WEED SCIENCE

RESEARCH

INVESTIGATOR(S): A. Ayers and L. Calderwood
7. TITLE: Wild Blueberry Weed Survey

OBJECTIVE(S)

- Determine current weed composition in wild blueberry fields
- Analyze trends in weed cover by location, management practices, and soil pH

LOCATION(S): Twenty wild blueberry fields located in Cumberland, Knox, Lincoln, Waldo, Hancock, and Washington counties ME.
PROJECT TIMEFRAME: 2019- 2020

INTRODUCTION

Weeds are considered one of the most challenging pests for wild blueberry farmers to manage. Weeds can reduce wild blueberry yield up to 4,000 lbs/acre by competing with wild blueberry for sunlight, nutrients, and water (NBDAAF, 2017 and Yarborough, 2012).

Weed management is critical to the success of wild blueberry farms not only to reduce competition but also to reduce the presence of pest insects and diseases. Fields with poor weed management have more moisture trapped in the crop canopy, increasing the risk for diseases such as *Monilinia vaccinii-corymbosi* (mummy berry) (Drummond et al. 2012). While many impacts that weeds have in wild blueberry fields are negative, they do play a role in the wild blueberry ecosystem. Weed species can serve as habitat for native and managed bees in addition to natural enemies of known pests (Kremen and Miles, 2012; Drummond et al. 2017).

The most recent weed survey of wild blueberry fields in Maine was in 1980. The survey was incorporated into a study looking at the effects that the herbicide hexazinone had on weed populations within wild blueberry fields scattered across the state. The survey found several genera that occurred in every field of the 14 surveyed. This included plants such as goldenrod (*Solidago sp.*), wintergreen (*Gaultheria procumbens)* and willow (*Salix sp.)* (Yarborough and Bhowmik, 1984). While that survey was informative at the time, current conditions have changed significantly. The further expansion of invasive species, changing climate, and updates in farm technology such as mechanized farm equipment are all factors that have altered the weed community over time. According to Dr. Calderwood's 2019 Wild Blueberry Conference survey, 25 of 61 respondents (40%) stated that they would like to learn more about how to manage weeds. It is important to conduct weed surveys regularly to identify the species that have the most impact by measuring each species frequency, area covered, and growth habit.

METHODS

A total of 20 fields will be surveyed over the course of the 2019 and 2020 seasons. Ten of the 20 fields were surveyed in the summer of 2019. Fields were selected to represent

multiple geographic regions and a range of management practices. Within each of the four geographic regions (Mid-coast, Ellsworth, Downeast, Way Downeast), at least one organic field and one conventional field will be surveyed. Fields in 2019 were surveyed during the prune year because the majority of weed management takes place in the prune year and we were able to avoid damaging the blueberry crop. Each field was surveyed twice: once in early summer (June - early July) and again in late summer (August - early September) in order to capture as many weeds as possible across the growing season.

Rank	Percent Range	Coverage Midpoint
1	0-5%	2.5%
2	5-25%	15.0%
3	25-50%	37.5%
4	50-75%	62.5%
5	75-95%	85.0%
6	95-100%	97.5%

Table 1. The Daubenmire Cover Scale for evaluating weed cover in fields, est. by Rexford Daubenmire in 1959.

Data Collection

On each farm, one study block was set up. Each block was up to 165 m^2 (~0.04 acres) in area and set in the middle of the field (up to 15.5 meters away from the field edge). Block placement was based upon ease of access and the ability to accommodate the size of the block with as little manipulation to the length and width as possible. This size was selected because while many fields are much larger than 165 m^2, several are smaller, and this size was able to fit on all study fields. The corners of blocks were marked using a GPS unit. Within each block, four transects were placed in the field in an inverted W pattern. Because the size of the blocks were malleable, the transect lengths from varied between each block. Five 1 m^2 quadrats were placed at even intervals along each transect.

Weeds enter wild blueberry fields primarily from edge habitats and equipment entering the field. In order to further understand the weed species, overlap between the edge and field center, an additional three quadrats were placed randomly on the field edges outside of the main block. Within all quadrats, the percent cover of broadleaf weeds, grasses, sedges, rushes and wild blueberries were taken using the Daubenmire Cover Scale (Table 1) (Daubenmire, 1959). All weed species within each quadrat were identified to genus level (at minimum) and given a Daubenmire Cover Scale rating.

Data Analysis

Each Daubenmire Cover Scale rating was converted to the midpoint percentage that each range covers. For example, a Daubenmire rating of 1 would be converted to 3%; the midpoint between 1-5%. These percentages were then converted to area in terms of m^2. These areas were summed to rank weed genera/species by area for each survey period (early and late summer weeds) and management practice (conventional and organic).

Three comparisons between organic and conventional fields were made for each survey period: wild blueberry cover, broadleaf weed cover and grass cover. Bartlett's test was used to measure if variance was equal between the observations of the two management styles. When variances were equal, averages were compared in a pooled T-test at the 0.05 level of significance. When they were unequal, averages were compared in a standard T-test at the 0.05 level of significance.

RESULTS

Weed Cover

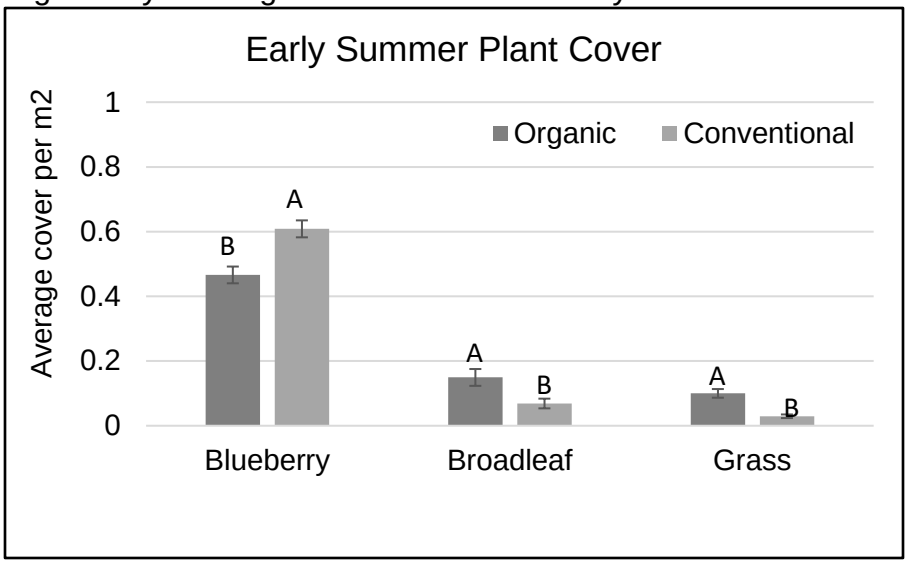
The first year of this survey found that red sorrel (*Rumex acetosella*) covered the most area in conventional fields regardless of seasonality. In organic fields, braken fern (*Pteridium aquilinum*) was found to have the second highest and the highest area during the early summer and late summer respectively. Both organic and conventional fields had a high overall surface area of Canadian mayflower (*Maianthenum canadense*) in the early summer, and a high amount of gray birch (*Betula pendulum*) in the late summer.

Table 2. Top five weed species that covered the largest area in the 2019 survey by season and management style

Early Summer (Early June-Late July)		**Late Summer (Mid-Late August)**	
Organic	**Conventional**	**Organic**	**Conventional**
Bunchberry *(Cornus canadensis)*	Red sorrel *(Rumex acetosella)*	Braken fern *(Pteridium aquilinum)*	Red sorrel *(Rumex acetosella)*
Braken fern *(Pteridium aquilinum)*	Whorled loosestrife *(Lysimachia quadrifolia)*	Sheep laurel *(Kalmia angustifolia)*	Gray birch *(Betula pendulum)*
Oatgrass *(Danthonia spicata)*	Hawkweed *(Hieracium spp.)*	Bunchberry *(Cornus canadensis)*	Goldenrod *(Solidago spp.)*
Chokecherry *(Prunus virginiana)*	Canadian mayflower *(Maianthemum canadense)*	Gray birch *(Betula pendulum)*	Rabbitfoot clover *(Trifolium arvense)*
Canadian mayflower *(Maianthemum canadense)*	Goldenrod *(Solidago spp.)*	Brambles *(Rubus spp.)*	Black Eyed Susan *(Rudbeckia hirta)*

Management Style Differences

Blueberry cover was found to be significantly higher in conventional fields in both early and late summer. Broadleaves and grasses were also found to be significantly higher in organically managed fields in both early and late summer. In both organic and



conventional fields, average wild blueberry cover increased from the early summer survey period to the late summer survey period as expected. Average wild blueberry cover per m^2 increased by 0.145 m^2 in organically managed fields and by 0.176 m^2 in conventional fields.

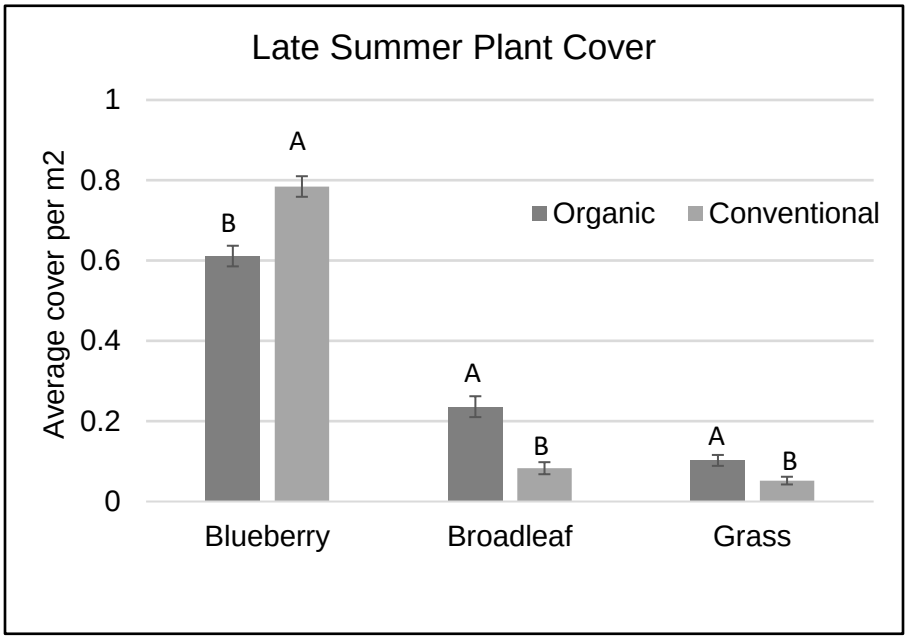
Figure 1. Average wild blueberry and weed cover in fields during early summer. Significant differences are identified with different letters and at the 0.05 level of significance. Cover was measured per m^2.

Figure 2. The average cover of wild blueberry and weeds in fields during the late summer. Significant differences identified with different letters. Cover was measured per m^2.

DISCUSSION

Red sorrel was the most prevalent weed by area in the conventional fields while braken fern was that most prevalent by area in organic fields. Many studies have been done to determine the efficacy of hexazinone, the most commonly used conventional herbicide, on red sorrel with inconsistent results. There is evidence that some populations of red sorrel can tolerate hexazinone. Red sorrel is also an aggressive weed that can reproduce locally through rhizomes (Stopps et al, 2011). These may be some of the reasons for its abundance in conventional fields.

Braken fern is a rhizomatic perennial with wide fronds that shade wild blueberry. It is easily controlled by spot sprays of asulam (Asulox) during the prune year (D'Appollonio and Yarborough, 2019). However, asulam is prohibited for use in certified organic fields



(MOFGA, 2019). The lack of herbicide options in addition to the large surface area of braken fern fronds likely make this the weed that covers the most area in organic fields.

As expected, the first year of this weed survey indicated that organic fields had a higher area covered by weed species when compared to conventional fields. Organic certification limits the use of certain herbicides and fertilizers. Because of this, organic growers rely on alternative methods of weed control such as hand weeding, weed

whacking, and sulfur application. These methods can be labor intensive and therefore expensive. Additionally, using multiple mechanical and cultural methods to manage weeds continuously through the season is more difficult than applying conventional herbicide one or two times per season. Organic fields that are meticulously weeded appear to be equally as “clean” as conventionally managed fields. Moving forward, the first year of this survey indicated that red sorrel, bracken fern, and bunchberry are currently the top weeds of concern in Maine wild blueberry fields.

CURRENT RECOMMENDATIONS

None at this time.

NEXT STEPS

- Look for a correlation between soil pH or location and weed cover.
- Survey ten more fields during the 2020 field season.
- Collect GPS waypoints at each sample quadrat for long-term data collection.
- Compare this survey with the 1980 weed survey by Yarborough and Bhowmik.

ACKNOWLEDGEMENTS

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