

Welcome to the webinar!

- The webinar will start at the top of the hour.
- If you'd like to type in a question, use the question box on your control panel and we will read the questions aloud after the c. 45 minute presentation
- The webinar is being recorded and you can find it in our archive at <http://www.extension.org/pages/70279>



Organic Blackberry Production: Tips Learned from an Ongoing Research Study

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March 13, 2014





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David Bryla



Luis Valenzuela



Organic Blackberry Production – Tips Learned From an Ongoing Research Study

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2010-01940; ORE00409); NCSFR





Graduate Students Working on the Project Department of Horticulture, Oregon State University

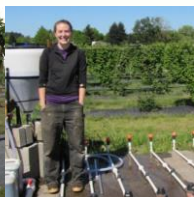
Renee Harkins, Masters of Science, 2011-2013 (completed)
Javier Fernandez-Salvador, Masters of Science, 2011-2014
Emily Dixon, Masters of Science, 2012-2015



Renee Harkins



Javier Fernandez-Salvador



Emily Dixon

Topics to be covered

- Project outline
- Planting establishment
- Trailing blackberry growth & management
- Cultivar & weed management effects
- Impacts on soil & plant nutrition
- Drip irrigation & fertigation
- Impacts on soil moisture & root growth
- Summary of successes & some challenges



Objectives

1. Impact of weed management on plant growth, weed pressure, yield & ...
2. Nutrient accumulation and losses



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Objectives

3. Effect of post harvest irrigation & ...
4. Impact of training time (August or February) on plant growth and yield



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Study site

OSU's North Willamette Research and Extension Center, Aurora, OR

Treatments

Cultivar

- 'Black Diamond'
- 'Marion'

Weed management

- 'Non-weeded'
- 'Hand weed'
- 'Weed mat'

Irrigation

- With or without post-harvest irrigation

Training time

- August
- February

Certified Organic, 2012



- 1 acre planting
- TC planted May 2010 (5' x 10')
- A cereal rye/common vetch cover crop between rows
- Single lateral drip tube either suspended on trellis or under weed mat (landscape fabric)

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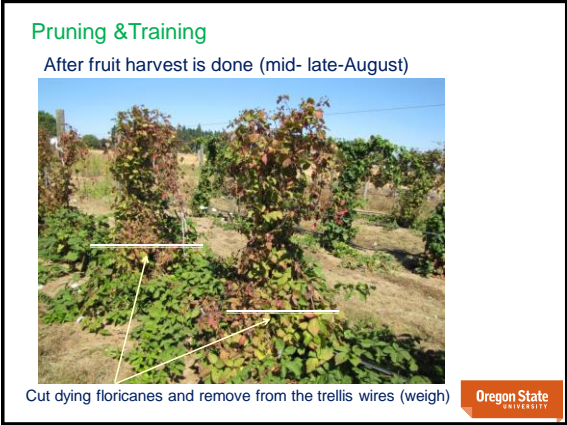














Training time

August trained



OR

Before training in Feb.



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After August Training, 2013



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Fertilizers Applied

Fertilizer	Macronutrients (lb/acre)					Micronutrients (oz/acre)				
	N	P	K	Ca	Mg	Na	B	Cu	Mn	Zn
2010										
Nutra-Rich	23	14	16	71	4	3	0	1	3	4
Fish-Agria	25	6	6	5	1	N/A	0	1	0	0
2011 and 2012										
Tue 402	47	6	55	1	1	23	0	0	0	1
2013										
Converted Organics 4-2-1	27	13	16	1	3	<1	0	0	0	1
Total Organics 5-1-2	37	8	11	<1	3	28	0	0	0	1

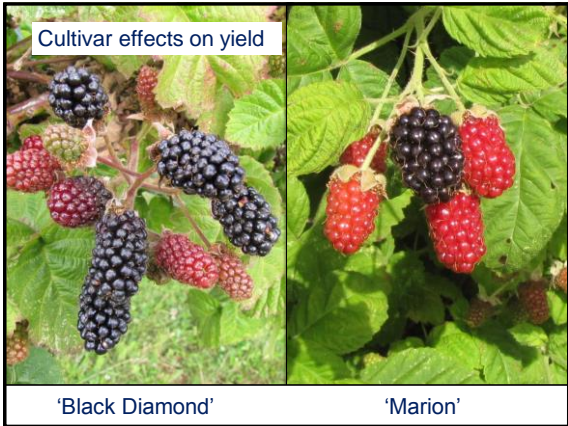


Emily Dixon



- 2 lb/a boron in 2013 and 2014 (Solubor)
- 500 lb/a dolomite lime (Pro-Pell-It) in 2013
- 1 ton/a fine lime (Pro-Pell-It) in 2013

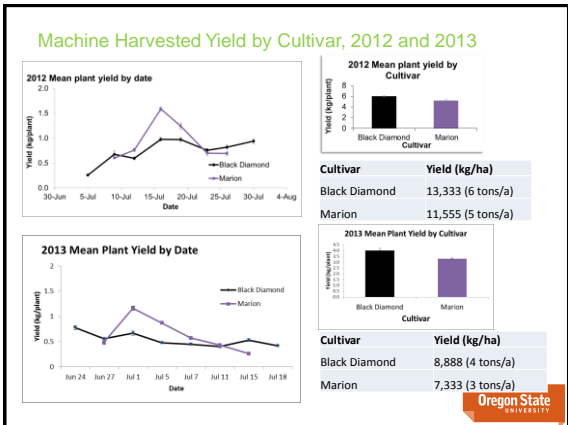
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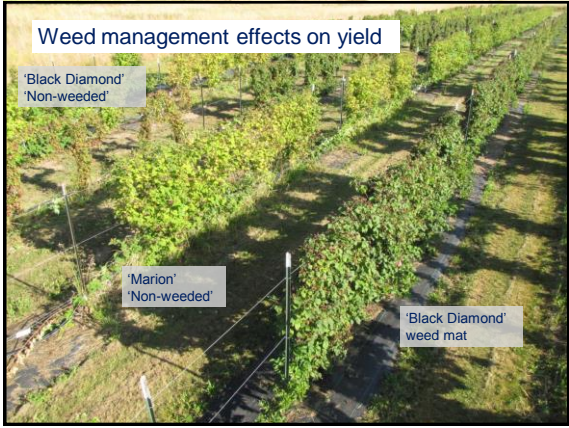
Cultivar effects on yield

'Black Diamond'

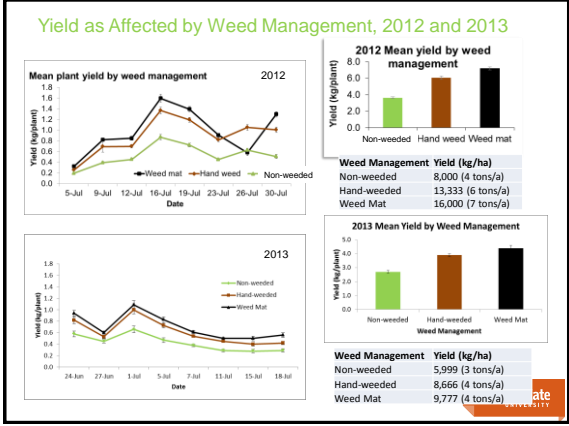
'Marion'



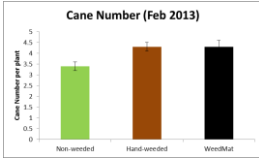




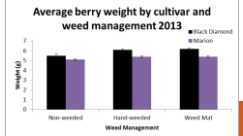
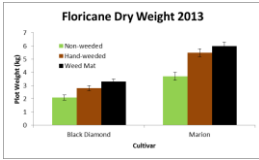




Floricanes, 2013



- Weeds in 2012 reduced primocane number in 2012/floricane number in 2013
- Floricane weight (at pruning in August) was reduced in non-weeded plots and was greater in weed mat than in hand-weeded
- Berry weight was reduced in non-weeded plots



Weeds do compete in blackberry

Commercial trailing blackberry field



Commercial, organic, 'Chester Thornless semi-erect blackberry field









Economics



Costs of the three weed management strategies during establishment (3 years) (\$/acre)

Weed management strategy	Materials and install	Hand weeding			Total costs	Gross returns (fruit sales/acre)	Net income (\$/acre)
		year 1	year 2	year 3			
Non-weeded	0	12	0	0	12	6831	6819
Hand weeded	0	55	281	546	832	11844	11052
Weed mat (amortized for 5-year life)	944	6	6	6	962	13661	12699

Weed mat materials cost was amortized over 5 years with 3 of 5 years included here
 Non-weeded plots were only hand-weeded in the establishment year around the plants
 Labor valued at \$15/hour (including all costs)
 Fruit for processing valued at \$0.95/lb

Note: this is gross income minus weed management costs = net income NOT including other management costs (assumed to be equivalent among treatments for other cultural practices)

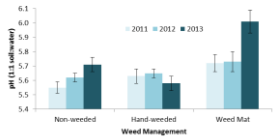
Adapted from: Harkins et al., 2014



Soil Nutrients

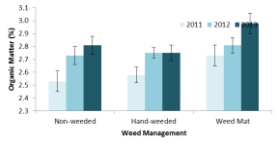


Soil pH (Oct-Nov. sample)



- Soil pH was significantly higher in weed mat plots in 2013
- Soil organic matter has increased over time; this may reflect core sampling including fine blackberry or weed (in non-weeded) roots

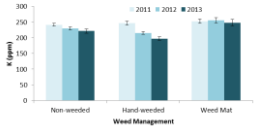
Soil Organic Matter (Oct-Nov. sample)



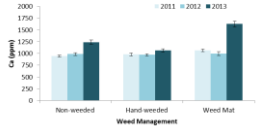
Soil Nutrients



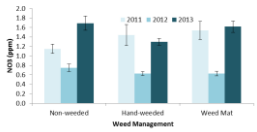
Soil Potassium (Oct. - Nov. sample)



Soil Calcium (Oct. - Nov. sample)



Soil Nitrate (Oct. - Nov. sample)



- Soil K has been greater under weed mat and has declined over the 3 years of the study
- Soil Ca was greater under weed mat in 2013 and levels increased after lime application (2012-13)
- Soil nitrate was less in 2012 than in 2011 & 2013, but was low each year in general

Irrigation Management

- Why is irrigation important?
- What is the best method to apply irrigation?
- Where, when, and how much?

Photo from <http://www.stahlbush.com>

Irrigation System Design & Layout

Drip system

- One line/row
- 2 ft. emitter spacing (adjust for soil type)
- 0.5 gph emitters (self-cleaning, pressure-compensating)

Hand-weeded
or
Non-weeded
(hanging drip)

Weed mat
(surface drip)

In-line emitter



Establishment

Irrigate young plants in short, frequent pulses (15-30 min x 4 times/day)

Weed mat
(water permeable)



Fertilizer

Application of fertilizer

- By hand (year 1)
- Fertigation (years 2+)



Fish emulsion + fish hydrolysate



Flush drip lines



10% plugging per year



Mix tank

Water-driven injector (no electricity)



Electric dosing pump

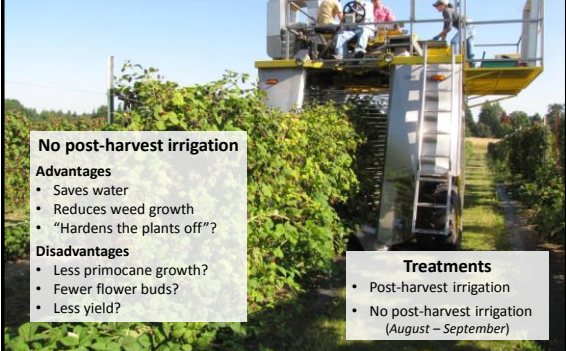
Irrigation of Established Plantings

<p>Bud break/flowering (May – early June)</p> <ul style="list-style-type: none"> • 3-6 in. rain • 50/70 °F • 2-6 gal/plant (daily) • Irrigate as needed 	<p>Fruit ripening (June – early July)</p> <ul style="list-style-type: none"> • 1-1.5 in. rain • 60/78 °F • 6-8 gal/plant (daily) • Irrigate 3-4 days/wk
<p>Harvest (early July – early Aug.)</p> <ul style="list-style-type: none"> • No rain • 70/85 °F • 6-9 gal/plant (daily) • Irrigate daily 	<p>Post-harvest (Aug. – Sept.)</p> <ul style="list-style-type: none"> • <1 in. rain • 70/85 °F • 4-8 gal/plant (daily) • Irrigate 3-4 days/wk

Weed mat increases plant water use

- Larger plant canopy
- Warmer air temperature
- 10-20% more irrigation than hand-weeded plots

Do we need to irrigate after harvest?



No post-harvest irrigation

Advantages

- Saves water
- Reduces weed growth
- "Hardens the plants off"?

Disadvantages

- Less primocane growth?
- Fewer flower buds?
- Less yield?

Treatments

- Post-harvest irrigation
- No post-harvest irrigation (August – September)

Post-Harvest Irrigation

Florican traits:

Irrigation treatment	Avg. length (ft.)	No. of nodes	Bud break (%)	Flowers per lateral
Post-harvest	18	99	58	9
No post-harvest	16	82	62	9
Significant	No	Yes	Yes	No

Fruit production:

Irrigation treatment	Total yield (ton/acre)	Berry wt (g)	Brix
Post-harvest	3.6	5.5	11.6
No post-harvest	3.6	5.6	11.8
Significant	No	No	No

How much water did we save?



67,000 gallons/acre!

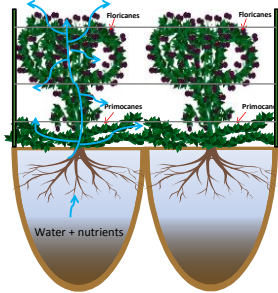
Can we do it every year?

Root development and water uptake



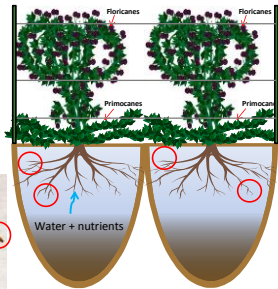
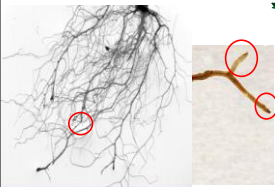
Plant water uptake

Plant water use starts belowground



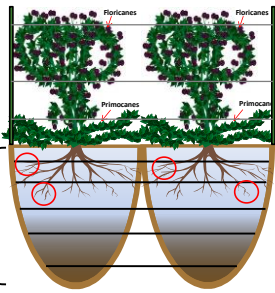
Plant water uptake

Water and nutrient uptake occurs predominantly by the fine roots

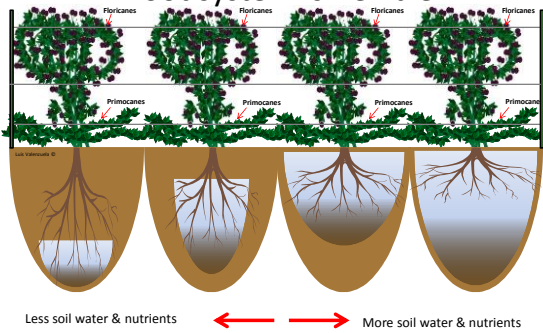


Plant water uptake

The location of fine roots in the soil is important for understanding plant water uptake



Root system is flexible



Effects of irrigation & weed management on soil moisture



Effects of irrigation & weed management on soil moisture



Effects of irrigation & weed management on root distribution

Root observation tubes (weed mat & hand-weeded)

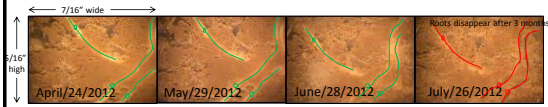


Effects of irrigation & weed management on root distribution

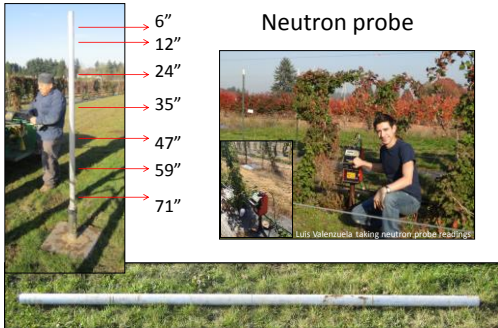


Effects of irrigation & weed management on root distribution

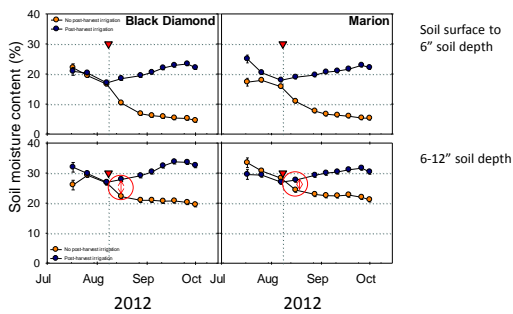
Total number of root images collected from the tubes in 2010-2013: 181,760!



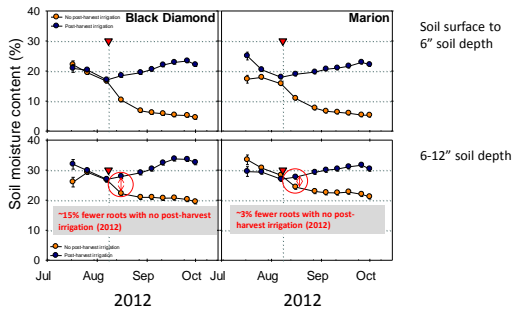
Effects of irrigation & weed management on soil water availability



Soil water availability within soil profile and root presence



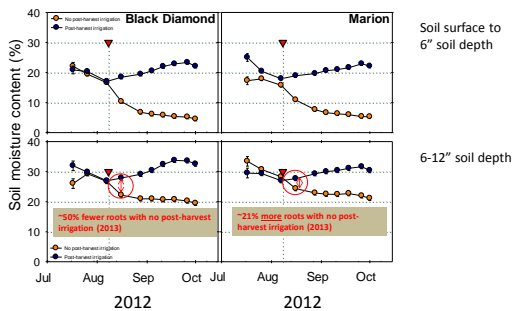
Soil water availability within soil profile and root presence



Soil surface to 6" soil depth

6-12" soil depth

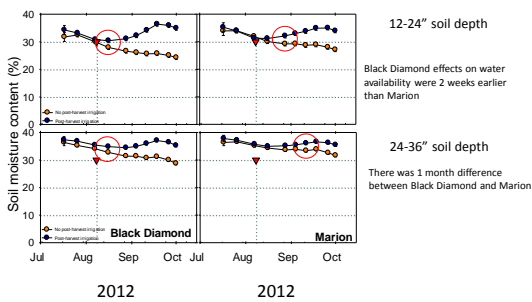
Soil water availability within soil profile and root presence



Soil surface to 6" soil depth

6-12" soil depth

Soil moisture availability within soil profile and root presence



12-24" soil depth

Black Diamond effects on water availability were 2 weeks earlier than Marion

24-36" soil depth

There was 1 month difference between Black Diamond and Marion

Summary

- Black Diamond appears to be using water faster than Marion
- Large differences in soil water uptake occurred at 12-36"
- No big differences at 36-48" (both cultivars are using water at the same locations in the soil?)
- Shutting off irrigation after harvest reduced roots in Black Diamond
- Marion seems more adapted to dry soil conditions
- How does this impact irrigation?



Keys to Successful Irrigation of Organic Blackberries

- **Use drip irrigation**
 - One line/row
 - Use self-cleaning, pressure-compensating emitters
 - Establish the planting with drip (not sprinklers)
 - Increase irrigation during fruit ripening
 - Add extra water with weed mat (10-20%)
- **Inject organic fertilizers through the drip system**
 - Use an electric dosing pump
 - Flush out the lines at least once a year
- **Irrigate after harvest???**

Challenges






- Insect management may be more difficult

Raspberry Crown Borer

Pennisetia marginata

Plots with larvae found or with recognizable damage were counted during August training

Plots with Raspberry Crown Borer

2013

Plot	Plots with Raspberry Crown Borer
Black Diamond	31.4
Marion	1.4
Combleed	16.4

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Spotted Wing Drosophila

Drosophila suzukii

Actual size 2-3 mm






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From OSU Extension Publication, EM8991

Spotted Wing Drosophila





Courtesy, WSU

Summary & Future Directions



- Weeds compete with establishing and mature blackberries reducing growth and yield
- Weed mat has been a cost-effective strategy with yield greater than hand-weeded during establishment
- We are learning more about treatment effects on nutrient removal and how this may be used to develop nutrient management programs
- While yields have been similar to conventional systems and use of weed mat looks promising, we need to look at the long-term effect of weed mat on soil properties and nutrient management

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Quick Poll Questions



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Questions?

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- Find the recording of this webinar at <http://www.extension.org/pages/70279>
- Have an organic farming question? Use the eXtension Ask an Expert service at <https://ask.extension.org/groups/1668/ask>
- We need your feedback! Please respond to an email survey about this webinar which you'll receive later.
- Thank you for coming!