FINAL PROJECT REPORT **YEAR**: 3 of 3

Project Title: Crop Load and Canopy Management of WA Tree Fruit

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Requested WTFRC Funds for Project:

Item	2018	2019	2020
Salaries	5950	6130	na
Benefits	2440	2510	na
Wages	25,000	27,500	30,250
Benefits	13,250	14,580	16,040
RCA Room Rental			
Shipping			
Supplies	1500	1500	1500
Travel	1000	1000	1000
Plot Fees	5040	4400	4600
Miscellaneous	500	500	500
Total gross costs	54,680	58,120	53,890
Anticipated Income (contracts and gift grants)	67,560	60,300	60,000?
Total net costs	(12,880)	(2180)	(6110?)

Footnotes:
Salaries: salary costs reflect time for Mendoza only in 2018 & 2019; no salary costs reflected in internal projects starting in 2020
Increase in wages & benefits include increase in WA minimum wage through 2020
Supplies include tractor/sprayer fuel & maintenance, spray suits, occasional chemical purchase, etc.
Plot fees assume use of 2 blocks at WSU Sunrise Research Orchard

NOTE: Budget for informational purposes only; research is funded through WTFRC internal program

OBJECTIVES:

1. Determine best use practices for metamitron including appropriate rates, timings, use of adjuvants, and weather considerations.
2. Explore other novel bloom and postbloom chemical thinning programs utilizing new chemistries and/or new use patterns for existing products, especially those approved for organic use.
3. Explore new uses of plant growth regulators to help manage apple crop load and orchard canopy systems.

SIGNIFICANT FINDINGS 2018-2020:

No treatments reduced fruit set in a chemical bloom thinning trial in 2018 and 2019 chemical bloom thinning trials, but fruit finish was improved by Regalia (Table 1)

The most efficacious options for chemical bloom thinning of apple continue to be spray oil + lime sulfur programs (Table 2)

Metamitron products continue to reduce fruit set, improve harvest fruit size, and increase return bloom more consistently than current industry standard thinning programs (Tables 3-5)

Metamitron efficacy can be promoted by tank mixing with non-ionic surfactants, increasing rate, or use of multiple applications (Tables 3, 4)

2019-EXP-01 significantly boosts the performance of 6-BA as a chemical thinner (Table 3) and of GA_7 as an inhibitor of return bloom (Table 6)

Applications of GA_7 effectively reduce return bloom in biennial apple blocks (Tables 6, 7); this new product has been registered as "Arrange" and is approved for use in organic and conventional blocks; grower should be able to purchase this product for the 2021 season

Collaborative research efforts continue to help develop new models, information, and technologies to improve crop load management of WA apples

Work restrictions due to COVID-19 precautions limited the scope of field trials in 2020

BACKGROUND:

After years of robust efforts to evaluate various aspects of bloom and postbloom chemical thinning programs, our current focus is to screen new chemistries and provide collaborative support for external research programs working on crop load and canopy management. Most of our current trials are funded in part or wholly by third party companies that contract our services to independently evaluate their products alongside industry standard programs. We continue to evaluate the relative success of thinning programs through three measurable targets which are directly tied to a grower's economic bottom line:

1. Reduction of green fruitlet hand-thinning
2. Improved fruit size and quality
3. Increased return bloom/annual bearing

The degrees to which our chemical thinning programs achieve each of these goals are reflected in our data labeled fruitlets/100 floral clusters, harvest fruit size, and percent return bloom, respectively.

BLOOM THINNING:

For years, chemical bloom thinning programs in Washington have predominantly featured lime sulfur or combinations of lime sulfur and horticultural spray oils. While these programs have been largely efficacious for most growers, there have been few alternative chemistries that have demonstrated potential as cost-effective chemical thinners, especially for organic growers. After hearing anecdotal reports of reduced fruit set in some commercial organic apple blocks and in pathology research trials by Regalia, a biofungicide derived from extracts of knotweed, we began testing the material as a chemical bloom thinner in 2018. Results from that initial Gala trial did not demonstrate any significant treatment effects from Regalia on fruit set, fruit finish, or return bloom, but we did observe an increase in fruit size in one Regalia treatment, as well as the industry standard oil + lime sulfur program.

In 2019, we tried thinning with Regalia again, this time in a Jonagold block (Table 1). As with the 2018 Gala trial, no treatment significantly affected fruit set, but there was a clear improvement in fruit finish across most treatments, both from Regalia and oil + lime sulfur. While we were unable to document statistically significant improvements in fruit size in 2019, some Regalia treatments once again suggested a trend toward that effect.

Table 1. Crop load and fruit quality effects of bloom chemical thinning programs. WTFRC 2019.

Treatment	Fruitlets/100 floral clusters	Blanked spurs	Singled spurs	Harvest fruit weight	Relative box size	Russet free fruit
Jonagold / M.26 - Rock Island		*%*	*%*	*g*		*%*
2% Regalia	45 abc	63 ab	30 ab	247 ns	74	43 ab
4% Regalia	49 ab	57 b	37 a	221	82	60 a
1.5% CFO + 1% Regalia	40 abc	65 ab	31 ab	232	78	21 b
1% WES + 1% Regalia	52 a	57 b	35 ab	241	75	59 a
1% WES + 2% LS	36 c	69 a	27 b	231	79	51 ab
Control	37 bc	67 a	29 ab	215	84	16 b

While the lack of clear thinning or improvements in return bloom in our two Regalia trials was disappointing, it is worth noting how infrequently our replicated field trials have documented significant treatment effects in other bloom thinning trials (Table 2). Regardless, improvements in fruit finish and size were intriguing and may be worth considering for organic growers seeking to improve their packouts.

Table 2 reflects the cumulative success rates of our most frequently tested chemical bloom thinners over time at achieving our three main criteria for effective thinning and demonstrates the overall superiority of programs featuring lime sulfur.

Table 2. Incidence and percentage of results significantly superior to untreated control. Apple chemical bloom thinning trials. WTFRC 1999-2020.

Treatment	Fruitlets/100 blossom clusters	Harvested fruit size	Return bloom[1,2]

ATS	15 / 60 (25%)	10 / 63 (16%)	4 / 55 (7%)
NC99	15 / 32 (47%)	7 / 34 (21%)	2 / 28 (7%)
Lime sulfur	26 / 58 (45%)	12 / 52 (23%)	9 / 52 (17%)
CFO + LS	62 / 115 (54%)	27 / 106 (25%)	22 / 105 (21%)
JMS + LS	14 / 24 (58%)	8 / 23 (35%)	4 / 22 (18%)
WES + LS	15 / 32 (47%)	5 / 31 (16%)	4 / 31 (13%)
ThinRite	7 / 22 (32%)	0 / 23 (0%)	0 / 12 (0%)

[1]Does not include data from 2020 trials.

[2] (no. blossom clusters year 2/sample area) / (no. blossom clusters year 1/sample area)

POSTBLOOM THINNING:

Our primary focus for postbloom chemical thinning research continues to be to identify and develop alternatives to carbaryl, which faces regulatory scrutiny as well as mounting pressure from elements of the consumer market seeking to reduce overall use of broad-spectrum pesticides. Even though WTFRC pesticide residue studies have been unable to detect any trace of carbaryl at harvest when used as a chemical thinner on Gala apples, some retail grocers have established policies prohibiting the sales of produce which has been treated with specific pesticides, including carbaryl.

Most of our recent postbloom thinning work has featured metamitron, a sugar beet herbicide that has been recently registered by Adama under the trade name “Brevis” as a postbloom thinning agent in several countries including Italy, France, Spain, and South Africa. We began working with small quantities of metamitron in 2011 and have scaled up the number and size of our trials in recent years as more product has become available. Our results have consistently found it to be a promising chemistry when used aggressively in our relatively low plant stress environment.

Like many other research programs, we were forced to scale back the scope of our planned field trials in 2020 due to rapidly evolving restrictions and guidelines for safe workplaces due to the COVID-19 pandemic. It was unclear if and when we could return to work during the early spring, but we were given approval to follow modified work protocols just in time to get two postbloom thinning trials in the field before bloom.

Unfortunately, we were unable to collect fruit set data at our Frenchman Hills trial site before the grower accidentally hand-thinned most of our trial plots in June, despite our regular communication with the orchard manager. As such, any data based on counts of fruit set for that trial is fatally compromised and not appropriate for analysis or reporting (Table 4). This was particularly unfortunate because this was the only 2020 site where we applied an experimental surfactant which had clearly amplified the efficacy of BA products in 2019 (Table 3). Nonetheless, we were still able to collect relevant data regarding harvest fruit size and quality, including fruit weight results which hint at some sort of thinning effect in fruit treated with metamitron due to their slightly larger fruit size at harvest. We will collect return bloom data from these plots in Spring 2021 to complete the assessment of the effects of chemical thinning programs included in the trial.

Our 2020 Golden Delicious postbloom thinning trial was executed without a hitch and produced yet another strong set of results showing clear reductions in fruit set for all treatments including several variations of programs utilizing metamitron, as well as some standard industry treatments featuring carbaryl, BA, and NAA (Table 4). Interestingly, each chemical thinning treatment also significantly improved harvest fruit size, while a June green fruit hand-thinning treatment did not. As we have seen in previous studies, the thinning effects of metamitron tend to be amplified with the use of a non-

ionic surfactant such as Regulaid; this option may prove to be valuable to WA growers interested in more aggressive thinning tactics once metamitron is registered for use here.

Table 3. Crop load and fruit quality effects of postbloom thinning programs. WTFRC 2019.

Treatment	Fruitlets/100 floral clusters	Blanked spurs	Singled spurs	Harvest fruit weight	Relative box size	Russet free fruit
		%	*%*	*g*		*%*
Fuji / M.9 - Wapato						
FAL 551 25.6 fl oz PF & 10-12mm	121 b	34 cd	26 bc	200 c	91	78 ns
FAL 551 25.6 fl oz + 2019-EXP-01 16oz PF & 10-12mm	103 bcd	35 cd	36 ab	227 abc	80	86
FAL 551 25.6 fl oz + 2019-EXP-01 32oz PF & 10-12mm	84 cde	43 cd	36 ab	228 abc	80	90
FAL 551 25.6 fl oz + 2019-EXP-01 64oz PF & 10-12mm	32 f	74 a	22 c	261 a	70	86
ADA 46343 40 oz PF&10-12mm	108 bc	38 cd	30 abc	205 bc	89	93
ADA 46343 40 oz + Regulaid 32 oz PF & 10-12mm	49 ef	60 ab	31 abc	248 ab	73	85
Carbaryl 4L 36 oz + Fruitone L 2 oz PF & 10-12mm	67 def	49 bc	39 a	232 abc	78	91
Control	158 a	28 d	21 c	188 c	97	80
Gala / M.9 – Frenchman Hills (George)						
FAL 551 25.6 fl oz PF & 10-12mm	140 ab	28 c	28 ab	158 c	115	16 ns
FAL 551 25.6 fl oz + 2019-EXP-01 16oz PF & 10-12mm	168 a	19 c	28 ab	166 bc	109	16
FAL 551 25.6 fl oz + 2019-EXP-01 32oz PF & 10-12mm	144 ab	27 c	28 ab	165 bc	110	11
FAL 551 25.6 fl oz + 2019-EXP-01 64oz PF & 10-12mm	136 ab	31 bc	26 ab	164 bc	111	18
ADA 46343 40 oz PF&10-12mm	88 cd	46 ab	32 ab	180 ab	101	No data
ADA 46343 40 oz + Regulaid 32 oz PF & 10-12mm	58 d	56 a	32 ab	191 a	95	24
Carbaryl 4L 36 oz + Fruitone L 2 oz PF & 10-12mm	122 bc	30 bc	33 a	171 abc	106	6
Control	152 ab	29 bc	23 b	152 c	119	25
Gala / M.26 - Orondo						
ADA 46343 40 oz PF	66 d	56 c	27 b	155 cd	117	38 ns
ADA 46343 40 oz 10-12mm	71 d	52 c	32 ab	159 bc	114	43
ADA 46343 40 oz PF & 10-12mm	19 e	86 b	11 c	186 ab	98	44
ADA 46343 32 oz + Regulaid 32 oz	8 e	93 a	7 c	187 a	97	35
Carbaryl 4L 36 oz + Fruitone L 2 oz	20 e	82 b	16 c	188 a	97	36
CFO 1 gal + LS 1 gal @ 400 GPA 10-12mm	99 c	41 cd	33 ab	129 d	141	38
CFO 1 gal + LS 1 gal @ 400 GPA PF & 10-12mm	129 b	24 de	37 a	143 cd	127	33
Control	163 a	16 e	36 a	135 cd	135	40

Golden Delicious / Bud.9 – Rock Island						
ADA 46701 1.3 pt 12-14mm	25 b	77 e	21 ab	213 bc	85	45 b
ADA 46701 2 pt 12-14mm	20 bc	83 cde	15 bcd	239 abc	76	49 ab
ADA 46701 2.7 pt 12-14mm	12 cd	88 bc	11 de	259 ab	70	60 ab
ADA 46701 3.3 pt 12-14mm	8 de	92 ab	8 ef	259 ab	70	54 ab
ADA 46701 3.3 pt + Regulaid 32 oz 12-14mm	3 e	97 a	3 f	286 a	63	39 b
Carbaryl 4L 36 oz + Fruitone L 2.5 oz12-14mm	14 cd	87 bcd	13 cde	246 abc	74	51 ab
Exilis 9.5SC 25.6 oz + Fruitone L 2.5 oz 12-14mm	21 bc	81 de	18 bc	198cd	92	78 a
Control	41 a	66 f	28 a	154 d	118	58 ab
Granny Smith / M.9 – Rock Island						
ADA 46701 3.0 pt PF	59 a	48 b	45 a	214 ab	85	94 ns
ADA 46701 3.0 pt 8-11mm	32 b	72 a	25 b	220 ab	83	84
ADA 46701 3.0 pt 12-15mm	28 b	73 a	26 b	232 a	78	94
ADA 46701 3.0 pt 16-20mm	29 b	71 a	29 b	220 ab	83	94
Carbaryl 4L 36 oz + Fruitone L 2 oz	34 b	68 a	31 b	217 ab	84	89
Control	67 a	42 b	49 a	177 b	103	86

Table 4. Crop load and fruit quality effects of postbloom thinning programs. WTFRC 2020.

Treatment	**Fruitlets/100 floral clusters**	**Blanked spurs**	**Singled spurs**	**Harvest fruit weight**	**Relative box size**	**Russet free fruit**
		%	*%*	*g*		*%*
Gala / M.9 – Frenchman Hills (George)						
ADA 46701 2 pt PF & 10-12mm	na	na	na	206 a	88	60 ns
ADA 46701 3 pt PF & 10-12 mm	na	na	na	201 ab	90	45
ADA 46701 2pt + Regulaid 1pt PF & 10-12 mm	na	na	na	200 ab	91	66
FAL 551 25.6 fl oz PF & 10-12 mm	na	na	na	194 ab	94	55
FAL 551 25.6 fl oz + 2019-EXP-01 32 fl oz PF & 10-12 mm	na	na	na	189 ab	96	53
CFO 1 gal 1 + LS 1 gal @ 400 GPA PF & 10-12mm	na	na	na	186 b	98	63
Carbaryl 4L 36 oz + Fruitone L 2 oz PF & 10-12 mm	na	na	na	190 ab	96	53
Control	na	na	na	191 ab	95	51
Golden Delicious / Bud.9 – Rock Island						
ADA 46701 2.0 pt PF & 12-16 mm	42 b	65 b	31 bc	189 abc	96	46 ab

ADA 46701 2.0 pt + Regulaid 1 pt PF & 12-16 mm	28 bc	75 ab	23 cd	196 ab	93	33 b
ADA 46701 2.5 pt PF & 12-16 mm	31 bc	71 ab	28 bcd	182 bc	100	43 ab
ADA 46701 2.5 pt + Regulaid 1 pt PF & 12-16 mm	26 bc	74 ab	25 cd	218 ab	83	38 ab
ADA 46701 3.0 pt PF & 12-16 mm	36 b	67 b	29 bcd	188 abc	97	53 ab
ADA 46701 3.0 pt + Regulaid 1 pt PF & 12-16 mm	19 c	82 a	16 d	223 a	81	53 ab
Carbaryl 4L 36 oz + Fruitone L 3 oz PF & 12-16 mm	31 bc	70 ab	28 bcd	189 abc	96	55 ab
Exilis 9.5SC 25.6 oz + Fruitone L 3 oz PF & 12-16 mm	32 bc	69 ab	29 bcd	182 bc	100	63 a
Hand thinned mid June	72 a	41 c	48 a	152 cd	119	53 ab
Control	62 a	49 c	41 ab	138 d	132	46 ab

Table 5 demonstrates the strong performance of BA + NAA programs and metamitron products as compared to other postbloom thinning options featuring carbaryl over the course of all our studies across varieties and locations. While we used to think of metamitron only as an acceptable alternative to carbaryl, we continue to see more consistent performance of those programs relative to current industry standards, suggesting that metamitron may ultimately prove to be a superior option to carbaryl, BA, and/or NAA products.

Table 5. Incidence and percentage of results significantly superior to untreated control. Apple chemical postbloom thinning trials. WTFRC 2002-2020.

Treatment	Fruitlets/100 blossom clusters	Harvested fruit size	Return bloom[1,2]
BA	7 / 29 (24%)	0 / 30 (0%)	0 / 28 (0%)
Carb + BA	33 / 91 (36%)	10 / 89 (11%)	13 / 86 (15%)
Carb + NAA	30 / 79 (38%)	20 / 78 (26%)	16 / 76 (21%)
BA + NAA	20 / 42 (48%)	9 / 41 (22%)	8 / 37 (22%)
Metamitron	19 / 30 (63%)	14 / 30 (47%)	9 / 27 (33%)

[1]Does not include data from 2020 trials.

[2] (no. blossom clusters year 2/sample area) / (no. blossom clusters year 1/sample area)

GIBBERELLIC ACID FOR BLOOM INHIBITION:

Over many years of trials, we have established that multiple applications of modest concentrations of GA_3 can be effective at reducing return bloom across multiple apple varieties as a tool for mitigation of biennial bearing. In the absence of GA products registered for this use pattern, we focused most of our work on GA_3 products because of their relatively low price point. Despite ample data demonstrating their efficacy, the registrants of these products have been reluctant to add this use pattern to their labels, primarily due to the abundance of competitive generic products in the market and relatively poor prospects for making a return on investment for such a label amendment.

In recent years, however, we have been testing a new formulation of GA_7 from Fine Americas alongside our standard GA_3 programs. GA_7 is known to be a more potent isomer than GA_3 in terms of inhibiting floral initiation and can produce analogous results at lower concentrations. Our 2018 trial on biennial Golden Delicious (Table 6) with this GA_7 product (FAL 900) demonstrated dramatic

reductions in 2019 return bloom when combined with a proprietary surfactant or partnered with a series of applications of GA_4 (Novagib). All GA_3 (Falgro 2XLV) and GA_7 (FAL 900) treatments in our 2019 trial on Honeycrisp (Table 7) generally reduced 2020 return bloom, although not all results were statistically significant. As we have seen in previous studies, application of GA_4 (Novagib) did not clearly affect return bloom.

After many delays in the regulatory process, we are pleased to report that this new GA_7 product known as "Arrange" has received full registration and should be available for use in the 2021 growing season. This product has also been approved by OMRI and may become an important crop load management tool for organic apple growers who have relatively few plant growth regulators in their toolboxes.

The use recommendations for Arrange largely reflect the treatments we found to be efficacious in our studies of FAL 900. The product label recommends up to 4 applications of materials totaling no more than 100 ppm per season, or a single application of 100 ppm if multiple sprays are not an option. Our results have indicated that multiple small doses of any GA product are generally more effective than single large doses. The product label also provides recommendations for annual maintenance sprays of Arrange, including use in the "on" year of a biennial bearing cycles. We did not test these programs and are unsure of their potential risks or benefits.

Table 6. Effects on tree vigor, fruit size, and return bloom of GA applications. WTFRC 2018.

Treatment	2018 harvest fruit weight	2018 relative box size	2018 shoot growth	2019 return bloom	2019 return bloom per CSA
	g		*cm*	*%*	*clusters/cm²*
Golden Delicious / M.9 – Rock Island					
4 x FAL 900 25ppm	245 ns	74	22.6 ns	2583 bc	1.2 a
FAL 900 100ppm @ petal fall	215	84	24.3	2398 bc	1.9 a
FAL 900 100ppm @ PF+14	216	84	24.2	1390 cd	1.2 a
FAL 900 100ppm + 2019-EXP-01 @ PF	216	84	24.9	154 d	0.2 b
FAL 900 50ppm; 4 x 20 oz Novagib	234	78	25.2	828 d	0.3 b
FAL 900 100ppm; 4 x 20 oz Novagib	246	74	16.8	650 d	0.2 b
4 x Falgro 4L 100ppm	211	86	22.5	3023 ab	1.6 a
Control	192	95	21.2	4399 a	1.9 a

Table 7. Effects on tree vigor, fruit size, and return bloom of GA applications. WTFRC 2019.

Treatment	2019 harvest fruit weight	2019 relative box size	2019 shoot growth	2020 return bloom	2020 return bloom per CSA
	g		*cm*	*%*	*clusters/cm²*
Honeycrisp / B.118 – Brewster					
FAL 900 (25 ppm) 32 oz @ PF, PF + 7, PF + 14, PF + 21	287 abc	63	30.7 ab	309 b	1.3 c
FAL 900 (100 ppm) 128 oz @ PF + 7	308 a	59	33.8 ab	659 ab	1.7 bc
FAL 900 (150 ppm) 192 oz @ PF + 7	299 ab	61	31.3 ab	604 ab	2.2 abc
FAL 900 (200 ppm) 256 oz @ PF + 7	299 ab	61	34.3 ab	563 ab	1.7 bc
FAL 900 128 oz @ PF+7; Novagib 20oz @ PF, PF+7, PF+14, PF+21	258 c	70	29.6 b	741 ab	1.6 bc
Novagib 20 oz @ PF, PF + 7, PF + 14, PF + 21	282 abc	64	32.7 ab	1011 a	2.6 ab

Falgro 2XLV 473 ml @ PF, PF + 7, PF + 14, PF + 21	311 a	58	34.8 a	629 ab	2.1 abc
Control	271 bc	67	31.8 ab	957 ab	2.8 a

COLLABORATIVE CROP LOAD MANAGEMENT RESEARCH:

"Optimizing light and water for orchards covered with netting" (AP-18-102; PI: Kalcsits) – support for labor intensive data collection, harvest sampling, and postharvest fruit quality analysis; also support for project leadership team including sharing of relevant WTFRC projects and protocols, as well as editing of project manuscripts

"Development and validation of a precision pollination model" (TR-16-102; PI: DeGrandi-Hoffman) – coordination of local data collection for bee foraging, bloom phenology, and fruit sampling activity at sites near Yakima and Chelan; active member of project leadership team (project funded through WTFRC technology committee)

"Developing and validating models for tree fruit" (TR-17-102; PI: Jones) – coordination of data collection for fruit growth at 39 blocks throughout Central Washington (primarily Golden Delicious, Fuji, Honeycrisp, and WA 38); help with outreach activities for new horticultural models (project funded through WTFRC technology committee)

"Precision Crop Load Management for Apples" (USDA-NIFA Specialty Crop Research Initiative (SCRI) - PD: Terence Robinson, Cornell) – project will begin in 2021 and include work in WA, NY, VA, MI, MA, and NC; objectives focus on development of predictive models and horticultural strategies to develop/optimize crop load, as well as development of vision systems, robots, & other automated tools to assess and adjust crop load as various phenological stages

Proposed to WTFRC Apple Horticulture Committee: "Maximize pollination window to improve fruit set in WA38" (PI: Serra) – help coordinate field activities including trial layout, data collection, spray application, reflective material deployment, sample collection, and harvest analysis; intent is to improve fruit set in WA38 to promote consistently high annual yields

EXECUTIVE SUMMARY

Project title: Crop load and canopy management of WA tree fruit
Key words: chemical thinning, PGR, metamitron, return bloom, GA

Abstract: Effective crop load management is fundamental to the financial success of commercial apple production. This project sought to identify and develop cost-effective management strategies primarily through the use of chemical thinners and plant growth regulators to help Washington apple growers produce consistent annual crops featuring large yields of high-quality fruit.

Our initial tests of Regalia as a chemical blossom thinner did not elicit significant reductions in fruit set but showed some encouraging trends toward improving fruit finish. The best available option for chemical bloom thinning continues to be combinations of horticultural oils and lime sulfur as were developed in prior WTFRC studies.

We continue to refine best management practices for metamitron, a new postbloom thinning chemistry that is nearing registration for the US market. Our studies clearly demonstrate that this product generally competes with or outperforms current standard postbloom chemical thinning programs featuring carbaryl, NAA, and/or BA products. Metamitron efficacy can be boosted with the use of a non-ionic surfactant such as Regulaid. We are confident that metamitron will represent a step forward for apple crop load management in WA and we look forward to its commercial release.

Our studies also validate the relatively strong performance of tank mixes of BA and NAA, programs which may be of increasing interest as regulatory and marketplace pressures on carbaryl continue to mount. We have also been impressed with the performance of a proprietary developmental adjuvant which significantly boosted the thinning and fruit sizing performance of BA products in thinning trials and the efficacy of GA products in inhibiting return bloom in apple.

We have worked for years to develop PGR programs to help mitigate alternate bearing in apple, primarily through the application of bloom-inhibiting gibberellins during the “off” year of the biennial cycle. We have had considerable success with multiple applications of GA_3 products, but commercial registrants have been reluctant to adapt those product labels to accommodate that use pattern. In more recent years, we have achieved similar positive results with a formulation of GA_7, which has now been registered as the commercial product “Arrange” and approved for use in organic orchards as soon as this upcoming growing season.