Progress Report for 2008
Weed and other pest control systems for cranberries

Project No: Continuing 13C-4167-1215

Title: Weed and other pest control systems for cranberries

Year Initiated: 1991 **Current Year:** 2008 **Terminating Year:** 2010

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Justification:
Weeds, insects and disease are major problems facing cranberry growers in Washington. The registration of new pesticides for use in the PNW on cranberries is critical to the survival of the industry. Research to help the registration of new pesticides and improve the efficacy of current registration is needed to help solve these major pest problems in the industry.

Objectives:

1) Screen and evaluate new herbicides for their effectiveness in controlling perennial weeds in established cranberry bogs.

2) Evaluate alternative controls for blackvine weevil.

3) Evaluate biorational insecticides for control of blackheaded fireworm and tipworm:

4) Implement new cranberry disease management alternatives for domestic and export markets for fresh fruit production.

Procedures:

Objective 1: Screen and evaluate new herbicides for their effectiveness in controlling perennial weeds in established cranberry bogs.

New herbicides: Several herbicides were screened for efficacy and phytotoxicity. A summary of findings and recommendations is provided in Table 1. Quinclorac and rimsulfuron are promising. Quinclorac is currently in an IR4 program; rimsulfuron is proposed for 2010. These will be powerful new tools to use once they get registered. Results on Princep, penoxsulam and KSU 12800 were not favorable. Both 2,4-D amine and triclopyr have potential for dominant season sprays. Their support by the registrants is questionable, so it will be an uphill battle to obtain registrations. Liquid Casoron showed promise and did not result in the crop damage the registrant was worried about. It has potential for use in accurate spot treatment on cranberry beds. Work with the registrant is in progress.

Table 1. Summary of WSU's herbicide screening for perennial weed control in cranberries.

Herbicide	Objective	Efficacy	Crop safety	Next Steps
Princep	Assess synergy with Callisto	No improvement over Callisto alone	Minor on established, moderate on new	Not enough efficacy to warrant renewal of label; label will be cancelled.
2,4-D amine	Efficacy and crop safety for new SLN – dormant broadcast	Good on arrowgrass	None at 0.5% v/v rate	Product no longer registered; data suggested there is a need to work with Nufarm to obtain a new SLN.
Penoxsulam	Screening	Moderate on arrowgrass	Minor	Inadequate efficacy to continue.
Quinclorac	Screening	Good on yellowweed and other species when used in combination with Callisto	None	Obtain additional efficacy data to allow for a Section 18 in 2010.
Triclopyr	Screening for dormant treatment of brambles	So-so	None	Additional data needed.
Carfentrazone-ethyl	Screening for moss	So-so	Moderate	Drop.
Liquid Casoron	Screening	Good	None	Recommend addition of cranberry to label.
KSU 12800	Screening	Excellent	Too hot	Drop.
Rimsulfuron	Screening	Good to excellent	None	Obtain additional efficacy to allow for an IR4 in 2010.

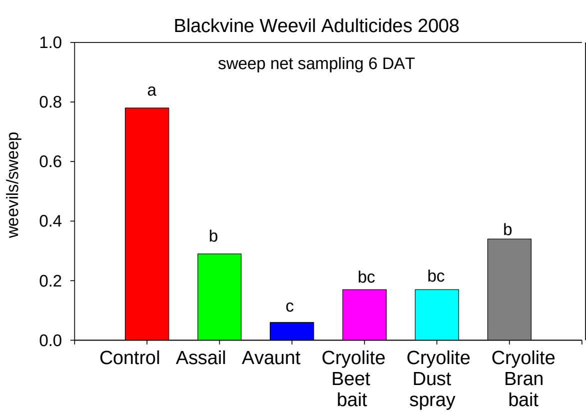
Improving the efficacy of Callisto: Callisto lacks efficacy on several recalcitrant weed species. A range of experiments was conducted to determine if that efficacy could be enhanced (Table 2). The most notable finding was the herbicide synergy observed with quinclorac and rimsulfuron. The combination of these herbicides with Callisto suggested that we could obtain excellent control of lily and yellowweed. Additional research in this area will be continued. There was no synergy with Princep, which is not what is reported in the literature on other crop/weed systems. Modifying the spray tank pH had no effect on Callisto's efficacy. Chemigation of Callisto for some weeds, like lotus or new and young plantings, seems promising. A label modification will be sought for this use pattern. Application of Callisto to weeds under the crop canopy seemed to improve when applied with higher volume. Apparently, achieving adequate weed leaf surface contract with broadcast spraying can be problematic with some weeds and spray timings. The results for ultra-low volume applications were mixed and no real trend for improved efficacy was found.

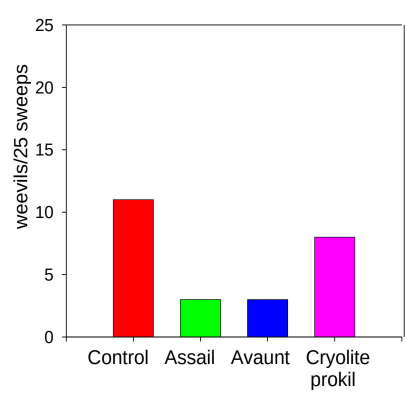
Table 2. Summary of assessment of methods to enhance the efficacy of Callisto for use on cranberries.

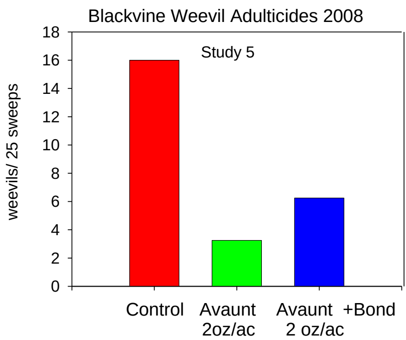
Treatment	Efficacy	Crop safety	Next Steps
Herbicide synergy with Princep	No improvement over Callisto alone	Minor on established, moderate on new	Not enough efficacy to warrant renewal of label; label will be cancelled.
Herbicide synergy with Quinclorac	Improved control for loosestrife and false lily of the valley over either product alone	No phytotoxicity noted	Seems a particularly effective mixture for lily control. Worth additional screening to assess timing effects.
Herbicide synergy with Rimsulfuron	Improved control for loosestrife over either product alone	No phytotoxicity noted.	Worth additional screening to assess timing effects.
PH buffering of tank mix (decrease to pH 2 and increase to pH 10 to 12)	No effect on efficacy	No effect on phytotoxicity	Drop.
Chemigation	For some weed species, especially if timing was early enough, good post-emergent efficacy was achieved. Some pre-emergent efficacy noted	No phytotoxicity noted	Seek a 2EE label modification for using chemigation.
Very high spray volume	Increase efficacy on Lily and other species under the cranberry canopy at the time of application	No phytotoxicity noted	None.
Ultra low spray volume	No real improvement noted	No phytotoxicity noted	None.

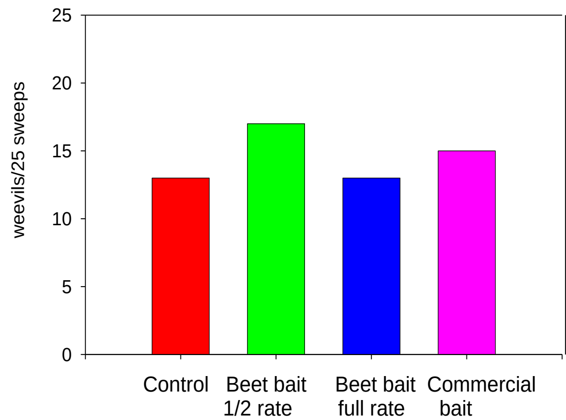
Objective 2: Evaluate biorational insecticides for control of blackvine weevil:

In 2008 we evaluated Assail, Avaunt and various formulations of baits for adult blackvine weevil control. Excellent results were obtained with Avaunt, providing almost immediate kill (see following graphs). Assail was also a good adulticide. None of the bait formulations, including the commercial one used by the growers, had commercially viable efficacy. Data on larvicide efficacy will be collected spring 2009.









Objective 3: *Evaluate biorational insecticides for control of blackheaded fireworm:*

For first generation fireworm control, most chemistries provided excellent control (Table 3). There was no difference between insecticides for the first application. By the second application, fireworm counts were too low to make strong inferences. However, Esteem, Venom and Rimon appeared to be less effective than the other insecticides. Overall there was a slight difference in efficacy between the 3.25 and 6.5 oz/ac rates of Delegate.

For second generation fireworm control, both rates of Delegate were as effective as Diazinon (Table 4). Intrepid was no better than the control.

Only two studies were conducted on fireworm and neither site had ideal conditions for making strong conclusions. Delegate appears to be an excellent contender for replacing Diazinon for application through a chemigation system. Not enough data is available, however, to determine if the 3.5 oz/ac rate of Delegate is adequate for achieving consistent efficacy through chemigation. Altacor is another chemistry that looks very promising but more data will be required to determine if it is consistent.

Table 3. WSU Long Beach blackheaded fireworm insecticide screening # 1 2008.

Treatment			First assessment on 1st generation blackheaded fireworm 5/19/2008								
			Small larvae		Medium larvae		Large larvae		Total		Total Alive + dead
			Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	
CONTROL			6.5	4.5	4.0	3.0	0.5	0.0	7.5	11.0	18.5
Delegate	3.25	oz wt/a	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5
Assail	8	oz/a	0.5	0.3	0.0	0.0	0.0	0.0	0.3	0.5	0.8
Avaunt	6	oz/a	0.0	1.3	0.0	0.0	0.0	0.0	1.3	0.0	1.3
Diazinon	2	qt/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Altacor	0.066	lb ai/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rimon	40	fl oz/a	0.3	0.5	0.0	0.0	0.0	0.0	0.5	0.3	0.8
Venom	3	oz/a	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.5
Tesoro	6.4	oz/a	0.5	0.0	0.3	0.0	0.0	0.0	0.0	0.8	0.8
Calypso	6	oz/a	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.3
Esteem	5	oz/a	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.5	0.8
Delegate	6.5	oz wt/a	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.3
LSD (P=.05)			2.30	1.16	2.39	1.18	0.42	0.00	1.98	4.98	6.62
Treatment Prob(F)			0.0001	0.0001	0.0723	0.0004	0.4671	1.0000	0.0001	0.0038	0.0001
Treatment			Second assessment on 1st generation blackheaded fireworm 6/12/2008								
			Small larvae		Medium larvae		Large larvae		Total		Total Alive + dead
			Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	
CONTROL			0.3	0.3	0.0	0.3	0.8	0.0	1.0	0.5	1.5
Delegate	3.25	oz wt/a	0.0	0.5	0.3	0.0	0.3	0.0	0.5	0.5	1.0
Assail	8	oz/a	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.5
Avaunt	6	oz/a	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.5
Diazinon	2	qt/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Altacor	0.066	lb ai/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rimon	40	fl oz/a	0.5	0.3	0.3	0.5	0.8	0.3	1.5	1.0	2.5
Venom	3	oz/a	0.0	0.0	0.0	0.8	0.5	1.0	0.5	1.8	2.3
Tesoro	6.4	oz/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calypso	6	oz/a	0.0	0.0	0.5	0.5	0.3	0.8	0.8	1.3	2.0
Esteem	5	oz/a	0.0	0.0	0.5	0.3	2.3	1.3	2.8	1.5	4.3
Delegate	6.5	oz wt/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSD (P=.05)			0.47	0.38	0.58	0.72	0.91	1.02	1.41	1.08	1.41
Treatment Prob(F)			0.5458	0.1784	0.4671	0.3356	0.0007	0.1408	0.0092	0.0111	0.0092

4 replications, 7’ x 8’ plots, in a heavily infested McFarlin bed in Grayland WA. Treatment applied to first generation 5/19/2008 and 6/4/2008 with 50 gpa spray volume followed by 620 gpa washoff. Data were collected from 10 sweeps per plot.

Table 4. WSU Long Beach blackheaded fireworm insecticide screening # 2 2008.

Treatment		Second generation blackheaded fireworm assessed 4 days after treatment 7/24/08								
		Small larvae		Medium larvae		Large larvae		Total	Total	Total
		Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Larvae
Control		0.8	0.0	1.3	1.3	1.8	0.0	3.8	1.3	5.0
Delegate	3.25 oz wt/a	0.0	0.8	0.0	0.3	0.0	0.0	0.0	1.0	1.0
Delegate	6.5 oz wt/a	0.0	0.8	0.0	0.5	0.3	0.0	0.3	1.3	1.5
Diazinon	2 qt/a	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	2.0
Intrepid	16 fl oz/a	0.5	0.5	1.3	1.5	0.3	0.0	2.0	2.0	4.0
LSD (p=.05)		1.29	1.74	0.98	2.46	0.58	0.00	0.58	0.00	3.47
Treatment prob(f)		0.5980	0.7700	0.0176	0.5388	0.0001	1.0000	0.0188	0.9199	0.1153

4 replications, 7’ x 8’ plots, in a heavily infested Stevens bed in Long Beach, WA. Treatment applied to second generation fireworm on 7/21/08 with 50 gpa spray volume followed by 620 gpa washoff. Data were collected from 10 sweeps per plot on 7/24/08.

Objective 4: Evaluate alternative fungicides for control of fruit rots and keeping quality of fresh cranberries:

In 2008 we assessed the effects of different timings of Indar and Abound on three Pilgrim and one Stevens beds. There was a significant treatment effect on yield at two Pilgrim beds, PCCRF and McPhail, with the grower treatment and the untreated plots having the lowest yield (Table 5). Treatment effects, however, were not consistent enough to make a definitive conclusion. The late Abound + Indar appeared to improve yield at PCCRF, but not at McPhail’s. Fruit rot, field and storage, was too low in 2008 to show any real treatment effects (Table 6). Grower treatments had the lowest rots, but those results could be confounded by the fact that these treatments usually had very low yield and fruit were picked further in from the edges.

Detecting an overall consistent pattern in fungicide treatments or timings that can result in grower recommendations has been problematic. Similar results have been found in previous years. Fruit rot levels are too low and there is too much variation between fields to make any inferences. Based on the cost to implement these different treatment arrays, it would be hard to justify use of supplemental Abound/Indar fungicides without more positive data. The most interesting effects appear to be on yield and not fruit rot. Additional studies will have to be done in this regard.

Table 5. Effects of different fungicides and timings on yield in 2008.

Treatment	Yield (bbl/ac at harvest)				Yield (bbl/ac after sorting)			
	Pilgrim			Stevens	Pilgrim			Stevens
	PCCRF	McPhail	Gray	PCCRF	PCCRF	McPhail	Gray	PCCRF
Untreated	214	205	167	137	204	195	161	132
Echo 720 7/22 Dithane M45 8/6	289	218	172	135	270	217	168	128
Abound + Indar 7/8 & 7/15 Echo 720 7/22 Dithane m45 8/6	275	211	174	152	266	208	171	149
Abound + Indar 7/8 & 7/15 & 8/13 Echo 720 7/22 Dithane m45 8/6	320	213	173	142	312	210	168	141
Abound + Indar 7/8 & 7/15 & 8/13	298	207	208	151	274	205	190	149
Abound + Indar 7/8 & 7/15	248	251	192	195	238	247	199	176
Grower treatment	189	142	187	190	186	139	181	180
LSD (p=.05)	72	47	34	51	71	45	36	50
Treatment prob(f)	0.008	0.0037	0.2116	0.1058	0.0161	0.0025	0.3529	0.2646
4 grower beds, 7 replications per bed. Timings were based on % of bloom (30 to 40% -7/8, 50 to 60% -7/15), fruit set 7/22, 14 and 21 days after fruit set 8/6 and 8/13 , grower treatment were -								

Table 5. Effects of different fungicides and timings on field and 6 weeks storage rot in 2008.

Treatment	Field rot %				Storage rot %			
	Pilgrim			Stevens	Pilgrim			Stevens
	PCCRF	McPhail	Gray	PCCRF	PCCRF	McPhail	Gray	PCCRF
Untreated	3.1	0.7	2.5	0.7	3.3	1.3	1.5	1.7
Echo 720 7/22 Dithane M45 8/6	3.8	0.5	1.5	0.5	3.8	0.6	1.9	2.4
Abound + Indar 7/8 & 7/15 Echo 720 7/22 Dithane m45 8/6	2.1	0.2	1	0.2	3.7	0.5	2.3	2.9
Abound + Indar 7/8 & 7/15 & 8/13 Echo 720 7/22 Dithane m45 8/6	1	0.3	2.9	0.3	2.5	0.3	1.3	1.4
Abound + Indar 7/8 & 7/15 & 8/13	2.1	0.3	0.4	0.3	3.8	0.9	0.9	1.2
Abound + Indar 7/8 & 7/15	1.7	0.7	2.4	0.7	4.1	1.1	1.8	3.0
Grower treatment	0.4	0.9	1.8	0.9	0.7	0.6	1.2	1.3
LSD (p=.05)	1.69	0.9	2.77	0.9	2.08	1.08	1.53	2
Treatment prob(f)	0.0054	0.6357	0.5258	0.6	0.0283	0.4837	0.6032	0.38
4 grower beds, 7 replications per bed. Timings were based on % of bloom (30 to 40% -7/8, 50 to 60% -7/15), fruit set 7/22, 14 and 21 days after fruit set 8/6 and 8/13								