Annual Report 2009: Organic Wine Grapes

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TITLE: Weed Management in a Newly Established Organic Wine Grape Vineyard

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OBJECTIVES

1. Conduct a trial of organic and sustainable methods for weed management in a newly established wine grape vineyard that is in transition to organic certification.
2. Establish a 3 acre replicated organic wine grape block for future research in organic wine grape production.

SUMMARY

Weed management in new wine grape vineyards was identified by local growers and wine makers in a 2007 meeting at WSU Mount Vernon NWREC as the primary constraint to organic production in the region. This project investigates weed management options in two wine grape cultivars 'Pinot Noir Precoce' and 'Madeleine Angevine' grafted on Couderc 3309 rootstock. The experiment was established at WSU Mount Vernon NWREC in a 3-acre newly established transition to organic vineyard and includes 5 weed control treatments: standard control of rototilling and mowing, the Wonder Weeder (a mechanized apparatus), and three grain/legume cover crop treatments. Cultivars and weed control treatments were selected by the local growers and wine makers. While comparable cover crop research studies have been conducted elsewhere in the U.S. and the world, climate and soil variations preclude directly transferring these results to western Washington.

The experimental vineyard was established in June 2009. Preliminary results indicate vine length was reduced when grapevines were grown with cover crops as compared to hand-weeding (standard and Wonder Weeder plots), and winter wheat reduced vine length more than other cover crop treatments. Vine length reduction by cover crop treatments as compared to hand weeding was greater in August than in July. Total between-row plant biomass was greater in cover crop plots than in standard or Wonder Weeder plots at both evaluation dates. Total in-row plant biomass did not differ among treatments in August but in September winter pea and wheat/pea plots had greater total plant biomass than the standard treatment. Between-row weed biomass was greater in cover crop treatments than in standard or Wonder Weeder plots in August. In September, winter pea contained the greatest amount of weed biomass between rows,

followed by plots treated with the Wonder Weeder. Weeding time was significantly less in cover crop treatments than in the standard or Wonder Weeder plots.

METHODS

The field experiment was established at Washington State University Mount Vernon Northwestern Washington Research & Extension Center (WSU Mount Vernon NWREC) and is arranged in a split-plot randomized complete block design with three replications. The main plots are two wine grape cultivars, Madeleine Angevine (white, MA) and Pinot Noir Precoce (red, PNP). Both cultivars are of commercial significance in the area and were selected with input from a local wine grape growers' advisory committee. The sub plots are weed control treatments and include:

1.) Standard/current control practices for organic vineyard management – cultivating in alleys and under vines in early April, till and rotovate under vines in mid April, harrow if needed for quackgrass control; periodic tilling between rows as needed; hill in late June or early July; till and hill again if weedy in late August.
2.) Standard control treatment but using the "Wonder Weeder," a tool beginning to be used in organic orchards in eastern Washington, for under-vine cultivation, with red fescue/Companion grass seeded at 10 lbs/A mid-July and again mid-August.
3.) Winter wheat seeded at 300 lbs/A mid-June with mowing in alleys and weed eating under vines early July, early August, and late September each year.
4.) Winter peas seeded at 300 lbs/A mid-June with mowing in alleys and weed eating under vines early July, early August, and late September each year.
5.) Winter wheat seeded at 200 lbs/A mid-June plus Winter peas seeded at 100 lbs/A to equal 300 lbs/A cover crop total with mowing in alleys and weed eating under vines early July and early August, and late September each year.

Sub plots each contain four MA or five PNP rows with 14 plants per row. Sub plot size was calculated to provide sufficient grapes to produce 5 gallons of wine, the minimum quantity needed for future wine research (Objective 2). Four border plants separate each treatment. Total number of plants is 1,946: 840 MA (300 data plants and 540 border plants), and 1,106 PNP (656 data plants and 450 border plants), see Figure 1.

In the center of each sub plot, 5 grapevines were flagged and shoot growth was measured. In each sub plot, vine length was measured for 5 grapevines on July 30 and August 14. Biomass of weeds and cover crops was measured on August 3 and September 27. Non-grape plant material within 0.13-m^2 quadrats was removed from the soil, separated by species, dried, and dry weight was recorded. Quadrats were centered on a row or placed between the rows; four quadrats were used per treatment per cultivar. The first biomass measurement was 3 weeks following initial hand-weeding/string-trimming, while the second biomass was 5 weeks after the second weeding operations.

The following is a summary of field management prior to grape planting. The field site was conventionally managed until October 31, 2007. In spring 2008, a barley cover crop was planted and grain was harvested that fall. Crop stubble was plowed into the field in fall 2008, and a rye cover crop was planted. The rye cover crop was plowed back into the field in spring 2009. Cover crops provided soil organic matter and reduced weed growth. Soil samples were collected and organic soil amendments were applied on May 19 and May 22. After cultivation, the plot was laid out and rows staked for planting. Trenching for installation of the irrigation system was completed by June 1, irrigation lines installed, and the cover crop treatments planted using a

drill. Grape plants of the selected cultivars Pinot Noir Precoce and Madeleine Angevine grafted on Couderc 3309 rootstock were planted the first week of June. The trellis system was installed, and cover crop treatments were planted immediately after (June 30). Transition to organic certification will be complete in Spring 2011.

RESULTS

Vine length for the two cultivars was not significantly different in July, though tended to be greater for MA (42 cm) than PNP (26 cm). In August, mean vine length did differ significantly between varieties, and was 56 cm for MA but only 34 cm for PNP (Table 1). When analyzed by sub-plot treatment, vine length in August was reduced in plots with cover crops as compared to hand-weeded plots (standard and Wonder Weeder plots). Among cover crops, winter wheat suppressed vine growth more than winter pea, with the wheat/pea combination between the two in suppressive ability. There were no significant interactions between treatment and cultivar, indicating that both MA and PNP responded similarly to treatments.

Biomass was significantly different in and between rows, so data were analyzed separately by location in the field (in- or between-row). Biomass did not differ by cultivar, however, so data were pooled across cultivar. Total in-row biomass (weeds plus cover crops) was the same across treatments in August (Table 2). Total between-row biomass was consistently greater in cover crop plots than in standard or Wonder Weeder plots at both evaluation dates, although winter pea plots produced less biomass than winter wheat plots at the September evaluation. In August, in-row weed biomass was similar between cover crops and the standard treatment, however, weed biomass was significantly greater in the Wonder Weeder plots than in cover crop plots. By September, in-row weed biomass was segregating by cover crop, with winter wheat containing only 2.9 g weeds/0.13 m^2 compared to 12.3 g weeds/0.13 m^2 in winter pea.

Weeding operations used during 2009 included two flail mowings between rows for every treatment, disking and/or using the Wonder Weeder between the rows of appropriate plots, and in-row hand-weeding in standard and Wonder Weeder plots. There was no significant difference in weeding times for the two cultivars, and there was no interaction between cultivar and treatment. Season-long weeding times were 8- or 9-fold lower when cover crops were used as compared with standard or Wonder Weeder plots (Table 1). Treatments in cover crops (string-trimming) took approximately 9 min/84-ft row, while cultivation and hand-weeding operations took 79 to 82 min/84-ft row in standard or Wonder Weeder plots.

DISCUSSION

In a meeting with local wine grape growers in 2007, weed management was identified as the primary constraint to organic production, and growers need organically sound and sustainable weed management methods that are well suited to local soil and climate conditions. While comparable cover crop research studies have been conducted elsewhere in the U.S. and the world, climate and soil variations preclude directly transferring these results to western Washington. Results from the first year of organic vineyard establishment indicate cover crops reduce vine vigor in year one, increase weed biomass, and require 8-9 fold less time for weed management than cultivated treatments. In year two we will determine if plant vigor continues to be less and weed biomass continues to be greater in cover crop plots. Future research is needed to determine if reduced vine vigor positively or negatively impacts fruit yield and quality.

The number of wine vineyards in western Washington has grown from 5-10 in 2000 to more than 70 in 2009. This indicates there is a large growth in the number of farmers who seek vineyard

management recommendations for this region. Dissemination of information resulting from this study is already in process, through workshops, field days and web sites (see Presentations below).

ACKNOWLEDGEMENTS

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FUND STATUS

Washington State Wine Advisory Commission	$ 10,000 (2009)
WSU-CSANR Organic Cropping Research	$ 36,737 (2009)
Washington State Center for Pesticide Registration	$ 10,325 (2009)
NARF and Puget Sound Wine Grape Growers	$ 5,000 (2009)

OUTSIDE PRESENTATIONS OF RESEARCH:

Miles, C., T.W. Miller, G.A. Moulton, M. Olmstead, J. Roozen, and T. Thornton. 2009. Weed Management in Establishing an Organic Wine Grape Vineyard. Tilth Producers Quarterly Spring 2009.

Bolton, C., T.W. Miller, J. Roozen, G.A. Moulton, and C. Miles. 2009. Organic wine grape research at WSU Mount Vernon NWREC. Wine Grape Workshop, WSU Mount Vernon NWREC, September 12, 2009.

Miles, C., M. Olmstead, C. Bolton, S. Johnson, G. Sterrett, and J.King 2009. Web page: Organic Viticulture Resources. http://winegrapes.wsu.edu/organic.html

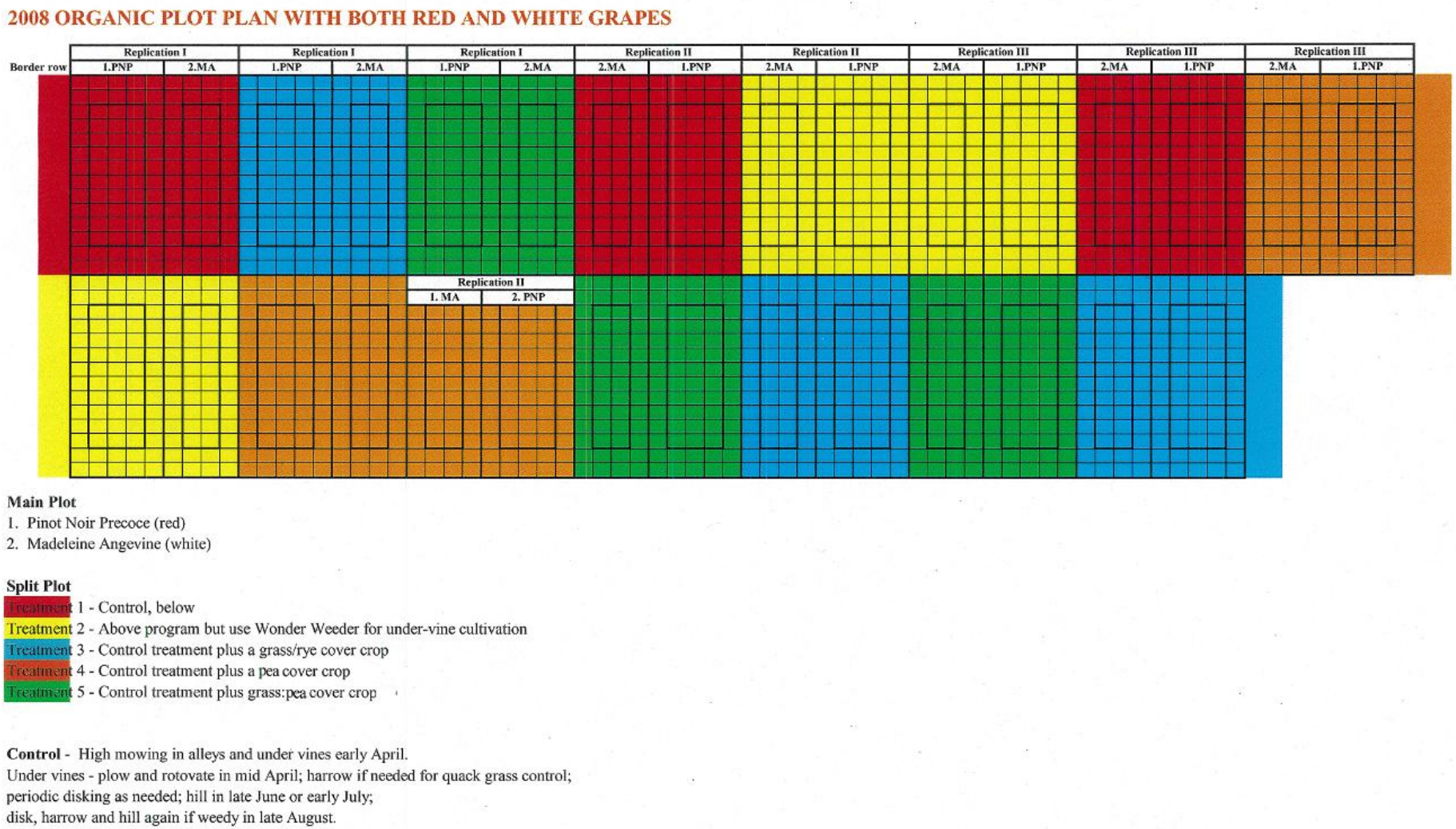

Figure 1. Plot plan for organic wine grape research project established in 2009 at WSU Mount Vernon NWREC.

Table 1. Mean vine length of two grape cultivars under several weed control regimes, and the treatment times required to implement those strategies in a first-year organic vineyard at WSU Mount Vernon NWREC in 2009.

	Vine length (cm)		Weeding time/row
Treatment	**Jul 30**	**Aug 13**	**min/person**
Standard	35.4 ab	52.1 a	79 a
Wonder Weeder	37.9 a	55.8 a	82 a
Winter wheat	29.8 b	34.4 c	9 b
Winter pea	34.4 ab	42.0 b	9 b
2:1 wheat:pea	34.4 ab	39.6 bc	9 b
Cultivar			
'Madeleine Angevine'	42.3	56.0 a	34
'Pinot Noir Precoce'	25.9	33.8 b	41

Means in the same column followed by the same letter are not statistically different (P<0.05).

Table 2. Dry weight of weeds and cover crops at two sample dates in the establishment year of an organic vineyard at WSU Mount Vernon NWREC in 2009.

	Weed biomass g/0.13 m^2		Total biomass g/0.13 m^2	
August 3	**In-row**	**Between-row**	**In-row**	**Between-row**
Standard	26.7 ab	0.1 b	26.9	0.1 b
Wonder Weeder	40.4 a	0.8 b	40.6	0.9 b
Winter wheat	15.3 b	11.6 a	28.1	35.4 a
Winter pea	20.3 b	15.2 a	34.4	39.1 a
2:1 wheat:pea	16.5 b	8.5 a	33.7	37.2 a
September 27				
Standard	6.9 bc	0.4 c	6.9 c	0.4 c
Wonder Weeder	8.8 ab	3.7 b	8.8 abc	3.7 c
Winter wheat	2.9 c	0.3 c	7.8 bc	14.1 a
Winter pea	12.3 a	9.3 a	12.9 a	9.3 b
2:1 wheat:pea	5.5 bc	0.6 c	12.7 ab	13.5 ab

Means in the same column followed by the same letter are not statistically different (P<0.05).