

Final Report to the Northeastern IPM Center

A. Grant Data

Title: Season-Long Use of Horticultural Oil on Vinifera Grapevines
Type: Minigrant
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State(s) involved: New York
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B. Nontechnical Summary

Vinifera grapevines, the predominant winegrape worldwide, are susceptible to various fungal diseases. These diseases are managed through cultural practices as well as with timely fungicides. Failure to minimize impacts from these diseases will result in both yield and quality losses. In an effort to farm in an ecologically sensitive manner, many growers include as many reduced risk (an EPA designation for pesticides that are relatively 'green') and organic fungicides as possible. For example, in Long Island vinifera vineyards, the organic formulation of a horticultural oil is widely used early in the growing season for control of powdery mildew (PM). This fungal disease is a threat to both grapevine fruit and foliage. Growers are reluctant to use horticultural oil season-long however primarily because long-term use has been linked in several studies to a reduction in sugar accumulation at harvest. There is concern that potential impacts will extend to other components of fruit and/or canopy quality. The goal of this work is to ascertain the advantages and disadvantages of season-long use of this oil in terms of its effects on pest management, the grapevine canopy and fruit ripening.

C. Objectives

1. **Evaluate an oil-based schedule for control of fungal diseases and mites.** We tested 5 treatment regimes for season long control of powdery mildew, one conventional and 4 different oil regimes. Oil provided better control of PM than a conventional schedule; downy mildew however was higher in oil plots. European red mite, which oils are known to control, did not appear in this block despite a history of infestations.
2. **Evaluate effects of season long oil on fruit quality at harvest.** Both berry samples and juice samples at harvest revealed that sugar accumulation was hindered by oil treatments but acidity and pH were similar among treatments. Though not a stated goal, we made small lot wines from each treatment regime to gauge potential impacts of oil on fruit flavors and aromas. These wines will be analyzed by the Wine Lab then assessed via sensory analysis in fall 08.

- Determine whether leaf epidermal characters differ between oil-sprayed vs. conventionally sprayed vines and whether leaf epidermal characters differ with respect to spray oil concentration (1% vs. 1.5%).** Oil treated leaves appeared to be slightly more chlorotic and displayed a higher level phytotoxicity compared to conventionally treated leaves. Association with diminished leaf function was not determined. A reduction in the thickness of the leaf cuticle was associated with the use of oil.

D. Approach

This trial was conducted in a block of 14 year old Chardonnay grapevines trained to a Vertical Shoot Positioned system. The fungicide regime for black rot, phomopsis and downy mildew was identical; only the powdery mildew treatments varied. Each season-long treatment regime was replicated four times by panel (post to post = 4 vines). Treatments were as follows, all using JMS Stylet Oil (JMS Flower Farms, Vero Beach, FL):

1. Conventional end late Aug (several fungicides used for PM control)
2. 1% oil end late Aug (1% oil season long as the only means of powdery mildew control)
3. 1.5% oil end late Aug
4. 1% oil end late September
5. 1.5% oil end late September

Diseases were rated systematically just prior to harvest by estimating percent disease per randomly sampled leaf, a total of 25 per panel, 100 per treatment. Berries were randomly collected utilizing a systematic collection methodology developed in France. The four replicates of fruit were crushed with a stemmer crusher and juice was collected and immediately frozen. All data was analyzed using the JMP statistical program (SAS Institute, Cary, NC). Analysis of variance was followed by the student's t test for means comparisons. For leaf anatomical evaluations, leaves were collected August 22 from three treatments and sent to Goffinet for examination under a 1000x oil emersion lens.

E. Results

The incidence of both powdery and downy mildew was statistically different among treatments. Oil treatments had a much lower incidence of powdery mildew, not surprising as oil is known to have both post-infection and residual control. Conversely, oil plots had a much higher incidence of downy mildew. There were no differences in disease among the two rates of oil or the last date of application. The cause of the differences between oil and conventional plots was not determined but could include 1) that conventional PM fungicides do provide some additional minimal control of DM that oil does not; 2) that the presence of PM in the conventional plots precluded the establishment of DM, a kind of antagonism between fungal species termed 'natural resistance'; and/or 3) the compromised leaf cuticle in oil plots facilitated penetration of the leaf epidermis by the DM fungus. Indeed, anatomical evaluation of leaves by Goffinet revealed that oil treated leaves were more chlorotic and that the leaf cuticle was compromised in oil treatments. Given that downy mildew fungicides were identical among all treatments, this suggests that the compromised cuticle in oil plots may have facilitated an increase in downy mildew infection. Further research would be necessary to clarify this issue.

We verified that extensive use of horticultural oil for powdery mildew control in grapevines reduced accumulation of sugar in berries at harvest. However, we did not find any significant effect on titratable acidity or pH in berries or juice. Analytical and sensory evaluations of wines made from each treatment should help to gauge effects, if any, on fruit flavors and aromas. We suspect that these components will not be affected by oil but we must verify this suspicion.

F. Impacts

The season-long use of horticultural oil for control of powdery mildew in vinifera grapevines must be viewed in terms of both its risks and benefits. From a materials viewpoint, it is more expensive than a sulfur based schedule. However, it offers post-infection control of powdery mildew, which sulfur does not. Though not verified in this particular study, oil suppresses European red mites, potentially eliminating the need for a miticide. However, based on our findings, downy mildew infection may be higher in vines treated extensively with oil. The cause of this increase in DM infections must be further explored in future research in cooperation with grape pathologist Wayne Wilcox. In terms of fruit quality, if the impact of oil treatments is restricted to a slight depression in sugar, as found in this study thus far, then this is not an issue. Growers however want to be assured that fruit and wine quality are not compromised, hence the need for wine evaluation. Alternating oil with another PM fungicide might help to mitigate impacts on fruit quality, another potential research topic. It cannot easily be alternated with sulfur, the other major control for PM, due to phytotoxicity issues.

Horticultural oil is commonly used in eastern winegrape production prior to bloom. There is no evidence to suggest that this particular use negatively impacts fruit quality. In previous experiments, we have evaluated oil as the final powdery mildew treatment of the season, again with no impact on fruit quality. Oil is also used as a post-infection rescue for powdery mildew infections, particularly on fruit. Beyond these scenarios, the primary potential for horticultural oil is for growers interested in using an organic product (both standard and organic formulations are available) and in situations where a grower wants an alternative to sulfur. From a vineyard worker viewpoint, oil is much more pleasant. Some individuals find that sulfur has an unpleasant odor and can be mildly irritating. For the public, both the sight and smell of pesticides can be upsetting. Growers with nearby neighbors are well aware of the need to avoid pesticide drift. Having a less aromatic alternative to sulfur might also help to appease anxious neighbors. We therefore suggest this scenario as an option for vineyard blocks adjacent to houses. Though other organic options exist for powdery mildew control, they tend to either be less efficacious than oil and/or to offer only post-infection but no residual (protective) control of the disease. Though there appear to be slight risks associated with extensive use of oil for powdery mildew control, the alternating of oil with other compatible products may reduce potential risks. As with any farm practice, the grower must weigh risks and benefits to determine the most appropriate course of action.

Appendix

Yield and fruit quality

100 berries collected per panel, 4 panels/treatment, analyzed separately @ LIHREC.

Trt no.	Trt.	Brix ¹		pH ¹		TA, g/l ¹		Berry wt.-g. ¹	
1	Conventional	23.0	a	3.21	ns	8.3	ns	1.89	a
2	1% oil, early	22.1	b	3.19		8.3		1.78	c
3	1.5% oil, early	21.7	b	3.23		8.2		1.78	c
4	1% oil, late	21.9	b	3.21		8.4		1.87	ab
5	1.5% oil, late	21.8	b	3.23		8.6		1.79	b c

Early and late refer to last spray Aug. 29 and Sept. 13, respectively.

1 – Values followed by the same letter are not significantly different (p=0.001); ns = not significant

Must samples, non-replicated, analysis done Oct. 24 at NYSAES/Geneva NY Wine Lab

Trt no.	Brix	pH	TA, g/l	Tartaric acid, g/l	Malic acid, g/l	Lactic acid, g/l	Acetic acid, g/l
1	23.2	3.26	9.8	4.2	4.2	0.8	0.3
2	22.2	3.27	8.7	3.1	4.1	0.6	0.2
3	22.0	3.27	1.5	4.7	4.6	0.8	0.2
4	22.4	3.19	10.6	4.7	4.2	0.7	0.2
5	22.1	3.32	9.0	3.1	4.5	0.6	0.2

Disease assessments

Incidence and severity of downy mildew on Chardonnay, Oct. 8, 2008

Trt no.	Percent downy mildew infection			
	Incidence (% of all leaves infested)		Severity (average % per leaf)	
1	24	a	2.0	a
2	63	b	3.9	b
3	63	b	3.3	b c
4	54	b	3.0	b c
5	52	b	2.5	a c

1 – Values followed by the same letter are not significantly different (p=0.001).

Incidence and severity of powdery mildew on Chardonnay, Oct. 8, 2008

Trt no.	Percent powdery mildew infection			
	Incidence (% of all leaves infested) ¹		Severity (average % per leaf) ²	
1	14.4	a	2.1	a
2	1.0	b	0.2	b
3	0	b	0	b
4	2.0	ab	0.05	b
5	0	b	0	b

1 – Values followed by the same letter are not significantly different (p=0.06).

2 – Values followed by the same letter are not significantly different (p=0.001).

Notes

Cuticle thickness and leaf characteristic assessments – data and detailed observations available upon request.

Work done in the same block in 2003, 2005 and 2006 supports results obtained in 2007.

A Power Point presentation on this project was given to growers on March 20, 2008 at a grape disease management meeting held at the Long Island Horticultural Research and Extension Center, Riverhead, NY. A more comprehensive version of this report will be posted on the Long Island Vineyard Manager List Serv.

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