

Research / IPM

April 2000

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Effects of Cover Crops on Yields, Quality, and the Vineyard Ecosystem

by Chuck Ingels, Sacramento County Farm Advisor

How do various cover crops affect wine grape production and quality? Do cover crops affect nutrient status, reduce vigor, or stress vines? Do they improve soil quality? Are some cover crops more attractive to gophers than others? The answers to these questions may vary depending on many factors, including variety and rootstock, soil type, irrigation method, and cover crop species and management. We sought to address these and other questions in a three-year study funded by the UC Sustainable Ag. Research & Education Program and the Lodi-Woodbridge Winegrape Commission.

The trial was conducted in a Merlot vineyard on 5BB rootstock, planted in 1993. Deer Creek Vineyard is located on Grant Line Road near the town of Sheldon in Sacramento County. The spacing is 7 x 11 ft. and the soil type is San Joaquin silt loam. Vines are trained to a bilateral cordon system with a standard T-trellis. The vineyard is drip irrigated, with sprinklers available for frost protection and cover crop germination. Drip irrigation and fertigation were applied uniformly across all treatments. Except where nontillage cover crops were used, the vineyard floor was managed by disking in the row middles and both pre- and post-emergence herbicides are applied in 4-5 ft. strips on the berms.

The experiment consisted of 5 treatments and 4 replications in a randomized complete block design. The native grass mix was planted in the fall of 1996. Other mixes were planted in the fall of 1997 and, if needed,

in 1998 and 1999. The mixes tested were:

1. Native perennial grass mix: Calif. barley / meadow barley / Calif. brome / blue wildrye – 25 lbs./planted acre; 40 lbs. N/planted acre; nontillage; mowed as needed in the spring or once in early spring and again after reseeding
2. Green manure mix: Bell bean / 'Magnus' pea / common vetch / barley – 80 lbs./planted acre; no fertilizer; planted every late October and mowed and disked in April or early May
3. Annual reseeding clover mix: Subclover / burr medic / crimson clover / rose clover – 25 lbs./planted acre; nontillage; no fertilizer; mowed once in early spring and again after reseeding
4. Cereal mixture: Barley / oats – 100 lbs./planted acre; 40 lbs. N/planted acre/year, planted every fall, mowed once in early spring, then mowed and disked in late spring
5. Disked control – disked periodically, no fertilizer

Each replication consisted of two adjacent middles, and neighboring replications were separated by one disked middle. Most plant and soil measurements were made from or adjacent to 10 contiguous vines.

Gopher Activity. Gopher activity



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was high only in the spring of 1999. Gophers showed a distinct preference for the annual clover mix, with an average of one mound per 23 vines in each middle. No fresh activity was observed in the cereal mix or the disked control, and very little was seen in the green manure and native grass mixes.

Soil Ecology. Cover crops strongly affected soil microbial populations. Soil samples were taken with to a depth of 6 in. over the course of two years. The samples were analyzed for microbial community size and composition using phospholipid fatty acid (PLFA) analysis.

The total microbial biomass was highest in the clover and native grass treatments and lowest in the cereal and green manure treatments. Microbial biomass was significantly higher in cover cropped middles than in both disked middles and non-disked berm samples. The proportion of bacteria in the cover crop was greater than in the berm, whereas the reverse was true for fungi.

Cover Crop Measurements. Weed populations were by far the lowest in the native grass treatment in 1999 and 2000. The total biomass of the clover mix was lowest in the first year (it grew very little the first year until March), highest in the second year, and lower in the third year as grass weeds became more dominant.

Effects on Vines. Pruning weights were slightly lower in the native grass treatment than other treatments. Shoot lengths were slightly lower in the native grass and clover mixes. Grapevine petiole nitrate and total nitrogen tended to be lowest in the native grass and cereal mixes, especially in year three. However, 2001 bloom petiole levels were lower for both the native grass and the clover mixes, and substantially higher in the vines where the green manure mix had grown. (During the 2000-2001 season, only the unfertilized native grass mix was allowed to grow; all other rows were disked.) There were few differences in water potential among the treatments during the experiment.

Yields and Juice and Wine Quality. There were no significant differences in yield in any year of the study; yields averaged about 6 to 7 tons/acre. There were also few consistent differences in juice pH, TA, or brix.

To evaluate wine quality, 50 lbs. of grapes were picked from each replications and combined for each treatment. Small wine lots were made by

E&J Gallo in Modesto, and the wines were crushed without oak. The wine was blind-tasted by 11 individuals, including Gallo winemakers, viticulturists, and research staff, as well as LWWC and UC personnel. Each taster was asked to rank the five wines based on their personal preference. Because the tasting was not replicated, it is not possible to state conclusively whether there were significant differences between the wines.

Wine lots from the annual cover crop mixes were found to be similar in flavor and “mouthfeel,” with wine from the green manure mix having the best fruit, the softest mouthfeel and the best balance of all the treatments. The wine from the native grass was found to be slightly thin and somewhat out of balance by some, although it was ranked first by two tasters. The disked control was noticeably thin and out of balance. However, while it was the least preferred, it was not unacceptable; none of the wines had acute vegetal taste or reduction.

Costs. In the first year, the use of the native grass mix is substantially more expensive than the other mixes because of the cost of seed. However, the cost of maintaining this mix in future years is relatively low – mainly requiring mowing and extra fertilizer. The cost of the annual clover mix is lowest in the long term, assuming that the vines do not require nitrogen fertilizer and that the stand does not decline and require replanting in future years (which it often does). Seed for the two annually sown cover crops used in this trial are relatively inexpensive, however, the requirements for repeated disking make these mixes costly each year.

Under the conditions of this trial, cover cropping had little or no effect on vine vigor or yield but positive effects on soil ecology and wine quality. There are certainly conditions under which greater effects would be seen, such as using a narrower herbicide strip. Also, there are benefits of using cover

crops, such as improved traction and water penetration, that were not measured and should be factored into the cost-benefit ratio. It is also likely that resident vegetation alone has some of the same effects as a cover crop.

In a four-year trial conducted in Lodi, an annual ryegrass cover crop had a devigorating effect compared to a clean cultivated vineyard floor; the effect was cumulative with little effect the first two years. The ryegrass also caused a significant decrease in petiole nitrogen. The devigoration was due to a synergism of both water deficits and nitrogen level. The effect on wine, when compared to a like water deficit treatment without a cover crop, was to increase tannins. Tasters who preferred tannins or were looking for a blending wine preferred the cover crop treatment wine.

Other investigators on this project were Kate Scow and Terry Prichard (Land, Air & Water Resources Dept., UCD), and Desley Whisson (Wildlife, Fish & Conservation Biology Dept., UCD). Thanks to Mahinder Dhaliwal, Juan Meza, and Andy Johas of Johas Associates for their outstanding cooperation in this trial. Thanks also to Bryan Anthony and E&J Gallo Inc. for their assistance in making and evaluating the wine lots. Seed was donated by Lohse Mill Inc., Artois CA, and ConservaSeed, Rio Vista.

Tokay High School Vineyard

With the support of Lodi Woodbridge Winegrape Commission and local businesses, the Tokay High School Agricultural Department has been able to plant a once-acre vineyard at the school farm. So far, the drip irrigation and trellis system have been established and half of the vines have been planted. Twenty-six different varieties of both wine and table grapes were planted this summer by students in the Tokay FFA and their parents. With the addition of twenty-four more varieties, this small block will include

fifty different varieties of wine and table grapes. Some of these varieties are very common to Lodi, such as Chardonnay, but others such as the Black Rose and Gewurztraminer are seldom seen in this area. The grapes will be exhibited at the Lodi Grape Festival, as well as becoming part of grape murals constructed for the festival. Students at Tokay High will be gaining knowledge in many areas of vineyard management. Students will keep records of vine nutrition, pest and water management and IPM. This on site vineyard will provide students with a facility to prepare for state vine pruning and judging contests. By seeing the different varieties, students will understand the differences in pruning and management of wine and table grapes. Students will observe the growing season-from pruning to bud-break, veraison, and then harvest. The Tokay FFA would again like to thank the Lodi Woodbridge Winegrape Commission for funding this project, and many local businesses for their support with donations and use of equipment.

The national FFA Organization

Calendar of Event

Sept.: Grape Festival & Harvest Fair. Lodi Grape Festival Fairgrounds.



Research/IPM Program Update

Lodi Woodbridge Winegrape Commission
Crush District 11
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Growers: *Mike and Dave Phillips*

Years in Winegrape industry: *25 years*

Acres in the district: 300

Varieties grown: *Zinfandel, Chardonnay, Cabernet Sauvignon, Merlot, Petite Sirah, Petite Verdox, Tannat, Symphony, and most Rhone varieties including; Syrah, Carignane, Mourvedre, Cinsault, Viognier, Roussane, and Marsanne*

In the 1860's the great-grandfather of brothers, Mike and Dave purchased farmland in Lodi where they grew and sold watermelons. Five generations later, the brothers continue the family farming tradition growing premium winegrapes and producing premium wines.

The brothers grew up working on the family farm. Their father, Don, taught agriculture in the 1940's and 50's. Don specialized in growing tomatoes and started his first fruitstand in the late '50's. Eventually more stands were added in several locations around Lodi.

As we were enjoying a sip of the newest wine blend, Mike reflected on his decision to return to his family heritage. He graduated from Lodi High School then earned his degrees in both psychology and zoology at U.C. Davis. He met his wife, Kristy, who also who also earned her degree from U.C. Davis. After graduation their first child Kevin was born. The family moved to San Diego where Mike studied marine biology as a graduate student. Jobs in San Diego related to his field were scarce, so Mike brought his family back to Lodi. He began planting new vineyards as well as farming the Carignane grapes that his grandmother had planted in the 1950's. Although most of the Carignane was replanted to Zinfandel ten years ago, the

family still grows several acres of Carignane.

Mike attended wine-related classes at U.C. Davis and even made wine at his home to gain experience. He believes the best wine they offer today comes from the grapevines he planted in the 1980's. The three acres of Syrah he planted are considered the oldest Syrah vines in Lodi. The variety of work, from every aspect of growing quality wine grapes to making and marketing premium wines, is what Mike enjoys most about his job. "It is gratifying that people like the product," he says.

Dave is very busy these days traveling around the world marketing their wine and promoting Lodi. The brothers make more than 16 varietals of wine, but during his marketing travels Dave likes to focus on Zinfandel and the Rhone varietals. Ironically, he finds society still has the perception that "wine is evil," a roadblock he frequently encounters when marketing their wines. Dave says the tougher and little less fun part of the job is all the paperwork required in marketing to new states – monthly reports for each state, paying taxes, and state regulations, which he finds frustrating. His

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reward comes from feedback from top chefs around the world who say they find the “softness of fruit in the wines very attractive.” The brothers are currently distributing their wines in 20 states as well as Japan.

Dave’s future plans include cross-marketing wines and fresh fruit and vegetables to gourmet restaurants. He is excited about the increase in local tourism, which has doubled in just the last year. The quality of the wine, comments Dave, gets better every year from the vineyard to the winery. That becomes obvious when you consider they have made 15 wines that are gold medal winners, and their new 1999 Syrah received 94 points at the State Fair and was recognized as the best wine in the region! The brothers crush about 15% of the winegrapes they grow, and the rest is sold to Canandaigua, Sutter Home, and Concannon in Livermore.

Both brothers are interested in using sustainable agriculture practices and believe in growing winegrapes naturally. That too goes for the other produce they grow on the farm. Over the past five years they have been experimenting with cover crop, mainly bulk oats, which are mowed down and worked into the soil. Other sustainable practices they employ include leaf pulling, drip irrigation, limiting pesticide spraying, and using only sulfur, copper and BT’s. As active and enthusiastic participants in the Lodi-Woodbridge Winegrape Commission BIFS program, the Phillips brothers are strong believers in monitoring. They use the monitoring information available on mites and leafhoppers

to ensure they wait as long as possible before treating, giving natural predators every chance to solve the problem.

Mike and Dave have hosted a workbook workshop for the Lodi Winegrower’s Workbook. Overall, the Phillips brothers would like to see a decrease in pesticide use with all the farmers in Lodi, as well as more education on sulfur stewardship. They may consider going back to organic farming in the future, although they both agree it is a major commitment.

Their mutual contribution to promoting the Lodi district and constant striving for improvement is what I find most remarkable. They are committed to helping all the Lodi district wineries grow together as a region and are solidly supportive of the Lodi-Woodbridge Winegrape Commission. Phillips Farms has benefited from these two very personable men who both use their expertise in promoting the winery as a great family-friendly experience.