AGRICULTURAL RESEARCH FOUNDATION
INTERIM REPORT
FUNDING CYCLE 2016 – 2018

TITLE: Mulching practices to improve plant growth, water savings, and soil organic matter content during establishment of highbush blueberry

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SUMMARY:

Since 2011, greater than 80% of the new blueberry acreage in Oregon has been established using weed mat—a porous, black polyethylene ground cover placed in the blueberry row—rather than the traditional Douglas fir sawdust mulch. Positive findings from our 9-year study in organic blueberry, in which the use of black-colored weed mat resulted in about the same yield and fruit quality as sawdust mulch, influenced this trend, because the weed mat was much more economical for weed control. Our research also revealed that weed mat, as an alternative to conventional sawdust mulch, increased irrigation requirements by as much as 50%. This is primarily due to increased soil temperature and reduced soil organic matter content compared to sawdust mulch, which is a disadvantage in blueberry production systems. We also observed in an un-replicated trial that blueberries grew particularly well when the plants were mulched with a combination of sawdust mulch covered with weed mat. We suspect that adding sawdust under the weed mat helps to mitigate fluctuations in soil temperature, but of course, it also requires additional materials and labor costs.

In addition to potential benefits to plant growth and yield, preliminary research has shown that populations of Spotted Wing Drosophila (SWD) are reduced when black weed mat is used as mulch compared to sawdust (Tochen et al 2014, 2015). This could be due to warmer temperatures in the plant canopy (SWD reproduces more slowly in hotter and drier conditions). Little information is available on the impact of the color of weed mat on canopy microclimate. We had originally planned on testing white weed mat, which does not increase soil temperature as much as black, but had issues in past trials with excessive weed growth underneath the white weed mat due to increased light infiltration. Green weed mat color has not yet been tested for effects on growth, yield, and fruit quality in blueberry, but has been shown to maintain lower soil temperatures than black, while preventing most weed growth underneath (Machado and Bryla, unpublished). For this reason, we decided to use green weed mat for this trial.

Our goal in the proposed study is to compare black and green weed mat, with or without addition of sawdust mulch underneath, to using sawdust mulch alone, during the establishment of a new blueberry planting to determine whether the combination of sawdust and weed mat is economical or otherwise adequately beneficial to warrant the additional expense. Early blueberry growth, root

distribution, soil water content, and soil temperate as affected by mulch treatments will be evaluated. Once established, the planting can be used over the long-term to further investigate the effects of these mulches on yield and fertigation efficiency. These cultural practices will also allow studies on whole-system SWD management.

OBJECTIVES:

- Evaluate the impacts of using black- or green-colored weed mat, each with or without the addition of sawdust mulch underneath, on shoot and root development in blueberry
- Assess the impact of mulch type on soil temperature and crop water use over the growing season
- Use soil cores during development and destructive sub-sampling of a plant in each treatment at the end of the study to assess the vertical distribution of blueberry roots within the planting bed

PROCEDURES:

This study is being conducted at the NWREC with five treatments: Douglas fir sawdust mulch (3" deep layer on the surface of the raised bed in-the-row, replenished over the study as needed); black weed mat placed on the soil surface in the row; green weed mat placed on the soil surface in the row; and both weed mat treatments placed over a sawdust mulch layer of approximately 2 inches in depth. The green and black weed mat products were chosen such that they are similar in quality (thickness, density, permeability). Each treatment plot has nine plants, with 10 ft of un-planted space between plots to allow for clearing of the machine harvester (for future harvesting when the planting is in fruit production). The planting was designed such that all five treatments are in each of five rows (randomized complete block design with five replicates). Each treatment row has three border plants at each end, and the planting is flanked by a guard row on each side (to avoid edge effects). Plants will be pruned and fertilized (fertigated) following standard commercial practices. Pest and weed management will be done, as required, using IPM protocols.

The field was fallow throughout the growing season of 2016. No added nutrient amendments were necessary (according to a soil sample) prior to planting. The soil was ripped using a single shank in North-South rows parallel to the planting rows as well as diagonally to a depth of 18" then a Tortella power spade was used to break up the soil to a depth of 14". It was rototilled to a depth of 6-8" and ripped in the planting row prior to incorporation of Douglas fir sawdust (20 units/acre). Raised beds with final dimensions of 4 ft wide at the base, 22 in wide at the top, and 11 in high, were formed in September. Typical 18-month-old blueberry nursery stock was planted on October 4, 2016 with an in-row spacing of 3 ft and a between row spacing of 10 ft. Drip irrigation (two lines/row and 1 gallon/hr emitters) was installed. Weed mat treatments will be applied in Winter 2017 when the materials become available. A between row grass cover crop will be established in Spring 2017 and a trellis installed in summer.

Each treatment will be irrigated independently to identify any differences in plant water use. Time-domain reflectometry (TDR) probes will be used to monitor changes in soil water content at depths of 6, 12, and 18 inches (using existing equipment), and irrigation will be adjusted, as needed, to maintain a similar soil water content in each treatment (~25% based on our previous research). The

amount of irrigation water applied per treatment will be recorded using water meters. Thermocouples and data loggers will be used to monitor soil temperature at various depths and locations within the treatment plots (we already have this equipment in our program).

Non-destructive measurements of canopy growth will be done using digital imaging. Soil cores will be collected to evaluate the distribution of the roots in the beds in the first and second year of the study. The roots will be washed from the cores (2-cm depth increments) and measured for length using a scanner and root imaging software. At the end of the second year, one plant per plot will be carefully removed. In this case, the root system of each plant will be excavated in 5-cm increments to document the rooting profile in each treatment. Each plant part, including the roots at each depth increment, crown, one-year-old wood, and older wood, will be dried and weighed, and the total root to shoot ratio will be calculated.

Soil and plant tissue samples will be collected in the second year to assess soil properties (organic matter and pH) and soil and plant nutrient levels. Treatment effects on soil and plant nutrients, soil temperature, root location (cores), rooting depth (from digging and cores) and plant growth and allocation (amongst plant parts) will be analyzed and evaluated. Results will be shared with industry via meetings and field days.

SIGNIFICANT ACCOMPLISHMENTS TO DATE:

The field was planted and a specialized irrigation system installed successfully in 2016 in preparation for the first year of data collection in 2017.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM: None

FUTURE FUNDING POSSIBILITIES:

Proposals will be submitted to grower organizations and federal funding agencies to determine the longer-term effects of these mulches on plant growth and the impact of these mulches on SWD management.

REFERENCES CITED:

Tochen, S., D. T. Dalton, N. G. Wiman, C. Hamm, P. W. Shearer, and V. M. Walton. 2014. Temperature-related development and population parameters for *Drosophila suzukii* (Diptera: Drosophilidae) on cherry and blueberry. Environ. Entomol. DOI: http://dx.doi.org/10.1603/EN13200.

Tochen, S., J. M. Woltz, D. T. Dalton, J. Lee, N. G. Wiman, and V. M. Walton. 2015. Humidity affects populations of *Drosophila suzukii* (Diptera: Drosophilidae) in blueberry. Journal of Applied Entomology doi: 10.1111/jen.12247.