Cranberry Research Report 2019: Defining new approaches to weed management in cranberry

<u>Cranberry Research Report</u>

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Title: **Defining new approaches to weed management in cranberry.**

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Cooperators
Research Associate Dr. Katherine Ghantous, UMass Cranberry Station technicians, and growers, etc. who are directly involved in the project.

RESEARCH OBJECTIVES

1. <u>Crop Safety – timing trials for promising new herbicides</u>
   - Test rates and application timing of preemergence herbicides Chateau (flumioxazin) and Zeus (sulfentrazone) at two different early cranberry growth stages (tight bud/spring dormant and bud swell/cabbagehead) impact on crop

2. <u>Screening novel herbicides</u>
   A. Postemergence (POST) greenhouse tests to evaluate control by novel herbicides of perennial grasses (broomsedge, BS; *Andropogon virginicus*, little bluestem, *LBS; Schizachyrium scoparium*, and deer-tongue grass, DTG; *Dichanthelium clandestinum*).
   B. Postemergence field tests with novel herbicides to evaluate control of dodder
   C. Assess crop safety of screened herbicides in field test

3. <u>Screening herbicides for moss control</u>
   - Conduct field studies with four novel herbicides to evaluate moss control and crop safety
   - Test different timings and application methods of herbicides

Crop Safety – flumioxazin and sulfentrazone

A study was conducted in 2018 on State Bog at the UMass Cranberry Station in East Wareham, MA to determine crop safety for two rates and two application timings of flumioxazin (Chateau, 51% a.i.) and sulfentrazone (Zeus XC, 39.6% a.i.). Herbicides were applied preemergence at one of two different dormant cranberry phenology stages: spring dormant/tight buds (SD) or cabbage head/bud scales beginning to loosen (CH). A set of 1-m^2 plots was established on var. Stevens. Treatments were applied by CO_2-powered backpack sprayer. Herbicides were delivered in the equivalent of 400 gallons of water per acre (GPA) to simulate application by chemigation, the typical application method for pesticides in MA. Each plot received a single treatment (see Table 1 for treatments and application dates), and all treatments were replicated four times.

Table 1. Flumioxazin and sulfentrazone treatments and treatment dates for crop safety field study, 2018. Location: State Bog facility, East Wareham, MA

Treatment	**Rate**	**Date**	**Cranberry Growth Stage**
Untreated	n/a	n/a	n/a
Flumioxazin	4 oz/A	4/17/2018	Spring dormant/tight buds (SD)
Flumioxazin	6 oz/A	4/17/2018	SD
Flumioxazin	4 oz/A	5/7/2018	Cabbage head/bud scales beginning to loosen (CH)
Flumioxazin	6 oz/A	5/7/2018	CH
Sulfentrazone	8 oz/A	4/17/2018	SD
Sulfentrazone	12 oz/A	4/17/2018	SD
Sulfentrazone	8 oz/A	5/7/2018	CH
Sulfentrazone	12 oz/A	5/7/2018	CH

Cranberry and moss were visually evaluated for injury May 16, June 25, and September 19, 2018. Moss damage was rated on a scale of 0 – 5: 0 = green/healthy, 1 = some browning, 2 = browning, but tips are green, 3 = mostly brown, but some green, 4 = moss completely brown, 5 = dead/black. Because this study was primarily a crop safety study, not all plots had moss and moss cover was not equal across plots. The cranberry fruit were collected from a 1-ft^2 area (930-cm^2) in each plot on September 20, 2018. Fruit were sorted, counted and weighed to determine sellable crop yield.

Cranberry vines in plots receiving applications at the later CH timing showed some visual symptoms of stunting on the 25 June evaluation (7 weeks after treatment (WAT)); however, plants grew out of these symptoms and there were no visual cranberry differences between treatments on the final evaluation (see pictures). Moss was injured by all treatments and rates (see pictures). At the final evaluation, all treatments had significant moss injury compared to the control (Dunnett's Test, $p \leq 0.05$) (Figure 1). Some of the untreated moss was browning at the final observation due to normal seasonal senescence.

Take-Home Message and Potential for Future Use Recommendations. No treatment differed from the untreated control for number or weight of sellable fruit; this was true for the treatments that showed symptoms of injury at the June visual evaluation ($p \leq 0.05$). Although yield was not impacted by later treatments in this study, the occurrence of stunting to the cranberry vines from later treatments may indicate the possibility for yield impacts to occur and thus earlier treatments on spring dormant cranberry vines would be recommended.

Researchers in other cranberry growing regions have reported more significant cranberry injury and associated yield losses when these herbicides were applied as a broadcast spray (20 – 30 GPA water) rather than as a chemigation application (400 GPA water). These are soil-active herbicides, and incorporating by irrigation immediately after application, rather than relying of rainfall, may mitigate these injuries based on the lack of injury seen with chemigation application.

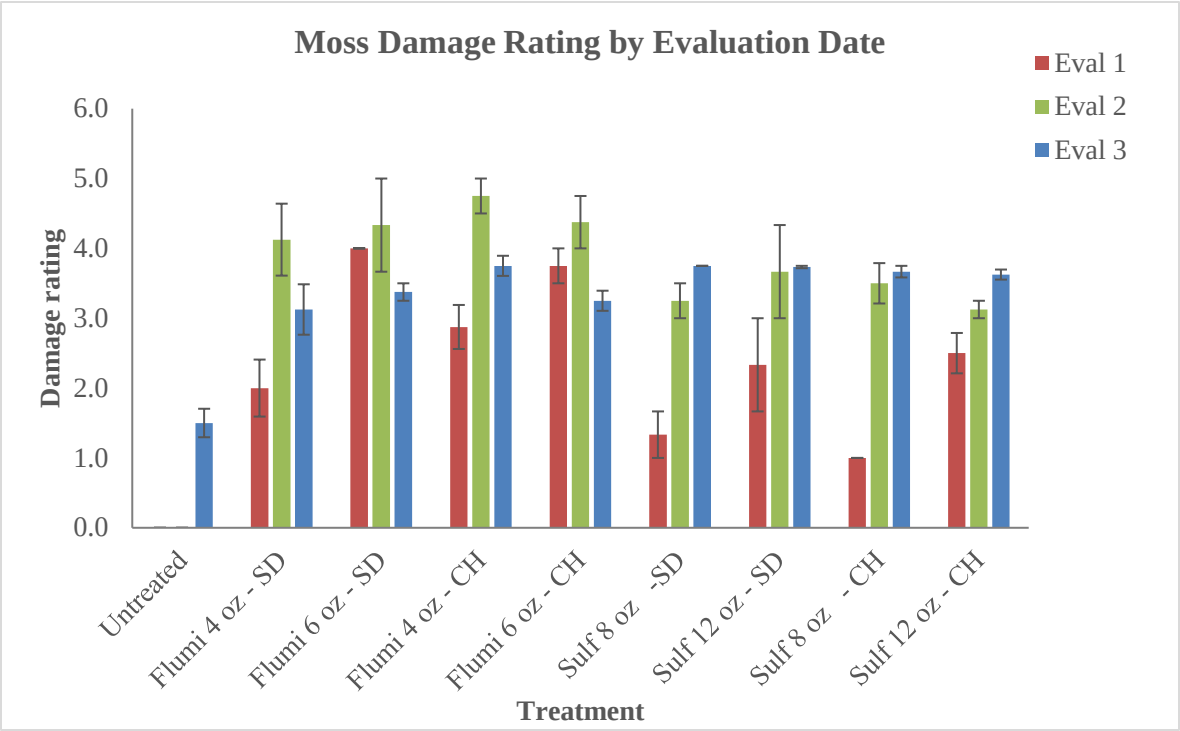

Figure 1. Mean moss damage rating by treatment for three evaluation dates (n=4, ±SE). Moss rated on a scale of 0-5 (0 = green/healthy, 1 = some browning, 2 = browning, but tips are green, 3 = mostly brown, but some green, 4 = moss completely brown, 5 = dead/black) on May 16, June 25, and September 19 2018. At the final evaluation all treated plots showed significant moss injury compared to the untreated moss (Dunnett's Test, $p \leq 0.05$).

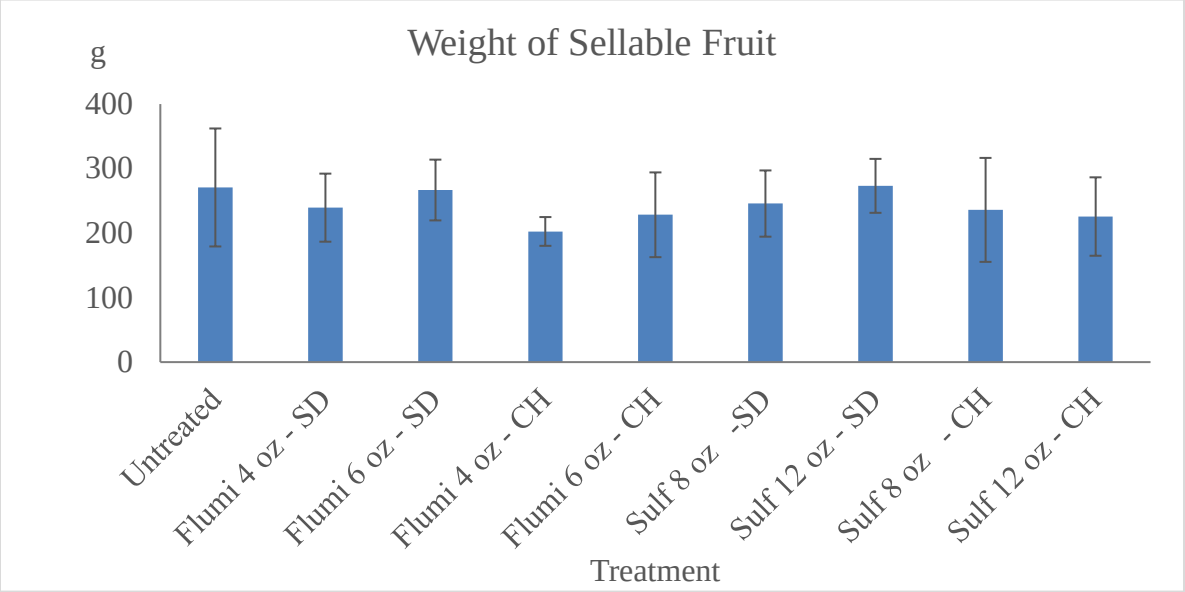

Figure 2. Mean weight of sellable cranberry fruit per ft^2 by herbicide treatment (n=4, ± SE). Differences are not statistically significant ($p \leq 0.05$).

Figure 3. Flumioxazin 4 oz/A Spring Dormant treatment on May 7, 2018, approximately 3 weeks after treatment. Red lines were digitally added to make plot boundary more clear for visual comparison to untreated moss outside of the plot. Sulfentrazone injury was slower to develop than plots treated with flumioxazin (see Figure 1).

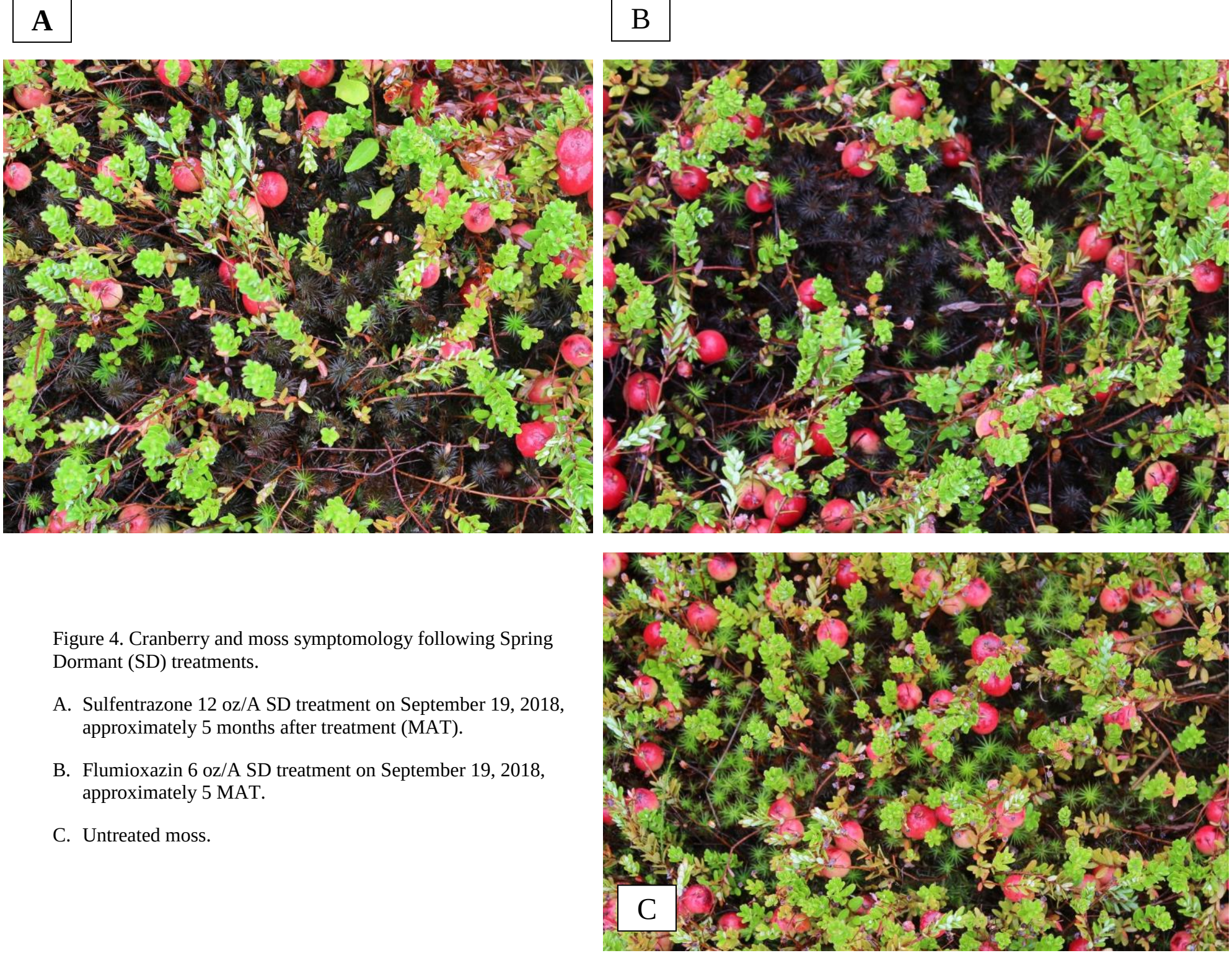

Figure 4. Cranberry and moss symptomology following Spring Dormant (SD) treatments.

A. Sulfentrazone 12 oz/A SD treatment on September 19, 2018, approximately 5 months after treatment (MAT).

B. Flumioxazin 6 oz/A SD treatment on September 19, 2018, approximately 5 MAT.

C. Untreated moss.

Figure 5. Plot treated with 6 oz/A flumioxazin at cabbage head (CH) showing symptoms of stunting of cranberry vines on June 6, 2018, approximately 1 MAT. Plants in the plot do not have as much lush new growth (elongated tips) as surrounding untreated areas.

Postemergence grass study - screening novel herbicides

A set of LBS (0.5 g, approx. 300 seeds), BS (0.10 g, approx. 300 seeds), or DTG (50 counted) seeds was sprinkled onto the surface of a pot filled with a peat/sand mix, and covered with a thin layer of the potting mixture. DTG seeds were cold stratified for 6 weeks prior to planting. Grasses were grown to a height of 4+ inches before treatments. Each pot received a single postemergence herbicide treatment (Table 2) and treatments were replicated four times. Treatments were applied by CO_2-powered backpack sprayer. Herbicides were delivered in the equivalent of 400 gallons of water per acre to simulate application by chemigation, and included 0.25% v:v nonionic surfactant as recommended by label. Grasses were visually evaluated for 8 weeks after treatment (WAT; Run 1) and 6 weeks after treatment (Run 2). The biomass was harvested from each pot, then dried and weighed. The entire study was conducted twice. Run 1 was treated 8/27/18 and Run 2 was treated 9/13/18. Both runs were harvested 11/9/18.

Neither of the herbicides (prometryn, bentazon) screened caused visual symptoms of phytotoxicity or reduced biomass of any of the three grass species compared to the untreated controls.

Postemergence dodder trial and field crop safety

Plots 0.25-m^2 were established on a commercial cranberry farm (Plymouth, MA) with a dodder infestation. Treatments were applied by CO_2-powered backpack sprayer. Caparol treatments were delivered in the equivalent of 400 gallons of water per acre (GPA) to simulate application by chemigation, while Brake and Broadloom were applied as spot treatments in approximately 30 GPA. Each plot received a single treatment (Caparol, Basagran, Brake, or untreated) and each treatment was replicated four times. Plots were treated on 8/10/18. Dodder was flowering at the time of treatments.

The cranberry fruit and dodder seed were collected from a 1-ft^2 area (930-cm^2) in each plot on October 4, 2018. Fruit were sorted, counted and weighed to determine sellable crop yield. Dodder seed was separated from the chaff, counted and weighted.

None of the herbicides screened caused visual symptoms of injury to dodder or reduced seed production of dodder compared to the untreated controls. While none of the herbicides screened caused a significant reduction in cranberry yield compared to the untreated control, Brake (fluridone) caused visual symptoms of bleaching to the cranberry uprights, which were still apparent at harvest. Dodder attachment to cranberry uprights causes tips to redden and show stress. It was unclear if some of the stress noted on cranberry uprights in plots treated with Caparol and Broadloom was due to the presence of dodder or from herbicide injury. Although these two compounds did not control dodder or poverty grass in our trials, if other target weeds could be controlled with these herbicides, they should be retested for crop safety in weed-free cranberry canopy.

Table 2. Novel herbicides screened for postemergence control of grasses and dodder in 2018.

Postemergence – Dodder and grasses		
Herbicide	Active Ingredient	Rate
Caparol	prometryn	2 pt/A (chemigation, 400 GPA water)
Broadloom	bentazon	2 pt/A (spot-treatment, 30 GPA water)
Brake (dodder only)	fluridone	16 oz/A (spot-treatment, 30 GPA water)

Screening nontraditional herbicides for moss control

A study was conducted in 2018 on State Bog at the UMass Cranberry Station in East Wareham to evaluate the efficacy of non-traditional herbicide products for moss control. A set of 1-m^2 plots were established on var. Stevens. Each plot received a single treatment (Table 2) and treatments were replicated four times. Cranberry and moss were visually evaluated for injury. The cranberry fruit were collected from a 1-ft^2 area (930-cm^2) in each plot on September 4, 2018. Fruit were sorted, counted and weighed to determine sellable crop yield.

Axxe and Scythe treatments both resulted in moss injury that lasted all season (4+ months), but they also caused extensive cranberry injury despite being applied to dormant cranberry vines. Both treatments significantly reduced cranberry yield ($p \leq 0.05$; Figure 6) and would not be practical for moss control.

Treatments of Brake showed some lasting moss injury, but also caused bleaching to the cranberry uprights (see picture). Unlike flashing seen from mesotrione applications that resolve quickly, the bleaching from Brake lasted most of the season. Brake treatments did not cause significant reduction of cranberry yield, but visual injury to the cranberry vines make this herbicide an unlikely candidate to pursue further.

TerraCyte did not reduce cranberry yields, and resulted in season-long moss injury (Figure 7). Applications of the product dissolved in water gave more consistent control throughout the plot than granular applications. The active ingredient in TerraCyte is sodium carbonate peroxyhydrate, also sometimes listed as sodium percarbonate. It is a combination of dried hydrogen peroxide and sodium carbonate. Sodium carbonate is a basic chemical, and it is unknown if repeated application could raise the soil pH. Due to good crop safety and efficacy on moss, this product holds promise for use in cranberry Further testing of this product should include multiple applications and soil testing. The active ingredient is a tolerance-exempt compound, which does not require MRLs to be established.

Table 3. Nontraditional Herbicides screened for moss control in 2018.

Moss Screening				
Herbicide	Active Ingredient	Rate	Timing	Application Date
Scythe	pelargonic acid	10% v:v (spray to wet)	Pre-budbreak	4/24/2018
Axxe	ammonium nonanoate	10% v:v (spray to wet)	Pre-budbreak	4/24/2018
TerraCytePRO (granular)	sodium carbonate peroxyhydrate	Applied as a granular - 10 lbs/1000 sq ft	Post-budbreak	5/17/2018
TerraCytePRO (liquid)	sodium carbonate peroxyhydrate	Dissolved in water 100 lbs/A (chemigation)	Post-budbreak	5/17/2018
Brake	fluridone	16 oz/A (chemigation)	Post-budbreak	6/14/2018

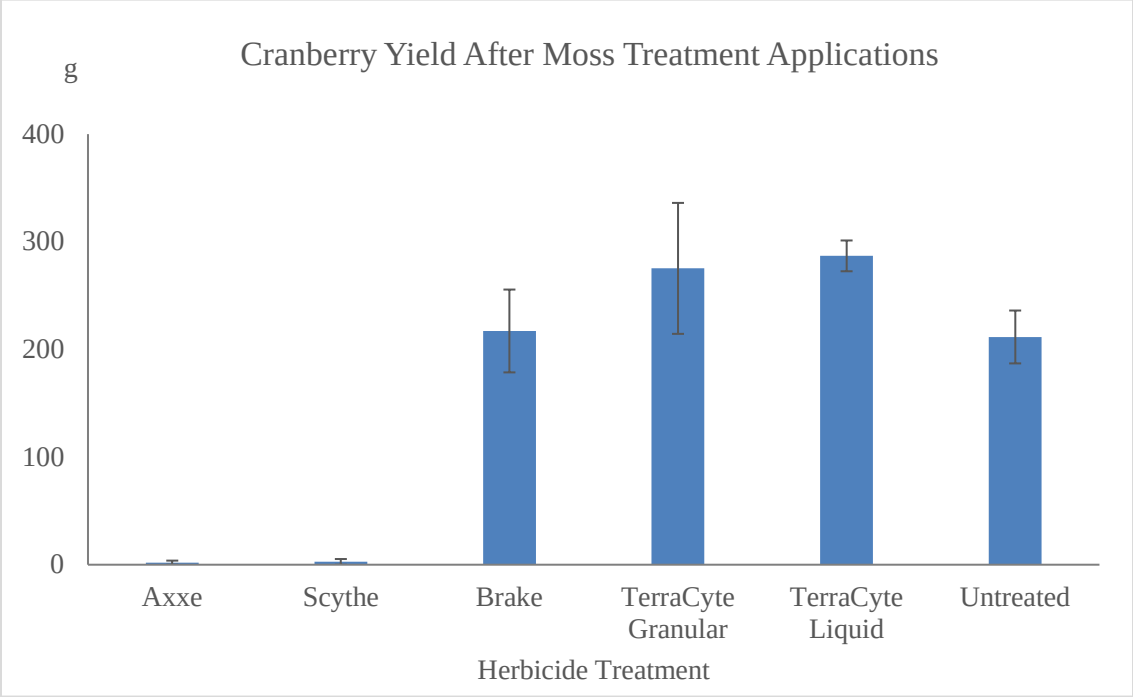

Figure 6. Mean weight of sellable cranberry fruit per square foot by herbicide treatment (n=4, ± SE). Only Axxe and Scythe are statistically different from untreated (Dunnett's test, $p \leq 0.05$)

Figure 7A. Untreated Moss

Fig. 7B. Moss treated with TerraCyte liquid application (100 lbs/A in 400 gallons of water per acre) approximately 3.5 months after application.

Fig. 7C. Moss treated with TerraCyte granular application (10 lb/1000 ft^2) approximately 3.5 months after application. Granular applications resulted in less consistent control.