

Moss Impacts and Control Efforts in Cranberry

Feb 18, 2021

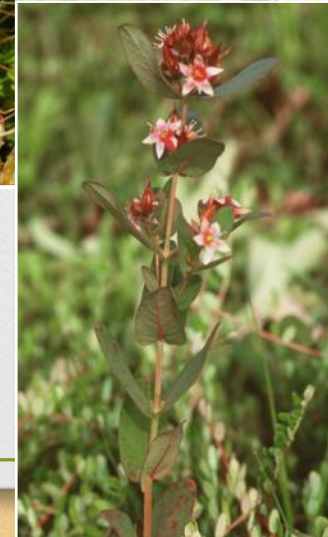
PNW Cranberry Congress

Katherine Ghantous
UMass Cranberry Station

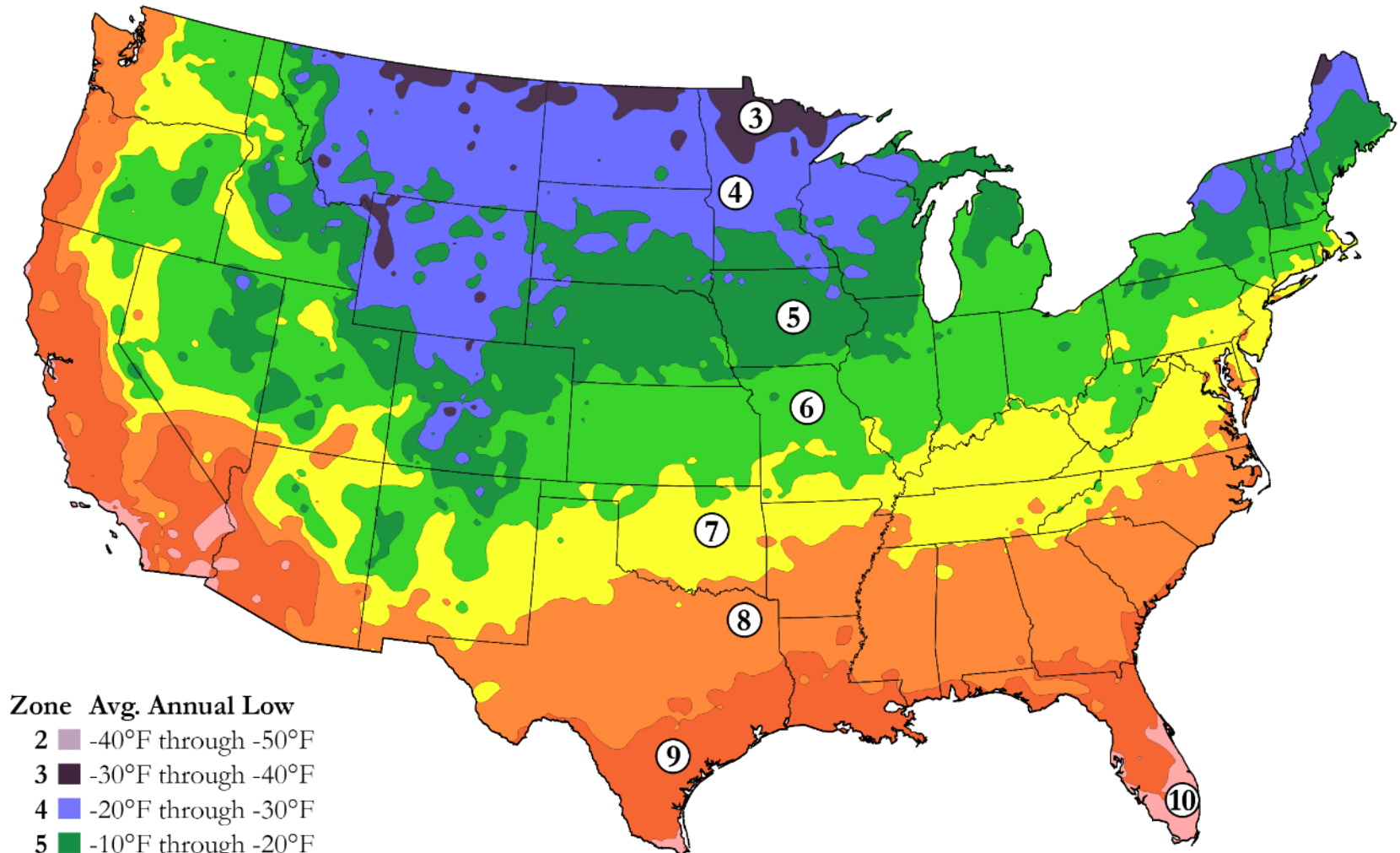
University of
Massachusetts
Amherst

Shifting weed populations

- **Gaps from newer herbicides**
 - Good control of previously widespread weeds leaves room for new players to move into
- **Changes in management**
 - Water use
 - Nutrients
 - Sanding
- **Changes in climate**



2015 arborday.org Hardiness Zones Map

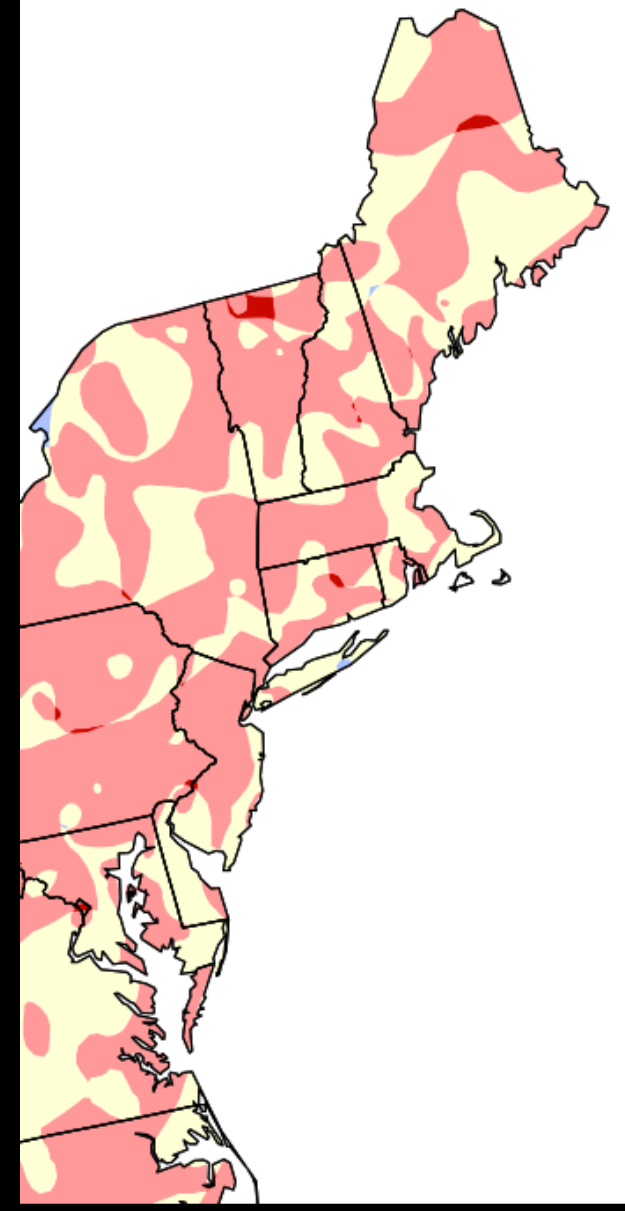
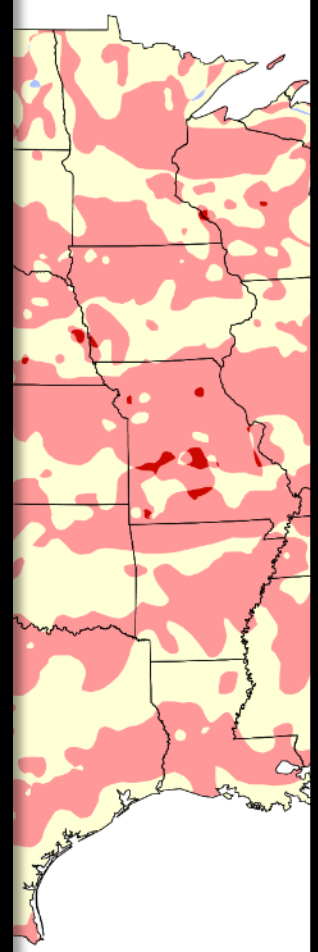
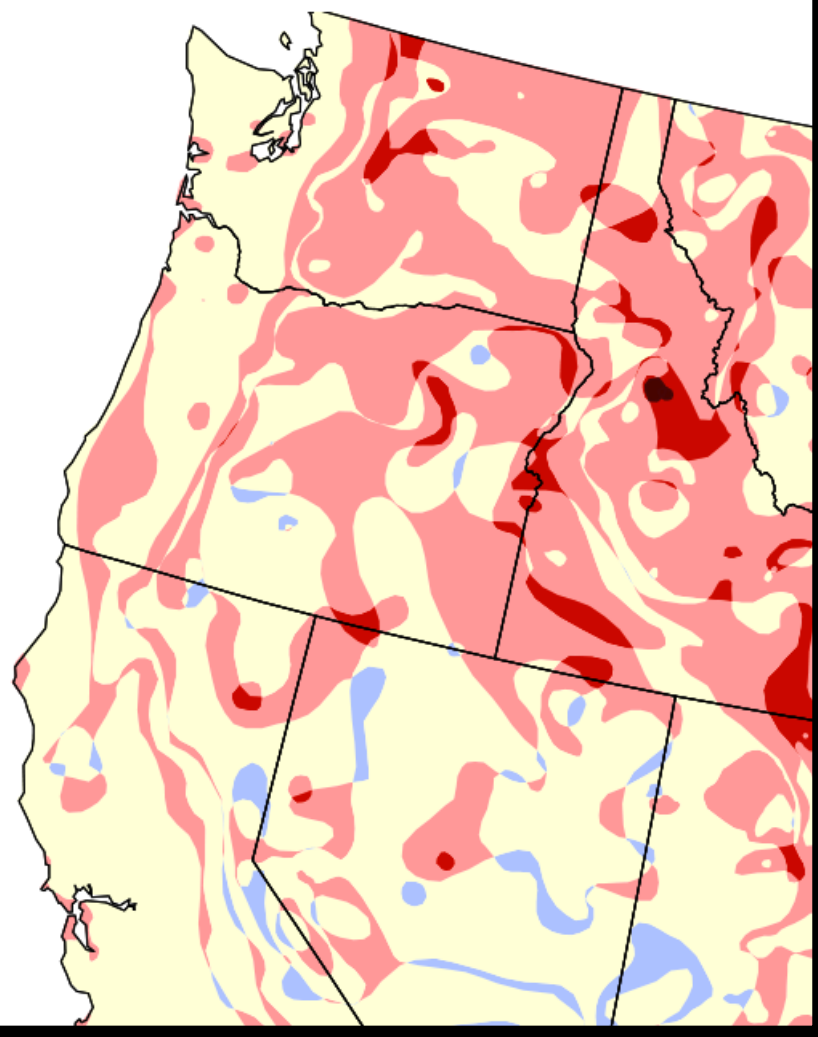


Zone	Avg. Annual Low
2	-40°F through -50°F
3	-30°F through -40°F
4	-20°F through -30°F
5	-10°F through -20°F
6	0°F through -10°F
7	10°F through 0°F
8	20°F through 10°F
9	30°F through 20°F
10	40°F through 30°F

**Go to arborday.org
to find the zone for your zip code.
You can also find trees for planting in your zip code.**

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Differences Between 1990 USDA
Hard



-3

Massachusetts State College
United States Department of Agriculture and
Plymouth County and Cape Cod Extension
Services Co-operatingCO-OPERATIVE EXTENSION WORK
IN
AGRICULTURE AND HOME ECONOMICS
STATE OF MASSACHUSETTSExtension Service
County Agent
Home Demonstration
4-H Club Work

1938 CRANBERRY WEED CONTROL CHART

NAME OF WEED	WHEN TO TREAT	WHAT TO USE	REMARKS
WOODY WEEDS, such as Poison Ivy, Horse Brier, Hardhack, Red Maple, Chokeberry, Leather Leaf, Sheep Laurel, Brake, etc.	After the harvest, and before growth starts in the spring.	Weed hook.	No satisfactory chemical treatment has been found for this kind of weed. In severe cases the bog should be re-made and all roots be removed before replanting.
DITCH WEEDS 1. Bur-reed 2. Pond Lilies 3. Pickerel-Weed 4. Water Smart Weed 5. Water Willow	Mid-summer.	Sodium arsenite. 15 lbs. in 100 gals. of water.	Drain the bog ditches and spray the weeds. CAUTION: This solution is very caustic. Protect the eyes with goggles and the hands with rubber gloves. Do not allow the spray to touch the cranberry vines, as it will kill them.
SEDGES, RUSHES, & GRASSES (Weeds with bases of leaves surrounding the stem like a sheath.) Early Hair Grass Quaking Grass Panicle species Carex species Spike Rush or Needle Grass Wool Grass or Bunch Grass	After the harvest, or just as vines start growth in the spring.	Water white kerosene, 200 to 400 gals. to the acre.	Apply the kerosene when the vines are dry, with only 50 to 75 lbs. pressure. Use enough to thoroughly wet the crowns of the weeds. Pour about half a cupful of kerosene into a clump of Bunch Grass. Kerosene is effective in killing 3-Square Grass only if applied before the weed is half-grown, and 600 to 800 gals. per acre must be used. (This plant seems to be root-tender to kerosene.)

		2. Ammonium sulphate or nitrate of soda.	(Choice of these treatments)
MOSS (Hair-cap Moss)	After the harvest or before vines start growth in the spring.	<u>Treatment No. 1</u> 800 lbs. of iron sulphate and 400 lbs. of ammonium sulphate to the acre, or <u>Treatment No. 2</u> 800 lbs. of iron sulphate and 400 lbs. of calcium chloride to the acre.	No. 1 for sand-bottom bogs. No. 2 for peat-bottom bogs.
BEGGAR-TICKS	Mid-summer.	75 lbs. salt to 100 gals. of	Use 200 gals.

PARTRIDG PEA	soon as the weed grows above the cranberry vines. 2nd treatment early in August.	1-1/2 lbs. sodium arsenate in 100 gals. water.	Do not spray until the tender cranberry vines, buds, flowers, or berries. Do not use the sodium arsenate spray before August. Spray only enough to wet the leaves. CAUTION: Be sure to use sodium arsenate and not arsenite.
PERNS Feather Sensitive Royal Cinnamon Chain	July or Early August.	Apply one or two handfuls of a mixture of 1 part of calcium chloride and 9 parts of iron sulphate. 1. Apply 1/4 to 1/2 pt. of salt solution (2 lbs. of salt in 1 gal. of water) or 2. Ammonium sulphate or nitrate of soda.	Iron sulphate does not act until dissolved. Calcium chloride helps to dissolve it by absorbing moisture from the air. On hard-bottom bogs, ammonium sulphate may be used instead of calcium chloride. 1. Pour solution around stalks. 2. Two or three handfuls thrown directly around the stalks. (Choice of these treatments)
MOSS (Hair-cap Moss)	After the harvest or before vines start growth in the spring.	<u>Treatment No. 1</u> 800 lbs. of iron sulphate and 400 lbs. of ammonium sulphate to the acre, or <u>Treatment No. 2</u> 800 lbs. of iron sulphate and 400 lbs. of calcium chloride to the acre.	No. 1 for sand-bottom bogs. No. 2 for peat-bottom bogs.
BEGGAR-TICKS	Mid-summer.	75 lbs. salt to 100 gals. of water.	Use 200 gals. per acre.
TEAR THUMB	Late summer.	Dry iron sulphate, 1600 to 3000 lbs. per acre.	
FIRE WEED	When weeds appear.	75 lbs. salt to 100 gals. of water.	Use 200 gals. per acre.
ASTERS	When weeds appear.	Sodium Arsenite, 1/2 lb. to 100 gals. of water.	Use 400 gals. per acre.
SAND SPURRY	July or August.	1600 lbs. of iron sulphate to the acre.	
OTHER PLANT	July or August.	Iron or copper sulphate.	
WINTER BRAMBLE	Hold winter flood till early June.		This treatment kills 90% of the weed.

All chemical sprays for weed control should be applied as a fine mist at 50 to 75 lbs. pressure.

Moss & MA Cranberry

- Increasing # of MA growers calls about moss infestations over the past few years
- Growers self-reporting moss issues
 - Appearing on more farms
 - Weed pressure increasing
- Other regions now having similar trends

Most common and “weedy” mosses in MA cranberry



Haircap
(*Polytrichum commune*)



Sphagnum
(Multiple *Sphagnum* spp.)

Moss Species – lots of diversity!

2017 survey of a single cranberry bed at State Bog
at least three additional moss species present



Aulacomnium palustre
(Bog groove-moss)



Ceratodon purpureus



Entodon seductrix

Moss Species – lots of diversity!

2018 survey of 2nd bed cranberry bed at State Bog

at least four additional moss species identified



Atrichum crispum

<http://northernforestatlas.org>



Callicladium baldanianum

<http://northernforestatlas.org>



Ditrichum pallidum

<http://bryophytes.plant.siu.edu>, Li Zhang



Pohlia nutans <http://northernforestatlas.org>

Most common and “weedy” mosses in MA cranberry



Haircap
(*Polytrichum commune*)



Sphagnum
(Multiple *Sphagnum* spp.)



Sphagnum

“Peat mosses”, 300+ species

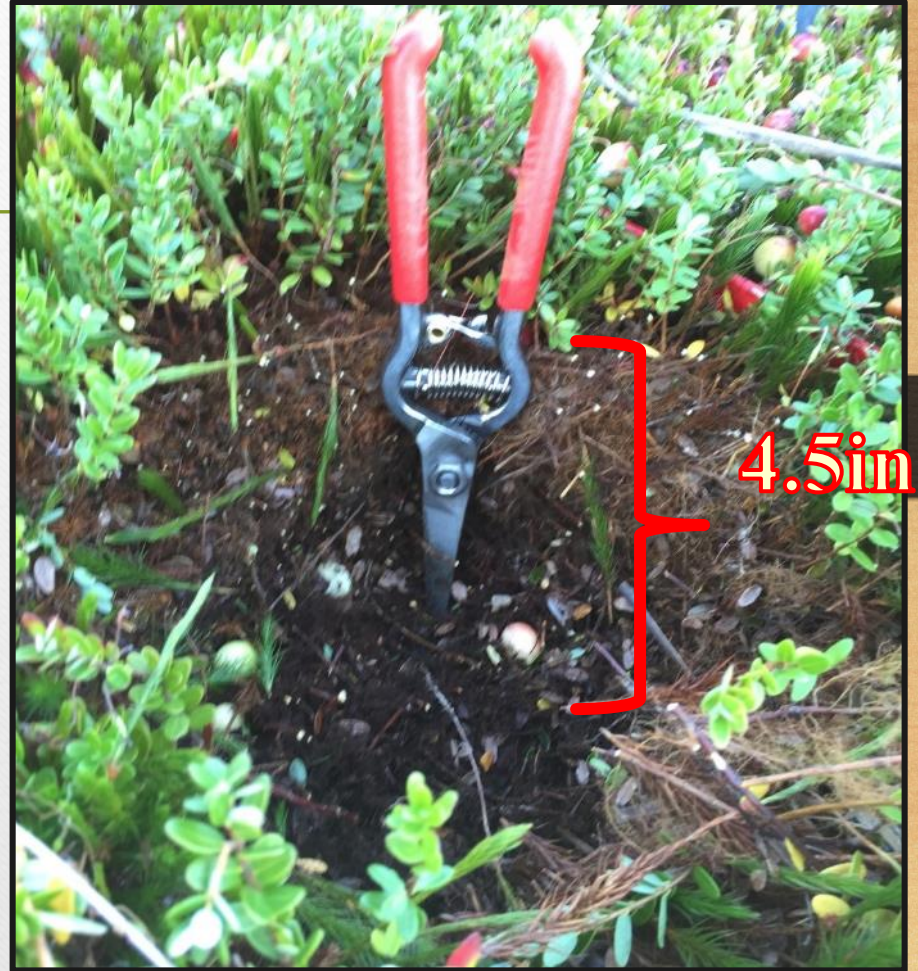
- Lack root-like rhizoid structures
- Specialized cells covered with pores to absorb water and hold it like a sponge
- In cranberry, found in wet areas
 - bed and ditch edges
 - areas w/drainage problems and high soil moisture

Haircap Moss

(Polytrichum commune)

- Stems attached to the soil by rhizoids (structures that resemble roots)
- Found in diverse habitats
- Large clonal patches interconnected underground
- Can reproduce vegetatively from buds on the rhizomes, or by spores that result from sexual reproduction







Haircap Impacts? Is it just cosmetic?

Two beds of 'Stevens' were sampled

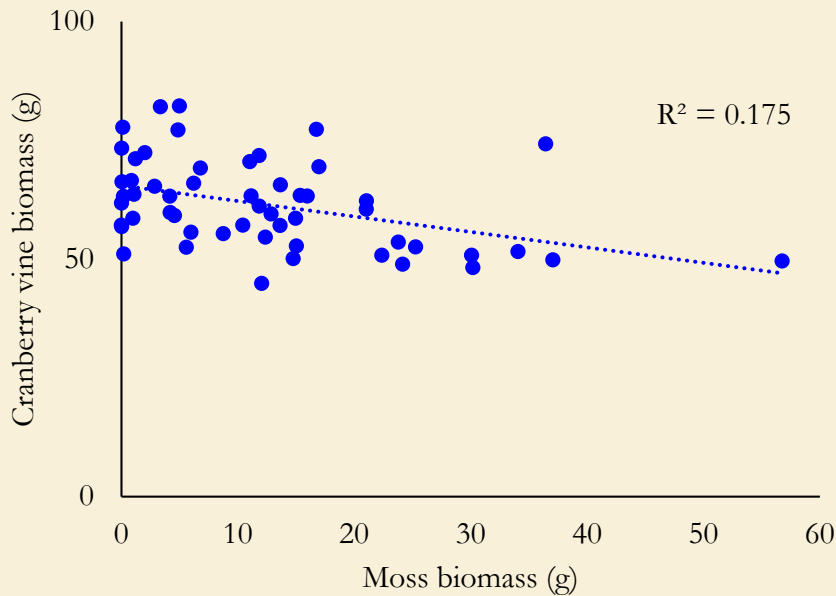
- 15 small sections (930-cm² squares) excised w/pruners
 - clipped all plant material to the soil level
- Fruit sorted, counted, and weighted
- Cranberry tissue dried and weighed
- Moss tissue dried and weighed



Documenting Impact of Haircap Moss

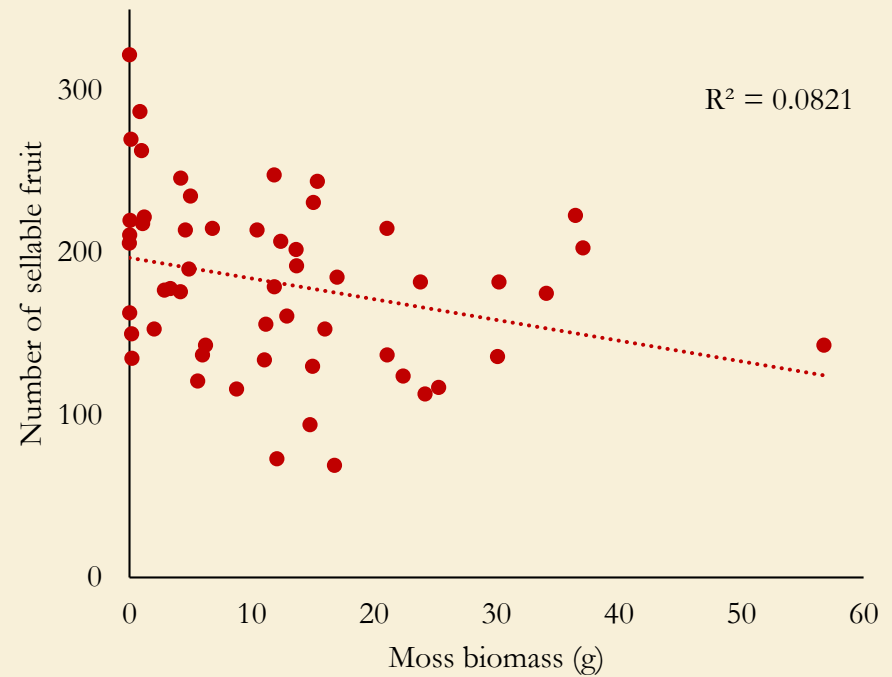
Direct competition between moss and cranberry

Cranberry vine biomass vs moss biomass



Cranberry biomass negatively correlated with moss biomass

Number of sellable fruit vs moss biomass



It IS a problem, now what do we do?

- Moss in turf, ornamentals, surfaces
 - Not common weed in food crops
 - Not “food-use” herbicides
- Non-vascular plant (some of the oldest on planet)
 - Different than all of our other weeds
 - Doesn't respond same way to herbicides



Conventional Herbicides

Recent work has confirmed that currently registered herbicides provided little to no control of moss

- Casoron (60 lb/A)
- Evital (80 lb/A)
- Devrinol 2-XT (18 qt/A)
- QuinStar (8.4 oz/A x2)
- Callisto (8 oz/A x2)

Historical recommendations

- Ammonium sulfate (100 lbs/A)
- Casoron (high rates, 100 lbs/A)
- Iron sulfate (ferrous sulfate)
 - Old chart book recommendation was for VERY high rates
 - 3 oz/sq ft as spot treatment ~ over 8,000 lbs and acre!

Iron sulfate

Historical recommendation

It (kind of) works **BUT...**

- Not registered as a pesticide in cranberry
- Difficult to apply, not practical for treating large areas (we have acres of moss)
- May require multiple applications yearly



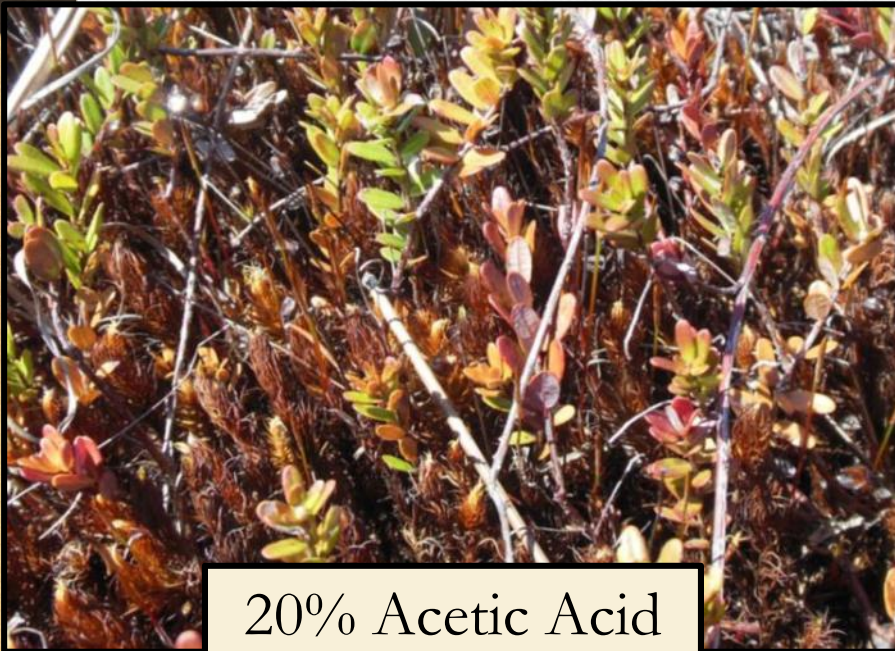
Looked into Iron (ferrous) sulfate products as a pesticide – no good options

- Powdered form via drop spreader (92% ferrous sulfate)
- Powdered form dissolved in water and applied by chemigation
- Large granules (fertilizer sized) (50% ferrous sulfate)
- Small granules (similar to sand) Scotts Moss Control Lawns (17.5% ferrous sulfate)
- Moss-out Liquid (a 35% ferric sulfate)
- FeRROMECC liquid turf product (15% Urea Nitrogen, 3% Combined Sulfur, 6% Iron)

Screened lots of other products over the years

Horticultural Vinegar (acetic acid)

- Injurious to cranberry
- (5%, 10%, and 20% acetic acid)
- Moss recovers, needs multiple apps



20% Acetic Acid

5% and 10% acid did not have lasting moss control

20% controlled moss, but injured vines

Herbicidal soap (22% Ammoniated Soap of Fatty Acids)

- Injurious to cranberry



Herbicidal soap



Good moss control, Lots of cranberry damage

Moss-aside (22% potassium salts of fatty acids)

Safe on cranberry but....

- Moss recovers, needs multiple apps
- Very cost prohibitive
- Would need hundreds of gallons (1:9 dilution)



Moss-aside

Potassium Salts of Fatty Acids

M-pede (insecticidal soap, 49% potassium salts of fatty acids)

- Already labeled for cranberry
 - Would only need a 2cc to use for moss
- More concentrated, more economical
- **BUT DOESN'T WORK!**

Potassium salts may include: potassium laurate, potassium oleate, potassium myristate, and potassium ricinoleate.



Screening trials identify two promising herbicides

Preemergence (applied before cranberry bud-break)

- Registered in other food crops
 - Including blueberry
- Effective for moss
- Safe on cranberry (if applied correctly)

Untreated



Moss injured by all treatments
photos 5 months after treatment

A 6 oz - SD



B 12 oz - SD



Herbicide A

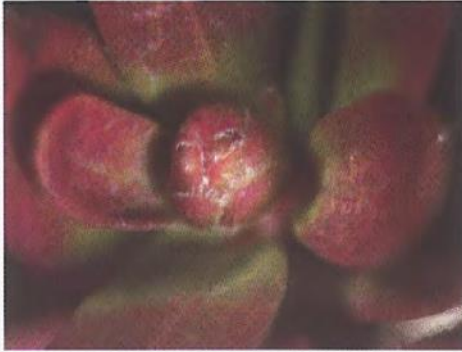
WI trials had more injury than MA...why?

- **Timing?**

- “dormancy” covers a range of stages
- Climate differences between regions could influence how quickly cranberry emerges from dormancy

- **Application method?**

Cranberry bud development



Tight Bud



White Bud



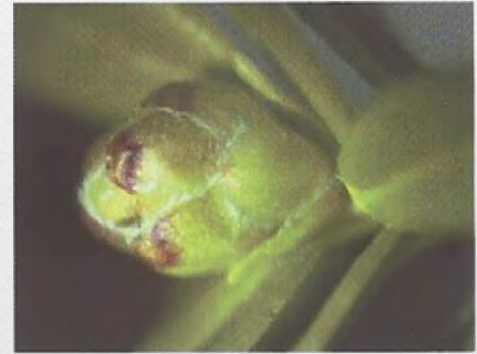
Bud Swell



Cabbage Head



Late Cabbage Head



Early Bud Elongation

Ben Lear
Stevens

Does Application Method Impact Crop Safety?

Chemigation

Delivered in ~ 400 gpa ($3,740$ L water ha⁻¹)



Boom Sprayer

Delivered in $\sim 20\text{-}30$ gpa ($187 - 280$ L water ha⁻¹)



Can we increase crop safety by washing soil-active herbicides off foliage and into soil?

Boom + Wash-off



- Most soil-active herbicides call for “sufficient” rainfall or irrigation with 2 weeks of application for incorporation/activation
- Wash-offs used in other crops like strawberry with some herbicides

Study Design

2 Sites – MA and NJ, 4 reps/site

Chemical B 2019, 2020

Chemical A 2021

● Early

- Chemigation
- Boom
- Boom fb wash-off (~ 1 hr irrigation, 0.1" water)

spring dormant, tight buds



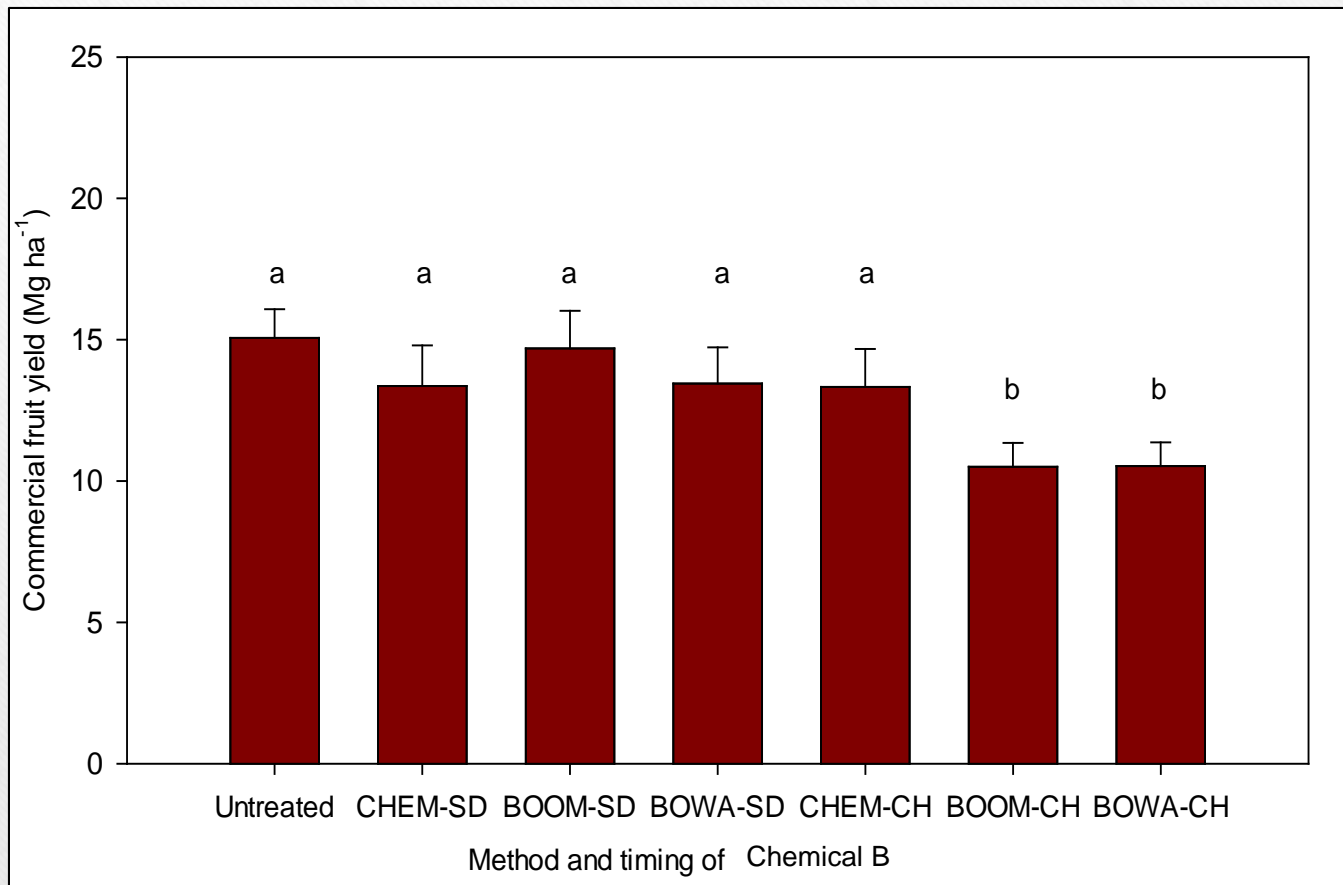
● Late

- Chemigation
- Boom
- Boom fb wash-off

cabbage head, buds swelling



Timing and application method are important factors for crop safety

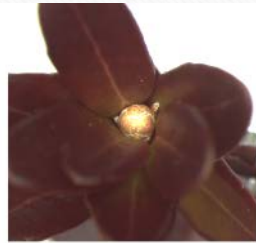


Special Local Needs Label (24c) Massachusetts and New Jersey

- Active Ingredient: a PPO inhibitor Group 14
- For control of moss and other susceptible weeds
- FMC released from any liability from damage that might occur with applications of the herbicide
- **NO FULL LABEL YET!**



Howes
Spring Dormant 18°F



Howes
White Bud Stage 20°F



Howes
Bud Swell Stage 22°F



Howes
Cabbage Head Stage 25°F

- Apply prior to cranberry breaking dormancy
 - Apply **before** cabbage head
- Potential for injury if not applied at the correct time (uprights stunted, new foliage injured)

Moss injury will develop over time – not fast acting!

- ▶ Some effects on moss apparent within a month of treatment, but full effects take months to develop
- ▶ Worked faster on sphagnum than haircap moss
- ▶ Treated haircap moss did not make reproductive structures

Untreated Moss in June

Haircap moss - lush and making spores

(State Bog 6/25/20)



Treated Moss in June

(State Bog Moss Treated 4/15/20)

May / 1 Month after Trt

June / 2.5 Months after Trt



Control lasts for whole season

Moss on State Bog 8 months after treatment

Treated 4/15/20, photos 12/13/20

Treated w/ 12 oz/A in April



Untreated





Questions?