2015

Improved Weed Management in Massachusetts Cranberry, 2015

Hilary A. Sandler
UMass Amherst, hsandler@umass.edu

Katherine Ghantous
UMass Amherst, kghantou@umass.edu

Cranberry Research Report

Submitted February 2016

Cranberry Research Foundation and Ocean Spray Cranberries, Inc.

TITLE: Improved weed management in Massachusetts cranberry

Principal Investigator

H.A. Sandler, IPM/Weed Specialist UMass Cranberry Station, hsandler@umass.edu
PO Box 569, East Wareham, MA 02538
Phone: 508.295.2212, ext. 21; FAX: 508.295.6387

Cooperators

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

RESEARCH OBJECTIVES

- Conduct germination tests with six unregistered herbicides (listed by code name as per nondisclosure clause for funding) to evaluate preemergence control of dodder seeds.
- Conduct greenhouse tests with two unregistered herbicides to evaluate postemergence control of dodder.
- Test different rates of CO (code name) for preemergence dodder control and crop safety in field trials.
- Evaluate QuinStar mechanism of delayed efficacy against dodder (Year 1).

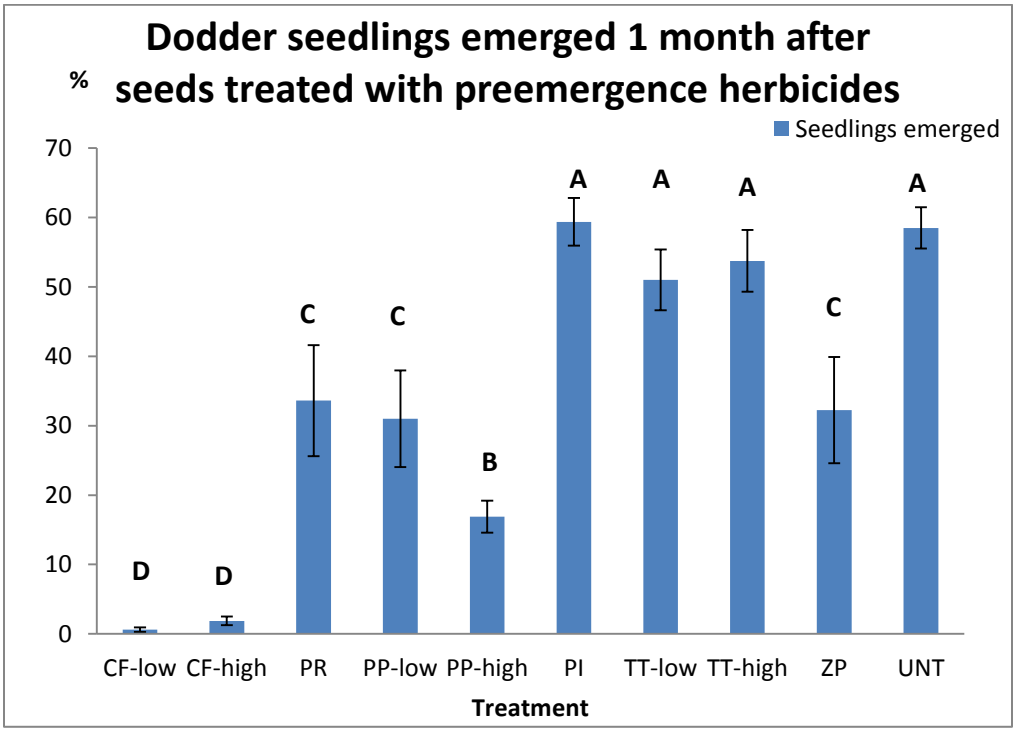
SUMMARY OF ACCOMPLISHMENTS:

Objective: Conduct germination tests with six unregistered herbicides to evaluate preemergence control of dodder seeds.

To evaluate the effect of six novel herbicides for preemergence control of dodder, germination tests were conducted in greenhouse at the UMass Cranberry Station, East Wareham, MA. Sets of 100 dodder seeds were mechanically scarified and placed onto the surface of pots containing 75:25 sand:peat potting media. Herbicides were applied in a manner to simulate application by chemigation in 400 gallons of water per acre. Herbicide rates were selected based on label recommendations and company representative recommendations. Two rates were tested from several products, resulting in a total of ten treatments. Each pot received a single treatment, and each treatment was replicated four times. The entire experiment was repeated. The first study was initiated on 6/9/15 and the second study was on 6/16/15.

Treatment	Code name	Rate (per Acre)
1	CF-low	4 oz
2	CF-high	6 oz
3	PI	6 oz
4	PP-low	2 qt
5	PP-high	4 qt
6	ZP	2.75 oz
7	PR	2 oz
8	TT-low	2 pt
9	TT-high	4 pt
10	UNT	n/a

Pots containing treated seeds were observed for four weeks. Germinated seedlings were counted and removed every few days. Results below are pooled across both runs of the experiment (n=8).



Several herbicides significantly reduced the percentage of dodder seedlings that emerged ($P < 0.0001$). CF (both 4 oz and 6 oz rates) was most effective at reducing the number of emerged seedlings, followed by high rate of PP. PR, the low rate of PP, and ZP also reduced dodder seedlings (Duncan's multiple range test, $P<0.05$). Error bars represent standard error.

Conclusions: Although several herbicides reduced the number of emerged dodder seedlings, CF was the most promising of the products tested. In another study, CF significantly reduced the number of seedlings that emerged from seeds of both species of poverty grass (broomsedge bluestem and little bluestem). We feel that this product has promise for use in cranberry. It is currently labeled for use in other small fruits like bushberries (including blueberry), grape, and strawberry.

CF is labeled for the control of many weeds, and has reported activity against moss in lowbush blueberry. It is safe on dormant lowbush blueberry plants at similar rates (4 – 6 oz/acre). We recommended moving forward with testing this product for crop safety and efficacy in the field with both fall and spring applications, targeting moss and poverty grass.

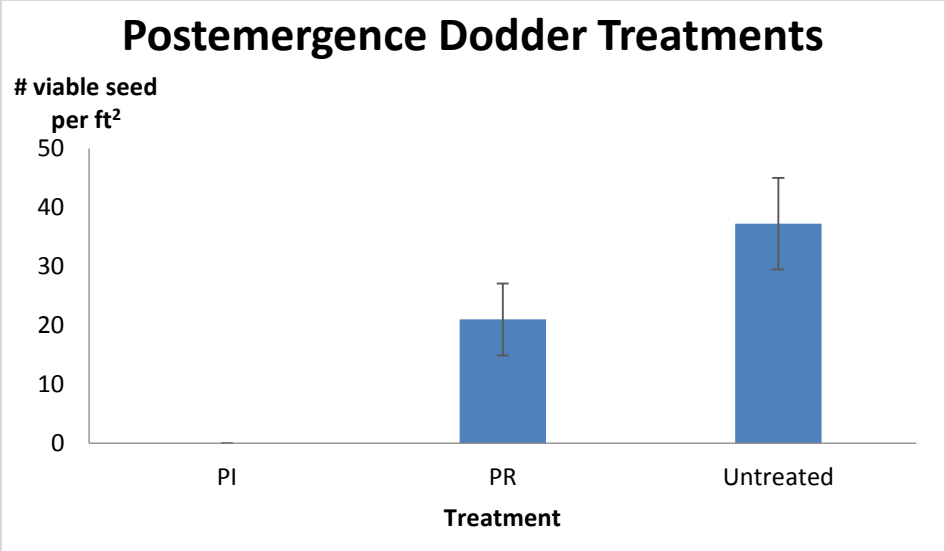
Objective: Conduct greenhouse tests with two unregistered herbicides to evaluate postemergence control of dodder.

Dodder postemergence trials were conducted in the field due to poor dodder growth in greenhouse conditions. Plots 0.25m^2 in size were established on a cranberry bog infested with dodder. Herbicides were applied in 400 gallons of water per acre to simulate application by chemigation. Herbicide rates were selected based on label recommendations and company representative recommendations. Each plot received a single treatment (one of two herbicides or untreated control). Each treatment was replicated four times. Plots were treated on 7/23/15. Dodder plants were starting to flower, and cranberry fruit was present.

Treatment	Code name	Rate (per Acre)
1	PI	6 oz
2	PR	2 oz
3	UNT	n/a

Dodder plots were visually evaluated 3 weeks after treatment, at which time dodder in PI treated plants were showing symptoms of injury (stems were browning and thinning), while PR treated plants were similar to untreated plants. Cranberry plants had no signs of injury.

All cranberry fruit and dodder were collected from a 1 ft^2 area in the center of each plot on 9/28/15, prior to harvest. Cranberry fruit was sorted by quality and weighted. Dodder seeds were separated from plant material, counted, and weighed.



Dodder treated with PI produced no viable seeds (n=4). Dodder treated with PR produced less seeds than untreated areas, but this difference was only marginally significant ($P \leq 0.10$). Cranberry fruit yields did not differ by treatment (number of good fruit, weight of good fruit, or total number of fruit produced per ft^2).

At the time of harvest, it was noted that many uprights in plots treated with PI had grown several new uprights (see photo on right). It is appears that the treatment may have had a growth regulator effect on cranberry. The long-term impact of the additional growth on yield or vine health is unknown. We plan to make applications at different stages of cranberry and dodder development, as well as to monitor any areas treated in 2016 into the 2017 to evaluate possible yield impacts (positive or negative) the year after treatment due to the new upright growth.

Objective: Test different rates of CO (code name) for preemergence dodder control and crop safety in field trials.

Dodder seed location is difficult to predict in the field for preemergence trials, and intentionally inoculating a bog could have lasting negative impacts for years to come. To evaluate CO for preemergence dodder control in the field, a novel test system was developed. Non-scarified dodder seeds were placed into 5-gallon buckets filled with 75:25 sand:peat. The seeds over-wintered outdoors near State Bog to mimic natural scarification processes. After the winter flood was removed from State Bog, the buckets were placed onto the bog so that seeds experienced actual bog conditions.

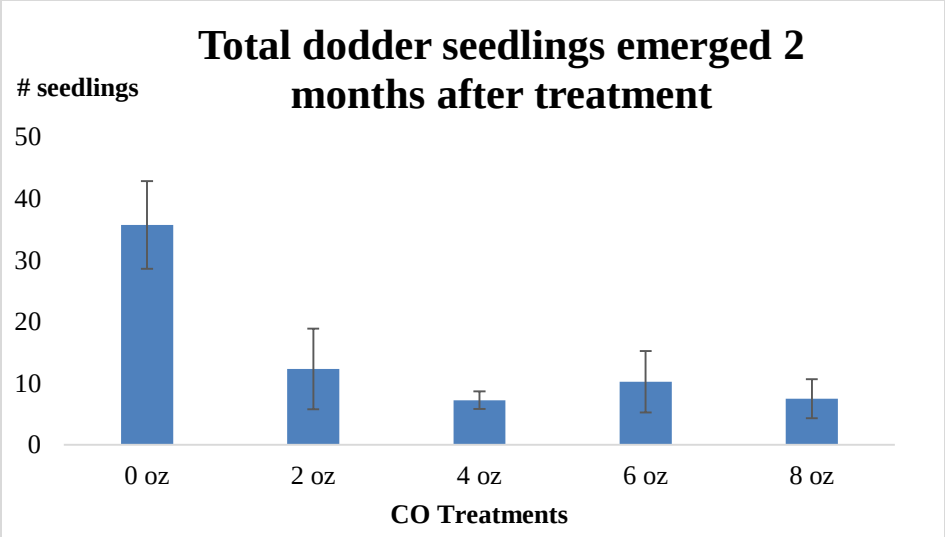
The CO label states that "at least 0.25 inch of irrigation or rainfall is required to activate the herbicide and should occur within 3 to 4 weeks after application". CO would be applied in spring before budbreak, and would likely receive this much water from rainfall or frost protection within the 3 to 4 week period after application. Preliminary greenhouse testing (2013-2014) incorporated a simulated wash-off after application. It was unknown if allowing the herbicide to dry on cranberry leaves would lead to any phytotoxicity. Two sets of cranberry plots were established. One set of plots received additional water immediately after herbicide application to simulate a "wash-off" (approximately 0.25" of water), and the other set of plots received an herbicide application only. All buckets containing the scarified seeds received additional water after the herbicide application.

CO treatments were applied in a manner to simulate application by chemigation in 400 gallons of water per acre. Greenhouse trials showed that CO treatments applied to cranberry plants at growth stages of spring dormancy, bud-swell, or cabbagehead did not result in injury. The application of 2016 field trials occurred when 'Stevens' were at or before cabbagehead. Each bucket or plot received single treatment of 0, 2, 4, 6, or 8 oz/acre. All treatments were replicated four times. Dodder seeds in buckets and the 0.25-m^2 plots of cranberry ('Stevens') were treated with CO on 5/1/15.

Buckets were evaluated every few days after treatment until August. Emerged seedlings were counted and removed from buckets. Cranberry plots were visually evaluated periodically. At observation on 6/24/15, it was noted that plots treated with 8 oz/acre that did not receive additional water appeared to have delayed flowering compared to untreated plants. All other treatments were visually similar to untreated plants at all other observation times. On 9/15/15, cranberry fruit was collected from a 1 ft^2 area in the center of each plot. Fruit was sorted by quality and weighted.

Cranberry fruit yields did not differ by treatment (number of good fruit, weight of good fruit, or total number of fruit produced per ft^2), regardless of whether additional water was applied after herbicide application or not.

All CO treatments, regardless of rate, significantly reduced the total number of dodder seedlings that emerged. The rates did not significantly differ from each other.



Dodder seed buckets treated with CO. Note that treatments also appeared to control crabgrass and nutsedge as well as dodder. The center bucket is untreated.

Objective: Evaluate QuinStar mechanism of delayed efficacy against dodder (Year 1).

Anecdotal reports from Massachusetts growers state that even if dodder control is not seen the year QuinStar (quinclorac) has been applied, control is seen in the year or years after application even with no future applications. It is known that quinclorac residues can be detected in cranberry fruit in the year following treatment.

We hypothesized that quinclorac is accumulated and stored in the tissue of cranberry plants. If the plant is parasitized by dodder the year after quinclorac has been applied, the dodder is exposed to quinclorac already present in the cranberry plant. To test this hypothesis and to assess how long residues (if any) persist after treatment, we designed an experiment to treat cranberry plants with the maximum rate of QuinStar over a period of three years. Plots 1 m^2 were established on 'Stevens' on State Bog in 2015. Over the course of this multi-year study, each plot will receive two 8.4 oz/acre QuinStar in 400 gallons of water per acre (chemigation)

applications at one of four timings: none, Year 1 only, Years 1 +2, or Years 1, 2, + 3. Each treatment will be replicated four times. Each fall, cranberry tissue samples will be collected tested by Ocean Spray for quinclorac.

Year 1 treatments were applied on 6/3/15 and 7/23/15. Cranberry fruit was collected from a 1 ft^2 area from each plot on 9/17/15. All cranberry plants from ¼ of the plot (0.25 m^2) were collected 9/17/15 and 9/18/15. Cranberry tissue was sorted in the lab into four categories of tissue based on whether tissue was from the current or previous growing year: new growth stems, new growth leaves, 1-year old stems, and 1-year old leaves. All other tissue was discarded. Tissue was stored frozen at 0°F until delivered to Ocean Spray.

Extracting small amounts of quinclorac from plant tissue is exceedingly more difficult than extracting residues from cranberry fruit, a known procedure. Ocean Spray chemists have tested many different extraction protocols, including some based on input from chemical company chemists. At the time of this writing, the resolution of the logistical details needed to detect the presence of quinclorac in cranberry plant tissue with available technology are being addressed.

Parties interested in knowing the specifics of the chemicals tested are invited to contact the authors.