benton'. We received a no-cost extension in 2024 and are considering the 2024 season as year 1 and 2025 as year 2.

SIGNIFICANT FINDINGS

- Ethephon and ACC are variable in their efficacy as post-bloom thinners
- Thinning efficacy may be cultivar dependent – treatments were largely ineffective for 'Chelan' but nearly thinned all fruit in 'Benton'
- Timing of thinning affected fruit quality but the earliest thinning did not yield the best results
- There can be benefits to thinning as late as 6 weeks after full bloom

METHODS

Investigate efficacy of Ethephon and Accede® as post-bloom thinners

Based on our previous findings, we will focus efforts on the period between shuck fall and 7 – 10 days afterward. We will evaluate the effect of Ethephon 2 (21.7% 2-chloroethyl phosphonic acid) and Accede® applied at 100 and 200 ppm on fruit set and fruit quality. Treatments will be made to heavily-set trees at shuck fall or shuck fall + 7 – 10 days (orchard blocks to be identified each Spring). Applications will be made to entire trees or limbs, with a minimum of 10 replicate branches (2/tree) selected for determining fruit set/density and fruit quality.

Within a day of application, we will flag two limbs in every tree (1 east-facing and 1 west-facing) and count fruitlet density (fruitlets/limb cross-sectional area and length), measuring limb caliper at the same time. In addition, we will measure fruit diameter on 10 fruit per limb to record fruitlet size at the time of treatment – this will facilitate comparisons among cultivars with respect to timing and final fruit size. A photo journal will be collected as well to visually document application timings and crop densities. At commercial fruit maturity we will make fruit counts to the same limbs and assess thinning efficacy as % fruitlet removal. Fruit subsamples (minimum 100 fruit per replication) will be collected and analyzed for quality attributes including color, weight, diameter, and firmness, at the facility in Prosser.

RESULTS & DISCUSSION

'Coral Champagne'. This trial was conducted in a 'Coral Champagne'/Mazzard block north of Pasco. Trees were trained to a Y-trellised, Tatura-type architecture with 7 horizontal fruiting tiers. Treatments were made on 10 May by backpack sprayer just to drip. Fruit set in untreated control was just under 70%. Fruit set reported here is the number of fruit harvested from selected limbs compared to the number of fruit present at the time of treatment (i.e., not overall fruit set as a % of available flowers). The inverse represents fruit drop and was ca. 32% for the control. Fruit density of untreated control limbs was not particularly high at ca. 36 fruit per foot. By other metrics that we evaluated, fruit density in control was ca. 8.0 fruit/spur or 0.86 fruit/cm^2 branch cross-sectional area. Treatment with ACC did not reduce fruit set (i.e. did not increase fruit drop) though fruit density was reduced by ca 40% with ACC applied at 400 ppm (Table 1). Ethephon at 100 ppm was ineffective as a thinner, however, Ethephon at 200 ppm reduced fruit set by about 36% (P=0.12) compared to the control. Fruit density was significantly reduced by applications of Ethephon 200 compared to the control – 14.7 vs. 35.5 fruit/foot, respectively.

Table 1. Effects of PGR treatments on fruit drop, fruit density, and fruit quality in 'Coral Champagne'. Data with different letters are significantly different at P>0.1.

Treatment	Fruit set (%)	Fruit/ft	Color (CTIFL)	Soluble solids	Firmness (g/mm)	Fruit weight (g)
Control	67.9 a	35.5 a	4.2 ab	13.4 a	246.8 bc	9.2 a
ACC 200	64.9 a	25.8 ab	3.6 b	12.7 a	255.3 abc	7.1 cd
ACC 400	58.2 a	20.8 b	3.8 ab	14.1 a	270.1 a	6.7 d
Ethephon 100	52.7 a	18.8 b	4.3 a	13.6 a	241.1 c	8.5 ab
Ethephon 200	43.7 a	14.7 b	4.0 ab	13.3 a	260.8 ab	7.9 bc
Pr > F	0.119	0.001	0.031	0.21	0.001	<0.0001

No treatment improved fruit quality, with the exception of an increase of about 10% of fruit firmness in response to treatment with ACC at 400 ppm (Table 1). Interestingly, treatment with ACC reduced fruit weight by about 25% compared to the control. The higher rate of Ethephon also reduced fruit weight by about 14%. Only Ethephon at 100 ppm did not have a negative effect on fruit weight. It is also interesting to see that no treatment had any significant effect on fruit color. Therefore, these treatments did not hasten maturity – a concern that growers have expressed.

'Chelan'. This trial was conducted in a 'Chelan'/'Gisela6' block, in Tricities. Trees were trained to a Y-trellised architecture with 7 horizontal fruiting tiers. Treatments were applied at ca. 10 days after shuck fall. Fruit set in the untreated control was much lower than in 'Coral' at 37% (Table 2). This means that between the time of treatment and harvest, nearly 63% of the fruit dropped without any treatment. This is unusually high and affected this experiment. Ethephon treatments did not affect the drop significantly. Treatment with 100 or 200 ppm exhibited fruit drop rates of ca. 67% and 59%, respectively. ACC treatments were similarly ineffective at inducing fruit drop. Applications of 200 and 400 ppm ACC resulted in drop of 67% and 74%, respectively, statistically similar to the untreated control. Similarly, no treatment had any effect on fruit density as fruit/foot was similar among all treatments, and relatively low overall (only ca. 16 for control).

Table 2. Effects of PGR treatments on fruit drop, fruit density, and fruit quality in 'Chelan'. Data with different letters are significantly different at P>0.1.

Treatment	Fruit set (%)	Fruit/ft	Color (CTIFL)	Soluble solids	Firmness (g/mm)	Fruit weight (g)
Control	36.7 ns	15.9 ns	4.04 ab	12.1 ab	269.1 ns	7.0 ns
ACC 200	32.6	15.5	4.13 ab	12.7 a	262.4	6.9
ACC 400	26.3	9.9	3.84 b	11.5 b	262.8	7.0
Ethephon 100	33.9	11.6	4.93 a	11.9 ab	286.6	7.7
Ethephon 200	41.4	14.6	3.93 ab	12.0 ab	275.8	7.3
Pr > F	0.64	0.59	0.088	0.12	0.38	0.31

Fruit quality was largely unaffected by treatment. Soluble solids were reduced slightly with ACC at 400 ppm, and treatment with Ethephon at 100 ppm increased fruit color (though treatment with Ethephon at 200 ppm did not). Firmness and weight were similar across all treatments.

'Benton'. This trial was setup at the WSU-Roza experimental farm in a 'Benton'/'Gisela5' block. Trees were trained to a modified steep leader architecture. Treatments were applied about 12 days after shuck fall.

Table 3. Effects of PGR treatments on fruit drop, fruit density, and fruit quality in 'Benton'. Data with different letters are significantly different at P>0.1.

Treatment	Fruit set (%)	Fruit/ft	Color (CTIFL)	Soluble solids	Firmness (g/mm)	Fruit weight (g)
Control	40.3 a	17.2 a	5.0 ns	20.0 ns	213.2 a	9.2 a
ACC 200	17.8 b	6.6 b	5.3	20.2	196.4 ab	8.4 ab
ACC 400	14.1 b	2.8 b	5.4	19.4	194.5 ab	9.2a
Ethephon 100	12.5 b	3.2 b	5.1	19.5	219.4 a	7.5 b
Ethephon 200	0.31 b	0.6 b	5.5	19.7	187.3 b	7.4 b
Pr > F	<0.0001	<0.0001	0.19	0.74	0.047	0.003

For 'Benton', fruit set of control limbs was 40% (i.e., about 60% of the fruit present on application of treatments dropped by harvest time). This translated to about 17 fruit/foot at harvest, which again is not a very high crop load. Control limbs had ca. 3 fruit/spur on average. In this trial each thinning treatment was effective (Table 3). Application of ACC at 200 and 400 ppm reduced fruit set by 56% and 66%, respectively. These treatments reduced fruit density to 6.6 and 2.8 fruit per foot. Treatment with ACC200 and ACC400 reduced crop load to 1 and 0.5 fruit/spur, respectively (data not shown). Ethephon applications were even more effective at reducing crop load. Fruit set was reduced by 69% and nearly 100% with applications of Ethephon at 100 and 200 ppm, respectively. This translated to 3.2 and 0.6 fruit/foot. Despite the significant reductions in crop load with all treatments, there was no increase in fruit size nor soluble solids. This is likely due to the low crop load in untreated limbs – fruit had sufficient carbohydrate resources. ACC treatments were similar to the control in fruit weight, but the Ethephon treatments reduced fruit weight (Table 3). This is similar to the reduction in 'Coral Champagne' fruit weight we observed under treatment with 200 ppm Ethephon.

We assessed the relationships between fruit quality attributes and fruit density (as fruit/foot, fruit/limb cross-sectional area, fruit/spur) and found little to no correlations. For example, in 'Coral Champagne', there was no clear relationship between fruit/foot and any key fruit quality attribute (Fig. 1). These experiments need to be conducted in blocks that have higher crop load in order to better assess these relationships.

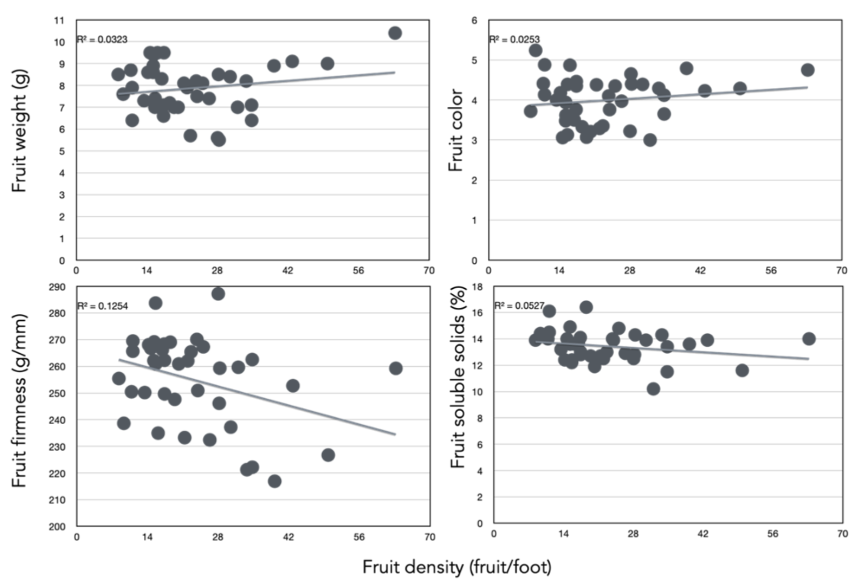

Figure 1. The relationships between fruit quality and fruit density (fruit/foot) for 'Coral Champagne'.

PGR Trials 2024

We conducted trials in 4th-leaf 'Black Pearl' and 'Santina' blocks. Both blocks were trained to a Y-trellised UFO architecture on 'Gisela 12' rootstock. Each treatment was applied to 12 replicate upright branches. Fruit counts were made on each branch on the day of treatment and again, at harvest. At harvest all fruit were harvested, weighed, and brought to IAREC for quality analyses. The basal caliper of each upright was measured at harvest.

Table 4. Effect of thinning treatments applied to 'Santina' on 29 April. Data with different letters are significantly different at 95% confidence. N=12.

Treatment	Fruit drop (%)	Fruit density (g/mm^2)	Weight (g)	Firmness (g/mm)	Color (1-7)	Sol. Solids (%)
Control	32.2 b	6.58 a	6.8 b	229 ns	5.7 ns	14.7 b
ETH100	72.4 a	2.56 b	6.9 b	240	5.8	17.7 a
ETH200	82.9 a	1.00 c	7.6 ab	238	6.2	17.9 a
ACC200	89.3 a	0.81 c	8.3 ab	241	5.6	15.7 ab
ACC400	86.1 a	0.97 c	9.3 a	236	5.9	14.6 b
Pr > F	<0.0001	<0.0001	0.011	0.637	0.141	0.011

Thinning treatments were applied on 29 April, about 2 weeks after full bloom. At this stage nearly all fruit were past shuck fall. Natural drop in 'Santina' was about 32%, meaning nearly one of every 3 fruitlets dropped between the date of treatment and harvest. All PGR treatments were effective as thinners, inducing significant drop compared to untreated control (Table 4). The drop induced by thinning treatments was ca. 2 – 2.5 times greater than the control, and there was no difference among thinners. As a result, fruit density (number of fruit per mm^2 of branch cross-sectional area) and fruit density (fruit weight per mm^2 branch cross-sectional area) were reduced by all thinning treatments. Without any treatment, fruit density was about $6.6 g/mm^2$ bcsa. This was reduced by nearly 90% with Ethephon at 200 ppm and both Accede treatments. For reference, unthinned control limbs had an average of 215 fruit and ca. 3.1 lbs of fruit. In contrast, ETH100, ETH200, ACC200 and ACC400 had branch yield of ca. 1.0, 0.85, 0.5, and 0.7 lbs, respectively. Yield of unthinned trees in this block was ca. 11 tons/acre so thinning treatments would have reduced this to about 3.5, 2.9, 1.7, and 2.4 tons/acre, respectively.

Thinning treatments improved fruit size (weight) and soluble solids, but had no effect on fruit firmness nor exocarp color. The only treatment that improved fruit weight was Accede at 400 ppm – this increased weight by 37%. This thinning was excessive however, as most branches dropped almost 90% of the fruit. At the time of treatment, there was an average of 320 fruit per branch in the ACC400 limbs. This was reduced to fewer than 40 at harvest, with several branches having only a few fruit left. Accede at 200 ppm was similarly effective as a thinner, inducing ca. 90% drop. Interestingly, Accede treatments did not improve fruit soluble solids but both Ethephon treatments did, by ca. 3%. This improvement would improve consumer appeal – previous research has shown the importance of fruit sweetness for consumers, and an increase from 14.7 to 17.7 would be easily discernible to consumers' palates.

There has been concern over use of ethylene-related PGRs in sweet cherry and their potential negative effect on fruit firmness. We did not document any influence of our treatments on either fruit firmness or color (indicative of maturity). This is likely due to these treatments being applied relatively early in fruit development. In other work we have demonstrated the potential for Ethephon treatments to reduce firmness and advance maturity (via darker fruit color) when applied within weeks of harvest.

Table 5. Effect of thinning treatments applied to 'Black Pearl' on 26 April. Data with different letters are significantly different at 95% confidence. N=12

Treatment	Fruit drop (%)	Fruit density (g/mm^2)	Weight (g)	Firmness (g/mm)	Color (1-7)	Sol. Solids (%)
Control	21.0 c	4.6 b	6.0 ns	265 c	5.0 b	16.9 b
ETH100	20.0 c	5.9 a	6.2	276 bc	5.7 a	18.4 ab
ETH200	44.4 b	3.1 b	6.6	284 ab	5.8 a	18.7 a
ACC200	37.3 bc	3.9 b	5.9	277 abc	5.4 ab	17.1 ab
ACC400	67.9 a	2.3 c	6.1	293 a	5.3 b	17.8 ab
Pr > F	<0.0001	0.01	0.383	0.002	0.0001	0.057

The thinning effects of Ethephon and Accede were variable in 'Black Pearl', and the response was different from that of 'Santina'. Natural fruit drop was less for 'Black Pearl' than it was for 'Santina', with about one in every 5 fruit dropping between 26 April and harvest (i.e., 21% drop). Treatments with Ethephon at 100 ppm and Accede at 200 ppm were ineffective at inducing drop. In contrast, 200 ppm of Ethephon was effective, inducing twice as much drop as the control. In addition, Accede at 400 ppm was the most effective at inducing drop with more than two of three fruit dropping (ca. 68%) before harvest. Fruit density was highest in ETH100 and lowest in ACC400 but similar for all other treatments. Yield per branch was about 3.1 lbs in control compared to 3.0, 1.7, 1.6, and 1.0 lbs for ETH100, ETH200, ACC200, and ACC400, respectively. At a proportional reduction, yield would be about 10.2, 5.8, 5.4, and 3.4 tons/acre for these treatments (from ca. 10.5 t/ac in unthinned). Interestingly, the thinning treatments were less effective overall in 'Black Pearl' compared to 'Santina', despite being applied at a very similar timing.

In contrast to the results with 'Santina', no treatment improved 'Black Pearl' fruit size/weight despite the higher rates of both Ethephon and Accede inducing significant drop. Clearly this is an unfavorable, and unexpected response – we don't yet understand how a PGR could induce drop (i.e., reduce crop load) at this timing without improving fruit quality. Trials will be repeated in 2025 to determine whether this response is consistent for 'Black Pearl'. In contrast, fruit firmness was improved ca. 7 and 11% with ETH200 and ACC400 treatments, respectively. In addition, the ETH200 treatment improved fruit soluble solids by about 11% - no other treatment was different from untreated control. Interestingly, for 'Black Pearl' the treatments with Ethephon advanced fruit color development – fruit were nearly a full grade darker at harvest compared to control. This change in fruit color was not associated with any reduction in firmness.

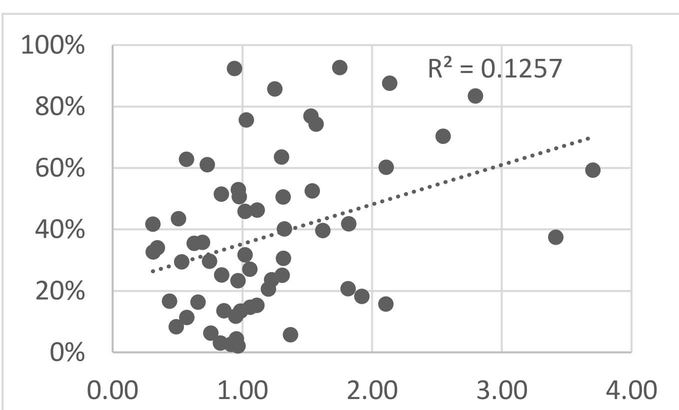

Figure 2. Relationship between thinning efficacy (% drop) and fruitlet density at the time of treatment.

Because we analyzed each limb separately we can assess relationships that may have influenced thinning efficacy. We found no strong role for initial crop load nor branch caliper on the extent of drop induced by treatment (Fig. 2).

Timing of thinning trials

Trials were established in the same 'Santina' and 'Black Pearl' blocks where PGRs were assessed. To determine the effect of timing of thinning, entire trees were thinned by hand at 6 distinct timings including dormant, full bloom (FB), and at two-week intervals subsequently. Treatments were carried out on 8 whole-tree replicates, though we collected data on each upright separately. At harvest, each upright limb was harvested separately and its basal caliper was measured. Branch yield was determined in the field and fruit were transported to IAREC for quality assessments.

'Santina'. Yield per tree was 12.0 kg (ca. 11 tons/acre) in the unthinned treatment. This is high considering trees were in their 4th leaf and reflects the excellent precocity of the UFO system. Yield was similar for trees thinned at all timings except the latest (FB+8 weeks) for which yield was ca. 3.5 tons/acre (70% lower than unthinned; Table 6). The significant yield reduction from the final thinning timing may reflect some unintended damage to fruit during the thinning process. Thinning treatments had little effect on fruit density – similar to yield, all timings except the last were similar to the control. Our goal was to isolate the timing effect as much as possible so it is useful that yield and fruit density were similar for most of the timings.

Table 6. Effect of timing of whole-tree thinning treatments on 'Santina' yield and fruit quality. Data with different letters are significantly different at 95% confidence.

Timing of thinning	Tree yield (kg)	Fruit density (g/mm^2)	Fruit weight (g)	Firmness (g/mm)	Color (1-7)	Sol. Solids (%)
Unthinned	12.0 a	5.0 ab	7.0 b	231.9 b	5.6 a	15.0 d
Dormant	12.1 a	5.3 ab	7.6 b	225.4 b	5.7 a	16.4 cd
Full bloom	12.0 a	5.9 a	8.3 ab	235.9 ab	5.6 a	17.4 bc
FB+ 2 weeks	10.5 a	4.8 ab	7.9 b	232.4 b	5.6 a	16.3 cd
FB+ 4 weeks	9.1 a	3.8 b	9.7 a	248.6 a	5.7 a	18.2 ab
FB+ 6 weeks	8.2 a	3.5 bc	9.7 a	247.3 a	5.6 a	19.2 a
FB+ 8 weeks	3.7 b	1.8 c	7.7 b	233.8 b	5.7 a	17.1 bc
Pr > F	<0.001	<0.001	<0.001	<0.001	0.9	<0.001

Fruit weight was improved by nearly 40% from thinning treatments at FB+4 weeks and FB+6 weeks (Table 6). These improvements in fruit weight clearly offset the reduction in crop load since yield and fruit density were similar for these two timings and control. The earliest thinning treatments did not improve fruit size significantly. Nor did thinning at FB+8 weeks. It isn't clear why the period of FB+4 – 6 weeks should be beneficial compared to earlier timings. Final fruit size is determined largely by cell size, but also by cell numbers in the mesocarp. Thinning at 4 to 6 weeks after full bloom coincides roughly with the end of phase II of stone fruit growth and therefore largely precedes cell expansion. We did not see a similar response for 'Black Pearl' (see below) so we will repeat the trials in 2025 to determine if this is unusual to 'Santina' and consistent across years.

Fruit firmness responded similarly – it was improved only by thinning treatments imposed between FB+4 and FB+6 weeks. These treatments increased firmness by ca. 7% compared to the control. Color was unaffected by timing of thinning. Soluble solids was improved by most timings of thinning, with the greatest improvements for trees thinned at FB+4 and FB+6 weeks. These treatments improved soluble solids by ca. 21% and 28%, respectively. Both thinning treatments led to improvements in soluble solids of more than 3^{o}brix – a level that would significantly improve the eating experience of the fruit. This is especially important for early-season cultivars as repeat purchases of sweet cherries are driven by eating experience and consumers routinely rank sweetness as the most important attribute.

Combined, it appears that thinning at FB+4 weeks provided the best response – yield of 9.1 tons/ac (est.) with significant improvements in fruit size/weight (+39%), firmness (+7%), and soluble solids (+ 21%). Again, this work will be repeated in 2025 to characterize the thinning response across years.

'Black Pearl'. Yield per tree was 11.6 kg (ca. 10.5 tons/acre) for unthinned. Importantly, yield of trees thinned at dormant, full bloom, and FB+2 weeks was statistically similar despite thinning – this is reflected in the improvement in fruit weight (Table 7.). The later thinning treatments reduced yield. Estimated yield for thinning at FB+4 and 6 weeks is similar at ca. 6.5 tons/acre (ca. 38% reduction compared to unthinned). The latest thinning treatment had the lowest yield at 4.7 kg/tree or, ca. 4.3 tons/acre, less than half of unthinned. In these cases, treatment effects may not reflect the timing of thinning but the reduction in overall crop load. Fruit density was assessed as the yield of fruit per branch basal cross-sectional area. Overall this varied between ca. 5.5 g/bsca and 3 g/bcsa, and was highest in the unthinned trees and trees thinned at dormant, FB, and FB+2 weeks treatments. The fruit density was lower than control only for the final three timings, which were similar.

Table 7. Effect of timing of whole-tree thinning treatments on 'Black Pearl' yield and fruit quality. Data with different letters are significantly different at 90% confidence.

Timing of thinning	Tree yield (kg)	Fruit density (g/mm^2)	Fruit weight (g)	Firmness (g/mm)	Color (1-7)	Sol. Solids (%)
Unthinned	11.59 a	5.6 a	6.3 b	257 b	5.4 ab	16.9 cd
Dormant	8.72 ab	4.7 ab	8.5 a	279 ab	5.7 a	18.4 bc
Full bloom	9.12 ab	4.6 ab	7.5 a	294 ab	5.4 ab	18.9 b
FB+ 2 weeks	8.97 ab	4.8 ab	7.6 a	293 ab	5.3 b	16.6 d
FB+ 4 weeks	7.19 bc	4.0 bc	7.8 a	293 ab	5.6 ab	20.7 a
FB+ 6 weeks	7.27 bc	3.6 bc	8.2 a	292 ab	5.3 b	18.2 bcd
FB+ 8 weeks	4.70 c	2.9 c	8.0 a	355 a	5.5 ab	18.1 bcd
Pr > F	<0.001	<0.001	<0.001	0.1	0.01	<0.001

Fruit quality was affected by the timing of thinning. Fruit weight was improved similarly (by 20 – 35%) from all timings (Table 7). This is a different response from what we observed with 'Santina' where the earliest and latest timings were ineffective for improving size. Fruit firmness by contrast was improved only with the final timing of thinning. In addition, we recorded subtle effects of the timing of thinning on fruit color. Fruit from trees thinned as dormant buds were darker that those thinned at FB+2 weeks and FB+6 weeks. The response of fruit soluble solids to timing of thinning was odd, with the greatest improvements seen at FB+4 weeks (a 22% improvement). For 'Black Pearl', it appears that the best timing of thinning was full bloom – yield would have been about 9.2 tons/acre with a 20% increase in fruit weight and 12% improvement in soluble solids.

By harvesting fruit from each upright individually we are able to look for relationships between fruit density/crop load and quality. We analyzed 540 'Santina' samples and 470 'Black Pearl' samples (i.e., uprights), determining branch basal caliper, fruit yield, and fruit quality for each. Our analyses revealed little to no relationships between the crop load/fruit density (g of fruit/branch cross-sectional area) for key fruit attributes (Fig. 3). Our analyses are now focused on determining common elements for the highest quality fruit.

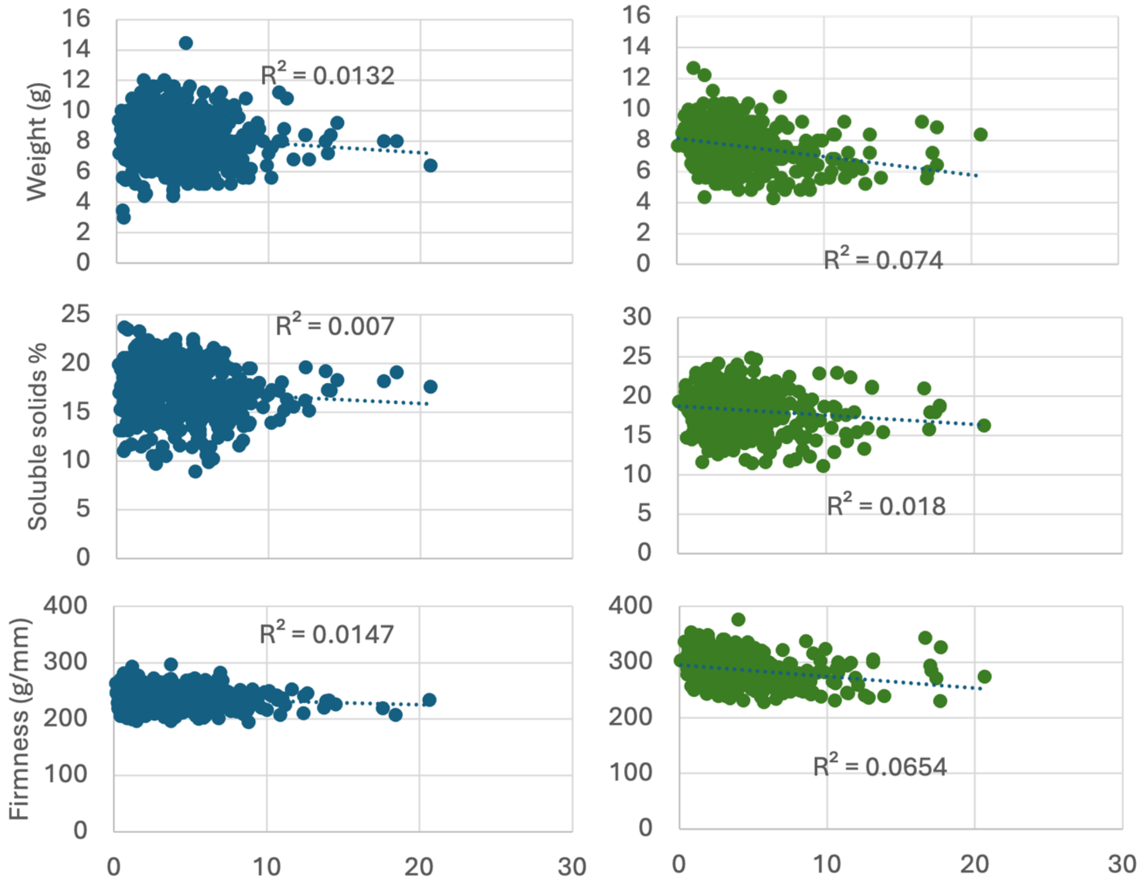

Figure 3. Relationships between fruit density (g/mm2 bcsa) and fruit weight, soluble solids, and firmness for 'Santina' (left) and 'Black Pearl' (right).

The effects of Ethephon and Accede can be compared with our hand thinning treatments imposed at FB+2 weeks since this timing coincided closely with the application of chemical thinners. Hand thinning 'Santina' at FB+2 weeks did not affect yield or fruit quality significantly (Table 6). No chemical post-bloom thinning treatment was especially beneficial since the reductions in yield were not offset by improvements in fruit quality (Table 4). In 'Black Pearl', hand thinning at FB+2 weeks did improve fruit weight/size without reductions in fruit yield (Table 7). Unfortunately, treatments with Ethephon and Accede at this timing were not effective for improving fruit size despite showing efficacy as thinners (Table 5).

Executive Summary
Project Title: Targets and tools for post-bloom thinning

Abstract: This project has evaluated the effect of timing of thinning as well as the efficacy of EthephonII and Accede as post-bloom thinning agents in several cultivars. We found that, when crop load is high, there are benefits from thinning as late as 6 weeks after full bloom (ca. straw timing – the transition from stage II to stage III of fruit growth). The best response in ‘Santina’ occurred from thinning at ca. 4 weeks after full bloom whereas the best response to thinning in ‘Black Pearl’ was at full bloom. It is not clear why there would be differences between cultivars in their response to thinning – this will be investigated further in 2025. Both EthephonII and Accede can induce fruit drop when applied about shuck fall (ca. 2 weeks after full bloom). The response may vary among cultivars though this has yet to be determined across years. These treatments improved fruit soluble solids but did not always improve size. At this stage, we recommend further testing (which we will do in 2025) before recommending either PGR for post-bloom thinning.

Key words: fruit quality, crop load management, fruit density, thinning