Progress Report for BC Cranberry Commission Research Committee

Project: British Columbia and Atlantic Canada Insecticide and Herbicide Screening and Efficacy Trials in Support of Canadian Registration Requirements for Cranberry Crops

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Project: British Columbia and Atlantic Canada Insecticide and Herbicide Screening and Efficacy Trials in Support of Canadian Registration Requirements for Cranberry Crops.

This report addresses the portion of the project in British Columbia

Investigators: Brian Mauza, Ocean Spray of Canada, Ltd. Richmond, BC. and Grant McMillan, ICMS Inc., Abbotsford, BC.

Objective 1: To generate efficacy data consistent with the requirements to register a product for use on cranberries in Canada, for the control of cranberry tipworm and blackheaded fireworm.

The portion of objective 1. pertaining to blackheaded fireworm was not completed. Products and sites were arranged but investigators decided to delay treatment of the first generation larva because of wet weather and inconsistent levels of the pest at the sites chosen. When it was time for treatment of the second generation the grower would/could not hold off over spraying plots until data was taken because of the high levels of the blackheaded fireworm. There was no means for the investigators to reliably obtain data, consequently no pest control products were evaluated in 2007 against blackheaded fireworm.

Two trials were carried out in Pitt Meadows and Maple Ridge to test seven products against cranberry tipworm.

Trial 1.

Methods:

Applications were made as a ground spray in early June at 500 litres per hectare. Sampling was conducted by collecting a composite sample of all cranberry tips from four random 25cm^2 quadrants within each plot. The composite samples were transported to the lab in coolers with ice. One hundred tips were randomly selected from the composite sample and the number of tipworm stages per tip were counted under a dissecting microscope.

The trial was placed in a commercial cranberry field that had a history of cranberry tipworm. The trial area was monitored weekly for tipworm and the first application was initiated when the population reached 25% incidence in the tips. (data not presented) Overall the season was wet and the growing degree days were about 70 degree days below normal.

Conclusions:
Crop tolerance: The cranberries were assessed at 7 and 14 days after application. Crop tolerance to all pest control products was excellent at all assessments.

Insect Control: Control of cranberry tipworm was assessed at 4 days after application. No treatment differences were observed in counts of the different tipworm life stages at 4 days after application (See Table I). Mortality was also difficult to assess due to moisture in the tips. Also the rate chosen for Diazinon was too low as reports from Wisconsin indicate the highest label rate needs to be used.

Tipworm Control Screening Trial 1.
Table I

insect stage			eggs	larva1	larva2	larva3	pupa	eggs	larva1	larva2	larva3	pupa	all larva dead
Days after application			0	0	0	0	0	4	4	4	4	4	
Treatment		Rate											
Name	Rate	Unit											
Untreated Check			10.8a	5a	3a	8a	1a	2.5a	7.5a	4.3a	2.3a	14a	0.3a
Sevin	7.6	L/HA	11.0a	4a	3a	5a	4a	1.8a	5.3a	3a	3.3a	9.8a	0.8a
DPX E2Y45	321	G/HA	8.3a	3a	2a	6a	1a	2.5a	4.5a	3.3a	2.8a	8a	0.5a
Spinosad	420	G/HA	16.5a	3a	3a	6a	1a	1a	2.3a	5.8a	2.8a	12.8a	2.3a
Actara	280	G/HA	12.0a	3a	5a	4a	3a	2.3a	6.8a	3.5a	13a	8.8a	0.8a
Flubendiamide (Belt)	280	ML/HA	9.5a	6a	2a	5a	1a	2.3a	7.3a	6.8a	1.8a	11.5a	1.5a
Diazinon	1	L/HA	8.0a	1a	2a	5a	1a	3a	7.8a	4.3a	.8a	7.3a	4a
Diatomaceous earth	28	KG/HA	5.8a	2a	2a	4a	0a	3.3a	7.5a	5a	2.3a	5.5a	3.5a

Trial 2.

Methods:

All applications were made as ground sprays in late July at 500L per hectare. Sampling was conducted by collecting a composite sample of all cranberry tips from four random 25 cm2 quadrants within each plot. The composite samples were transported to the lab in coolers with ice to slow down insect metabolism and kept refrigerated at the lab until evaluation. Ten tips were randomly selected from the composite sample and the number of tipworms per tip were counted in the lab using a dissecting scope.

The trial was placed in a commercial cranberry field that was representative of typical commercial practices and which had a history of cranberry tipworm. The trial area was monitored weekly for cranberry tipworm and the first application was initiated when the population reached ~30% incidence in the tips (subjective, data not presented).

Overall the season was slightly wet and the growing degree day accumulation was ~70 degree days below normal.

Conclusions:

Crop tolerance was assessed at 7 and 14 days after application (DA-A). Control of cranberry tipworm (*Dasineura oxycoccana* [DASYVA]) was assessed at 2 and 10 DA-A.

An ANOVA was conducted and means were separated using Tukey's HSD at the 5% significance level. Columns containing subsample data are not shown in the final report.

Crop tolerance:

Crop tolerance was excellent at all assessments.

Insect Control:

No differences between the treatments and the untreated control were observed in population counts of the different tipworm life stages at 2 and 10 days after application (see Table II). Sevin had higher mortaility than the untreated control at 10 DAA, but only provided 26.3% control. All other treatments had the same mortality as the untreated.

Yield:

No yield differences was observed between treatments.

Conclusions:

The cranberry variety 'Stevens' had excellent crop tolerance to the products tested. Sevin showed some activity on cranberry tipworm but only 26% control while all other products were the same as the untreated. The low control may have been in part due to the fact that tipworms had already caused leaf cupping on the cranberry tips by the time of application. Insects inside the cupped leaves my have been shielded from the insecticide applications. An earlier application timing before leaf cupping may result in greater efficacy.

Table II						
Tipworm Control Screening Trial 2.						
insect stage			**Percent larval kill**			
Days after application				O	2	10
Treatment		Rate				
Name	Rate	Unit				
Untreated Check				0.0a	1.3a	2.5b
Sevin	7.6	L/HA		0.0a	2.5a	26.3a
DPX E2Y45	321	G/HA		2.5a	0.0a	5.0ab
Spinosad	420	G/HA		0.0a	2.5a	16.9ab
Actara	280	G/HA		2.5a	5.0a	5.6ab
Flubendiamide (Belt)	280	ML/HA		0.0a	2.5a	5.0ab
Diazanon	1	L/HA		0.0a	7.5a	2.5b
Diatomaceous earth	28	KG/HA		2.5a	2.5a	2.9b

Objective 2: To test control products, including mesotrione if needed, for potential registrations for British Columbia weeds such as creeping buttercup, yellow loosestrife, vetch species, bedstraw and grasses in cranberries.

Abstract:
Weeds are one of the major factors that impact yield in cranberry production. Few products are registered and only one is applied as a broadcast application, all other products are early spring applications or spot spray applications. As the result, late season weeds are becoming a major problem with very little control options available. In 2007, four field trials were conducted in British Columbia with the objectives to expand weed control options for cranberry producers by providing data to expand the Canadian Callisto (mesotrione) label, and to screen additional herbicides for broadleaf and grassy weed control. Across all four trials, the cranberry cultivar 'Stevens' showed minor crop injury (<3%) from Ultim (nicosulfuron + rimsulfuron) at 8 days after application. Crop tolerance was excellent with single applications of Puma Super (fenoxaprop-p-ethyl), Axial (pinoxaden), Accent (nicosulfuron) and Horizon (clodinafop propargyl) as well two applications of Callisto or Ultim applied alone or tank mixed. Two applications of Callisto controlled buttercup (*Ranunculus repens),* cleavers (*Galium aparine),* Asters (*Aster spp*), common vetch (*Vicia sativa)* and white clover (*Trifolium repens)* and suppressed yellow loosestrife (*Lysimachia terrestris*) with regrowth occurring in the plots at later assessments. One or two applications of Ultim controlled buttercup, white clover, cleavers, and common vetch. Tank mixing Callisto and Ultim heightened weed control early in the study but did not differ from the non tank mix applications by the end of the trial period. Puma Super, Axial, Ultim and Horizon controlled barnyard grass (*Echinochloa crus-galli),* witchgrass (*Panicum capillare),* yellow foxtail (*Pennisetum glaucum)* and large crabgrass (*Digitaria sanguinalis).*

BROADLEAFED WEEDS

Crop tolerance and the control of buttercup (Ranunculus repens), white clover (Trifolium repens) cleavers (Galium aparine) and common vetch (Vicia sativa) as assessed at 8 and 15days after application A (DAA-A), 16, 37 and 48 days after application B (DAA-B).

ANOVA analyses was conducted using non-transformed data. Means were separated using Tukey's HSD at the 5% significance level.

"Unacceptable crop injury" is defined as having greater than 10% crop injury.

"Suppression" of weeds is defined as having 60-79% weed control relative to the untreated control.

"Effective control" of weeds is defined as having greater than or equal to 80% weed control relative to the untreated control.

Crop tolerance

The cranberry cultivar 'Stevens' had excellent crop tolerance at all assessments.

Weed Control

(see Table IV)

Buttercup

All treatments were better than the untreated check at 8 and 15 DAA-A, but none provided suppression until 36 DAA-A. The only difference between treatments (other than the check) at 8 or 15 DAA-A was that the tank mix of Callisto and Ultim had higher efficacy than Callisto By 16 DAA-B, all treatments except one application of Callisto demonstrated suppression, and two applications of Callisto + Ultim provided control. At 37and 48 DAA-B, all treatments provided equivalent control of buttercup, with the exception of the one application of Callisto which only provided suppression.

White Clover

Two applications of Callisto and two applications of Callisto + Ultim provided control at 16 DAA-B. All treatments except one application of Callisto provided control of white clover by 37 DAA-B, and by 48 DAA-B this treatment also provided control. Two applications of Utim) or Callisto provided higher white clover control than one application of the products at 16 and 37 DAA-B but there were no differences by 48 DAA-B. Tank mixing Ultim and Callisto enhanced control early in the study but there were no differences between tank mix and the individual products at 48 DAA-B.

Cleavers

With the exception of one application of Callisto), all treatments provided effective control of cleavers by 48 DAA-A. Two applications of Callisto or Ultim had higher control of cleavers than one application at early assessments but no differences between one or two application were observed at 48 DAA-B. Tank mixing Callisto and Ultim provided higher earlier control of cleavers but no differences occurred at 48 DAA-B.

Common Vetch

One application of Ultim provided higher common vetch control than one application of Callisto at 16, 37, and 48 DAA-B. Applying a second application of Ultim did not increase common Vetch control over a single application. A second application of Callisto did enhance the control of common vetch over a single application. One application of Callisto + Ultim) provided no better control than one application of Ultim alone at all assessment dates. By 48 DAA-B, all treatments provided almost complete control of common vetch except one application of Callisto.

Conclusions

The cranberry cultivar 'Stevens' showed excellent tolerance to one and two applications of Callisto or Ultim when applied alone or tank mixed together. One or two applications of Ultim provided control of buttercup, white clover, cleavers, and common vetch. Tank mixing Callisto and Ultim increased weed control early in the study but did not differ

from the non tank mix applications by 48 DAA-B.

GRASSES

Crop tolerance and the control of barnyard grass (*Echinochloa crus-galli* [ECHCG]), yellow foxtail (*Pennisetum glaucum* [PESGL]), witchgrass (*Panicum capillare* [PANCA]) and large crabgrass (*Digitaria sanguinalis* [DIGSA]) was assessed at 8, 15, 36 and 57 days after application (DAA).

An ANOVA was conducted and means were separated using Tukey's HSD at the 5% significance level.

"Unacceptable crop injury" is defined as having greater than 10% crop injury.

"Suppression" of weeds is defined as having 60-79% weed control relative to the untreated control.

"Effective control" of weeds is defined as having greater than or equal to 80% weed control relative to the untreated control.

Crop Tolerance

At 8 DAA, Ultim exhibited injury on the cranberry cultivar 'Stevens' in comparison to the UTC, however, the level of injury was very low (<3%) and well within acceptable limits. All treatments had excellent crop tolerance at 15, 36 and 57 DAA.

Weed control

(see Table V)

The level of weed control seemed to be influenced be crop density and weed development at the time of application. Even though quite advanced in growth stage, some weeds were still beneath or within the crop canopy during application timing. This may have caused some variability in the ratings as the cranberry crop sheltered some weeds from the spray, resulting in lower control.

Barnyardgrass

There were no differences between treatments at 8 DAA and no treatment provided suppression. At 15 DAA all treatments provided suppression except Puma Super. Accent provided higher barnyard grass control than Puma Super at 15 DAA. By 36 DAA all treatments provided suppression with Axial and Ultim providing acceptable control, although they did not differ from the other treatments. At 57 DAA, Puma Super and Accent provided suppression of barnyard grass, while all other treatments provided effective control. The only difference between treatments at 57 DAA was that Ultim provided better control than Accent

Yellow Foxtail

There were no differences between chemical treatments at 8, 15 and 36 DAA but all differed from the untreated check. The products provided unacceptable control at 8 DAA, some suppression at 15 DAA and by 36 DAA Axial, Ultim and Accent provided effective control, but were not different than the other two treatments that provided suppression. At 57 DAA, all products provided effective control with the exception of Accent, which provided suppression and had a lower level of control than Ultim.

Witchgrass

All treatments were better than the untreated check at all assessment dates. There were no differences between treatments at 8 and 36 DAA. By 15 DAA all treatments except Puma Super provided suppression. At 36 DAA Axial and Ultim provided control but were not significantly different from other treatments.. At 57 DAA, all products provided effective control with the exception of Accent which provided suppression and had a lower level of control than Ultim.

Large Crabgrass

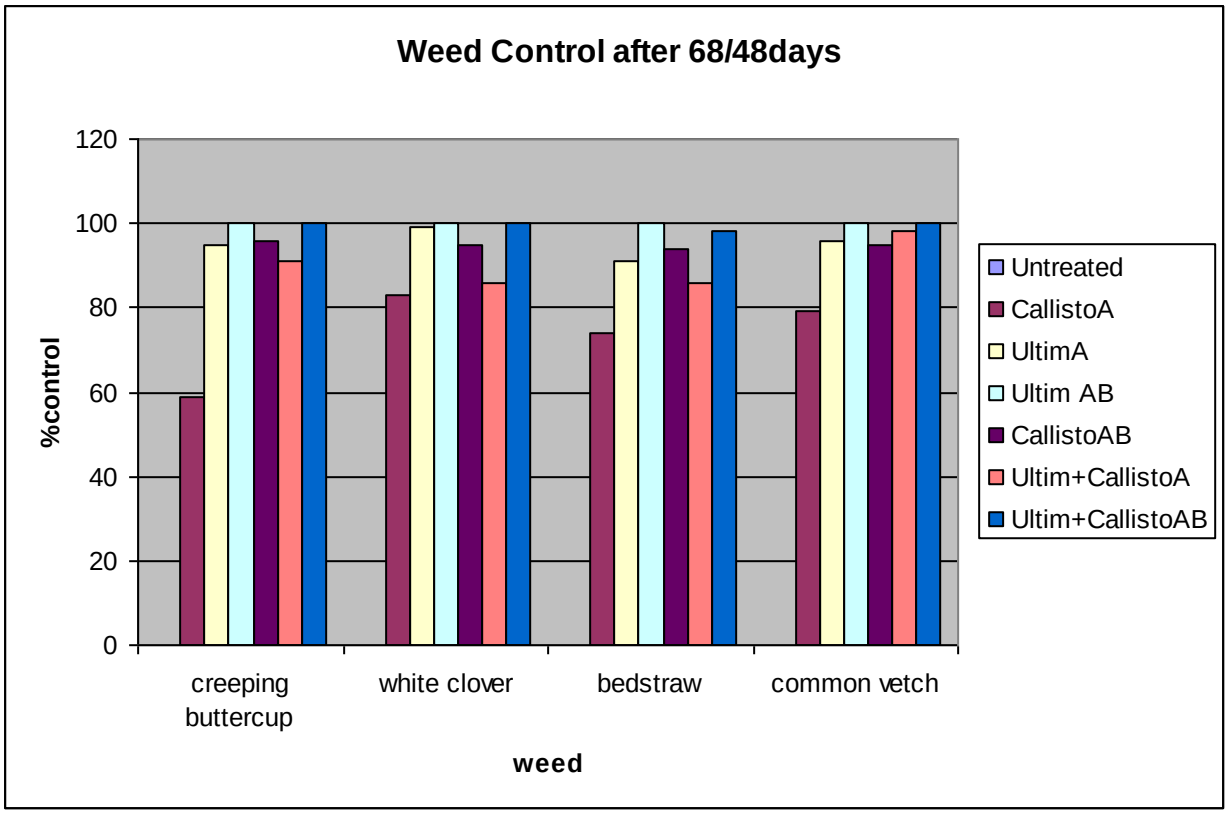
There were no differences between treatments in the level of control at 8 DAA and no treatment provided suppression, although all treatments were better than the untreated check. At 15 DAA, Ultim and Accent) provided suppression although they were not different from the other treatments with the exception of Accent having a higher level of control than Puma Super At 36 DAA Ultim, Axial and Accent had acceptable control of crabgrass and the other two treatments had suppression, although the only statistical differences between treatments were that Axial was better than Puma Super and Ultim was better than Puma Super and Horizon. By 57 DAA, crabgrass control with Accent had declined to suppression and all other treatments provided control, although only Ultim and Horizon were statistically better than Accent.

Yield

There were no differences in yield or 50 berry weight between treatments.

Conclusions

The cranberry cultivar 'Stevens' showed excellent crop tolerance to all herbicides tested. By 57 DAA Puma Super, Axial, Ultim and Horizon all provided effective control of barnyard grass, witchgrass, yellow foxtail and large crabgrass, with the exception that Puma Super only provided suppression of barnyard grass. Accent provided suppression of all weeds tested by 57 DAA. Axial and Ultim provided effective control earlier than the other treatments, typically by 36 DAA


Weed Control after 68/48days
120
100
80
60
40
20
0
%control
creeping buttercup
white clover
bedstraw
common vetch
weed
Untreated
CallistoA
UltimA
Ultim AB
CallistoAB
Ultim+CallistoA
Ultim+CallistoAB

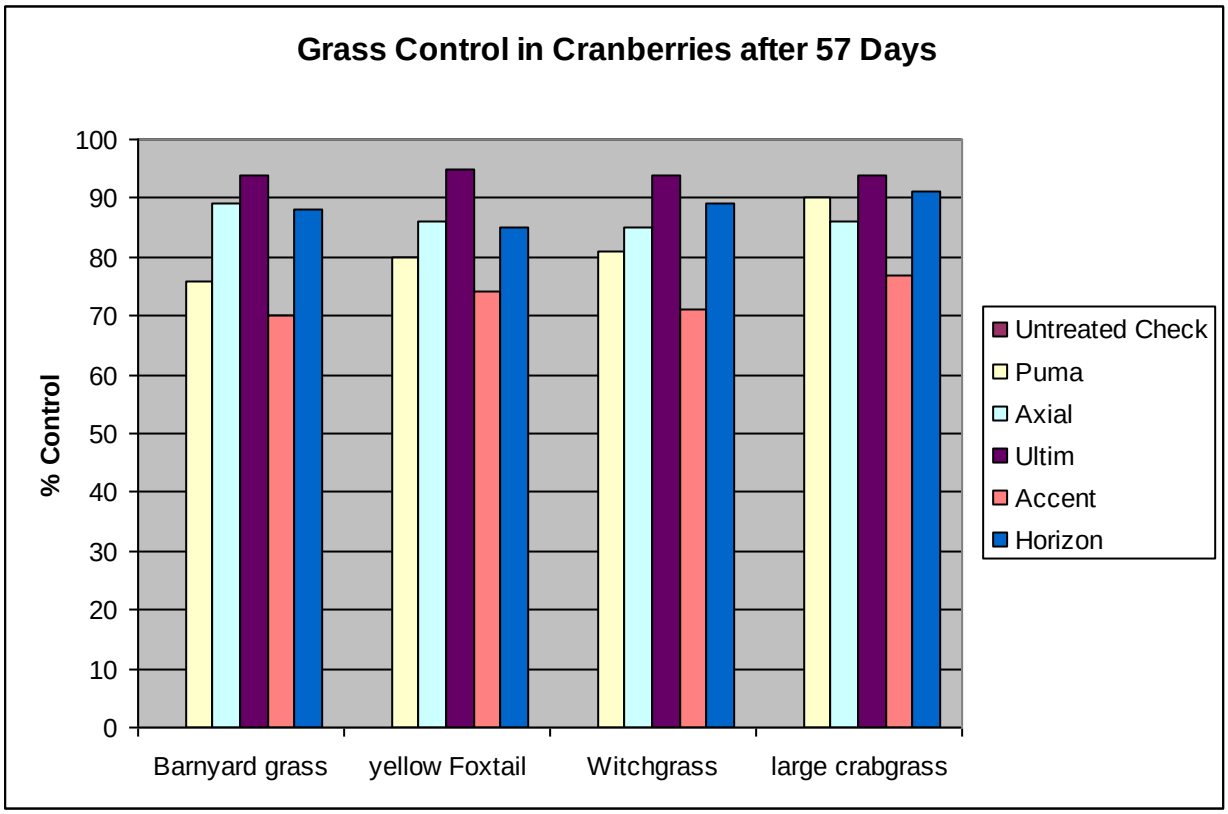

Grass Control in Cranberries after 57 Days
100
90
80
70
60
50
40
30
20
10
0
% Control
Barnyard grass
yellow Foxtail
Witchgrass
large crabgrass
Untreated Check
Puma
Axial
Ultim
Accent
Horizon

TABLE III																																
Broadleaf Weed Control	Mean % Control																															
weed				**creeping buttercup**								**white clover**								**catchweed bedstraw**								**common vetch**					
Days after firstf(A)/last application(B)				8/8		15/15		36/16		57/37		68/48		8/8		15/15		36/16		57/37		68/48		8/8		15/15		36/16		57/37		68/48	
Treatment Name	Rate	Rate Unit	**App Code***																													
Untreated Check				0	b	0	c	0	e	0	c	0	c	0	b	0	c	0	e	0	d	0	c	0	c	0	c	0	d	0	d	0	c	0	b	0	c	0	d	0	d	0	c
Callisto	210	ML/HA	A	36	a	45	b	54	d	65	b	59	b	34	a	39	ab	51	d	58	c	83	b	35	a b	39	ab	63	c	71	c	74	b	40	a	41	ab	65	c	79	c	79	b
Agral 90	0.2	% V/V																																									
Ultim	66.7	G/HA	A	39	a	51	ab	63	c	89	a	95	a	39	a	36	ab	64	c	81	b	99	ab	31	b	36	ab	73	b	88	b	91	a	36	a	40	b	79	b	93	b	96	a
Agral 90	0.2	% V/V																																									
Ultim	66.7	G/HA	AB	36	a	50	ab	79	b	94	a	100	a	35	a	40	ab	84	a	93	a	100	a	36	a b	40	ab	86	a	96	a	100	a	40	a	41	ab	86	b	95	a b	100	a
Agral 90	0.2	% V/V																																									
Callisto	210	ML/HA	AB	38	a	48	ab	73	b	90	a	96	a	36	a	44	a	83	a	91	a	95	ab	41	a	43	a	71	b	88	b	94	a	40	a	36	b	83	b	93	b	95	a
Agral 90	0.2	% V/V																																									
Callisto	210	ML/HA	A	39	a	50	ab	75	b	88	a	91	a	35	a	33	b	73	b	83	b	86	ab	38	a b	33	b	75	b	83	b	86	ab	40	a	41	ab	83	b	96	a b	98	a
Ultim	66.7	G/HA																																									
Agral 90	0.2	% V/V																																									
Callisto	210	ML/HA	AB	34	a	55	a	86	a	95	a	100	a	36	a	34	b	83	a	94	a	100	a	36	a b	34	b	83	a	95	a	98	a	43	a	53	a	95	a	99	a	100	a
Ultim	66.7	G/HA																																									
Agral 90	0.2	% V/V																																									
						means follwed by same letter do not significantly differ (P=.05, Tukey's HSD)																																						
* App Code	A = one treatment AB = two treatments at the noted application interval of 16 days																																									

TABLE IV

Grass Control in Cranberry Mean % Control

weed			**common barnyard grass**				**yellow foxtail**				**witchgrass**				**large crabgrass**			
Days after first/last application			8	15	36	57	8	15	36	57	8	15	36	57	8	15	36	57
Untreated Check			0 b	0 c	0 b	0 c	0 b	0 b	0 b	0 c	0 b	0 c	0 b	0 c	0 b	0 c	0 d	0 c
Puma Super	670	ML/HA	36 a	55 b	76 a	76 ab	39 a	54 a	76 a	80 ab	36 a	51 b	76 a	81 a b	38 a	53 b	71 c	90 ab
Axial	0.6	L/HA	39 a	65 ab	88 a	89 ab	34 a	68 a	84 a	86 ab	40 a	62 a	83 a	85 a b	36 a	58 a b	85 ab	86 ab
Adigor	700	ML/HA																
Ultim	66.7	G/HA	39 a	65 ab	83 a	94 a	40 a	61 a	85 a	95 a	39 a	65 a	88 a	94 a	39 a	61 a b	89 a	94 a
Agral 90	0.2	% V/V																
Accent	33.4	G/HA	35 a	70 a	74 a	70 b	34 a	69 a	75 a	74 b	35 a	66 a	76 a	71 b	37 a	64 a	82 ab c	77 b
Agral 90	0.2	% V/V																
Horizon	235	ML/HA	36 a	60 ab	73 a	88 ab	36 a	59 a	79 a	85 ab	36 a	61 a	74 a	89 a b	38 a	59 a b	75 bc	91 a
Score	0.8	% V/V																
			means follwed by same letter do not significantly differ (P=.05, Tukey's HSD)															

Crop tolerance and control of broadleaved weeds with Callisto.
(See Tables I and II)

Crop tolerance and the control of buttercup (*Ranunculus repens)* ,cleavers (*Galium aparine)* white clover (*Trifolium repens*) and Aster (Aster spp) was assessed 11 and 17 days after application-A (DAA-A), 8 , 15, 36 and 57 days after application B (DAA-B).

Means were separated using Tukey's HSD at the 5% significance level.

"Unacceptable crop injury" is defined as having greater than 10% crop injury.

"Suppression" of weeds is defined as having 60-79% weed control relative to the untreated control.

"Effective control" of weeds is defined as having greater than or equal to 80% weed control relative to the untreated control.

Crop tolerance

No injury was observed at any of the assessment dates. The cranberry cultivar 'Stevens' had excellent crop tolerance to Callisto applied once or twice at 210 ml/ha.

Weed control

Both Callisto treatments provided suppression of all weeds at 17 DAA-A.

Buttercup
Two applications of Callisto provided Buttercup control by 8 DAA-B and maintained this control at 56 DAA-B. One application of Callisto had lower buttercup control than treatment 3 at all assessments and only provided suppression of Buttercup by 56 DAT-B.

Cleavers
Two applications of Callisto provided cleaver control by 8 DAA-B and maintained this control until 56 DAA-B. One application of Callisto had lower cleaver control than treatment 3 at all assessments and only provided cleaver suppression by 56 DAA-B.

Aster
Two applications of Callisto provided Aster control by 36 DAA-B. This control was maintained until 56 DAA-B. One application of Callisto had lower control than treatment 3 at all assessments and only provided suppression of Aster.

White Clover
Two applications of Callisto provided control of white clover by 15 DAA-B. The level of control increased with time and reached almost complete control by 56 DAA-B. One application of Callisto achieved acceptable control levels at 56 DAA-B but only provided

suppression of white clover at previous assessment dates.

Yellow loosestrife
Two applications of Callisto provided greater control of yellow loosestrife than one application at all assessment dates (post application B) except 15 DAA-B. (see Table II) Two applications provided suppression at 8 DAA-B and both treatments provided suppression at 15, 36, and 57 DAA-B. the level of suppression dropped from 36 to 57 DAA-B due to plant regrowth. Neither one nor two applications of Callisto provided acceptable yellow loosestrife control at any assessment date.

Yield

There were no statistical differences in 50 berry weight or yield between the two Callisto treatments. The lack of differences in yield is due to a high CV caused by having three missing plots in a twelve plot trial. The missing plots for yield were due to very low cranberry populations in those plots due to the high weed pressure. Numerically, kg/ha yields using one application of Callisto and two applications of Callisto were approximately 3 and 8 times higher than the untreated check plot yield, respectively.

Conclusions
Stevens had excellent crop tolerance to either one or two applications of Callisto at label rates. Two applications of Callisto controlled buttercup, cleavers, Asters and white clover within the trial and provided consistently higher levels of control than only one Callisto application.
Callisto provided suppression but not acceptable control of yellow loosestrife. Although yield differences were not statistically different due to some missing plots, the numeric yield differences in yield indicate that large increases due to weed removal are possible.

TABLE V

Callisto Trial 1 Mean % Control

weed				**creeping buttercup**												**catchweed bedstraw**												**Asteraceae spp.**												**white clover**											
Days after first/last application				11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57	
Treatment		Rate	**App Code***																																													
Name	Rate	Unit																																															
Untreated Check				0	b	0	b	0	c	0	c	0	c	0	c	0	b	0	b	0	c	0	c	0	c	0	c	0	b	0	b	0	c	0	c	0	c	0	c	0	b	0	b	0	c	0	c	0	c	0	c
Callisto	210	ML/HA	A	40	a	51	a	58	b	74	b	79	b	81	b	53	a	55	a	65	b	68	b	73	b	78	b	55	a	56	a	63	b	71	b	74	b	75	b	40	a	48	a	56	b	61	b	76	b	81	b
Agral 90	0.2	% V/V																																														
Callisto	210	ML/HA	AB	40	a	50	a	74	a	84	a	95	a	100	a	53	a	59	a	80	a	85	a	96	a	96	a	56	a	54	a	70	a	79	a	84	a	86	a	40	a	51	a	75	a	86	a	90	a	99	a
Agral 90	0.2	% V/V																																														

means follwed by same letter do not significantly differ (P=.05, Tukey's HSD)

* App Code A = one treatment AB = two treatments at the noted application interval of 15 days

TABLE VI

Callisto Trial 2 Mean % Control

weed				**creeping buttercup**												**catchweed bedstraw**												**common vetch**												**yellow loosestrife**												**white clover**											
Days after first/last application				11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57		11/11		17/0		25/8		32/15		53/36		74/57	
Treatment name		Rate	**App Code***																																																			
	Rate	Unit																																																			
Untreated Check				0	b	0		0	c	0	c	0	c	0	c	0	b	0	b	0	b	0	c	0	c	0	c	0	b	0	b	0	c	0	c	0	c	0	b	0	b	0	b	0	b	0	b	0	c	0	b	0	b	0	b	0	b	0	c	0	c
Callisto	210	ML/HA	A	40	a	53		58	b	72	b	78	b	78	b	53	a	50	a	62	a	72	b	78	b	78	b	47	a	58	a	65	b	78	b	83	b	87	a	47	a	40	a	50	b	62	a	70	b	63	b	40	a	40	a	52	a	72	a	80	b	78	b
Agral 90	0.2	% V/V																																																			
Callisto	210	ML/HA	AB	40	a	47		75	a	85	a	93	a	97	a	57	a	47	a	72	a	82	a	88	a	92	a	50	a	60	a	75	a	90	a	93	a	98	a	50	a	43	a	60	a	65	a	78	a	68	a	40	a	40	a	63	a	77	a	93	a	100	a
Agral 90	0.2	% V/V																																																			

means follwed by same letter do not significantly differ (P=.05, Tukey's HSD)

* App Code A = one treatment AB = two treatments at the noted application interval of 15 days