

Grower Practices

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This chapter documents the cover cropping practices of several vineyardists who have substantial experience in managing cover crops. Each vineyard manager has valid reasons for using his or her particular cover cropping practices. These reasons include personal philosophy, production goals, the tolerance for the way the vineyard floor looks, and the financial and physical limitations of the vineyard.

Whereas researchers attempt to find workable solutions to existing problems in agriculture, it is usually innovative farmers who discover new practices and ways of adapting old practices to meet the needs of present management systems. Because optimal cover cropping strategies can be highly site-specific, species or management practices may vary greatly among growers. Furthermore, many vineyards consist

of distinct blocks that may differ greatly in soil type, slope, irrigation method, and drainage; these differences often necessitate multiple cover cropping strategies.

As mentioned in chapter 1, about 16 percent of the grape acreage in California is sown to cover crops. There are hundreds of other growers whose cover cropping experience is not being reported. It is hoped that the innovative growers selected here represent a cross-section of experience and wisdom in modern vineyard cover cropping. These grower profiles should not be construed as recommendations. They are a snapshot of what has worked and what has not worked for several grape growers who use cover crops, based on interviews conducted in 1995 and 1996.

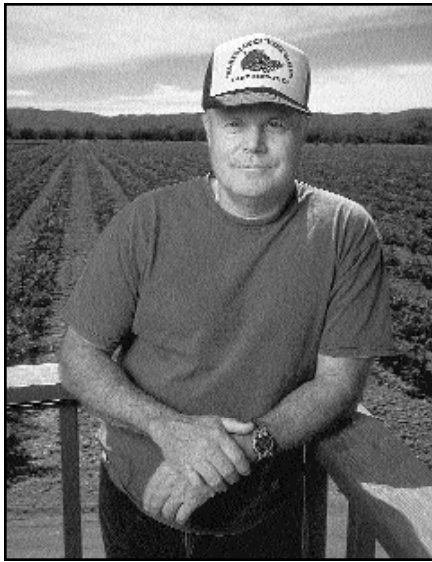


Figure 12-1. Ron Bartolucci, Fetzer Vineyards.

Fetzer Vineyards

Few people have as much enthusiasm and knowledge about cover cropping as Ron Bartolucci (fig. 12-1), a consulting viticulturist with Fetzer Vineyards and other vineyards in Mendocino, Lake, Sonoma, and Monterey Counties. But he wasn't always so interested in cover crops; in fact, he had to undergo a complete change in his way of thinking when Fetzer decided to go organic on several hundred acres. He notes that he had to relearn virtually everything he knew, this time taking a whole-systems approach to farming. Now he views all management practices as interconnected, with each practice affecting many others.

Bartolucci began using cover crops at Fetzer Vineyards in 1987. Before then, the standard practice was strip-spraying weeds in the vine row and disking the weeds in the middles beginning in spring. Cover crops were seen as an important way to improve soil quality by adding nutrients and organic matter and by increasing microbial activity; attract beneficial arthropods by providing a habitat during the dormant season; and help control weeds by outcompeting them.

Bartolucci and other Fetzer vineyard managers have tested numerous cover crop species, mixes, and management strategies at Fetzer. They worked closely on many of these trials with University of California Cooperative Extension Farm Advisor Glenn McGourty. For the first 2 years in which Fetzer Vineyards began sowing cover crops, they used a reliable and readily available mix consisting of vetch, Austrian winter peas, and oats in alternating rows. This mix produced a tremendous amount of biomass, however, and the vetch tended to grow up into the vines. Also, both the vetch and oats reseeded themselves in the vine rows when allowed to mature. Bartolucci decided to reduce the amount of vetch and increase the peas and oats, but the vetch continued to mature and reseed. Then he began using a mix of oats and three pea cultivars with no vetch. This mix worked well except that the peas did not respond well if mowed too short or too early.

Bartolucci has tested other species, such as common mustard, a typical weed species in many North Coast vineyards. He continues to test numerous other brassica species. Crimson and rose clovers also work well in many vineyards. According to Bartolucci, crimson clover produces substantial biomass and requires little maintenance. Rose clover produces less biomass but grows well on poor soils. He has recently developed a strong interest in subterranean clovers because of their ability to compete with weeds and reseed under a variety of mowing regimes. He notes that while mowing of subclovers is not essential, they spread and compete with weeds better when mowed. He has also tried perennial cover crops but in general does not like them because they devitalize the vines excessively. The only conditions under which vigorous perennial species such as 'Berber' orchardgrass were acceptable were on high-fertility soils with a vigorous grape cultivar. Bartolucci has also tested a summer cover crop of buckwheat to attract beneficials. His strategy involved planting every fourth row on one date, then planting every fourth

adjacent row 3 weeks later. However, Bartolucci soon realized that they were trying to farm the cover crop instead of the vines. Also, the buckwheat required more water than he was willing to apply to the vines.

Bartolucci has been fine-tuning cover crop management after several years of experience. He considers seedbed preparation one of the most important factors in producing a good cover crop stand. He recommends making two passes with a disk to ensure a smooth seedbed. A rototiller should not be used because it tends to pulverize the soil, creating a powder that does not hold moisture well. He also recommends using a drill rather than a broadcast seeder to use less seed and to ensure a better stand. Like many growers, Bartolucci has used alternate row cover cropping to reduce expenses and to improve vineyard access for pruning. In the near future, he plans to try planting a high-biomass mix in every other row, alternating with a low-growing, self-reseeding cover crop of subclover or medic or both.

Cover cropping is a key practice in the increasing organic acreage at Fetzer Vineyards. According to Bartolucci, grape yields have been unaffected by cover cropping. He believes that grape quality has improved from the use of cover crops and compost, which together improve soil fertility and soil tilth. He notes that these and other benefits far outweigh the costs associated with these practices.

Domaine Chandon

Zach Berkowitz (fig. 12-2) is no stranger to cover cropping in vineyards. Having worked at Domaine Chandon since 1974, he has tested a wide range of cover crop species and management practices since 1984. As the vice president of vineyard operations, he oversees 1,300 acres (520 ha) of vineyards (mostly Pinot Noir and Chardonnay) in Sonoma, Napa, and Mendocino Counties. The vineyards have a diverse array of conditions. The terrain ranges from flat to rolling hills to very steep hillsides, and the soils range from clayey to sandy and from very deep to only 1 to 2 feet (30.5 to 61 cm) deep. Rainfall varies from 20 to 45 inches (51 to 114.5 cm); both drip and sprinkler irrigation are used.

Domaine Chandon managers started using cover crops in vineyards prone to erosion, testing various quick-growing species. One mix that proved successful in a trial with the Napa County Resource Conservation District used the perennial grasses meadow barley and 'Covar' sheep fescue, with the annual legume crimson clover, which reseeds well. The most commonly used no-till cover crop for hillside vineyards at Chandon is a mix of 'Blando' brome and annual clovers (rose, crimson, and subterranean). On less fertile sites, or where erosion control is needed in new vineyards, a green manure blend of common, purple, and 'Lana' woollypod vetches, Austrian winter pea, bell bean, and either oats or barley is used. This mix is also used to build the soil in fallow areas before planting vines. On very high-vigor sites Chandon has tried annual ryegrass and other aggressive



Figure 12-2. Zach Berkowitz, Domaine Chandon.

grass mixes in various layouts to control excessive vine growth. The strategy that reduced vine growth optimally was alternate row planting of these grasses. Berkowitz notes that grasses alone may take up large quantities of nitrogen from the soil. In most of Chandon's vineyards, he has observed that including a legume in cover crop mixes reduces competition and often results in improved wine quality. Chandon's vineyard managers are now testing California native perennial grasses and insectary blends.

Managing the cover crop has proven as challenging as selecting the right species. Like many growers, Berkowitz has found that the earlier in the fall that the cover crop is planted (at least by mid-October), the better the cover crop seems to grow. To avoid scheduling conflicts with a single seed drill, cover crop seeding is started in mid-September in vineyards harvested early. After sowing, fall rains germinate the cover crop; no irrigation is applied to the cover crops in the fall or spring. The cover is mowed high (6 to 8 inches [15 to 20.5 cm]) once in the winter and again in the spring before vine flowering.

Berkowitz and the vineyard managers weighed the benefits of disking versus no-till for the vetch mix described above (ultimately, they would like to avoid disking altogether). They liked the biomass that vetch contributed, but it frequently grew up into trellises and also dried the soil rapidly. To compromise, they decided to cultivate every other row in early April and to mow the alternating rows. The mowed rows would then be disked in May, giving more time for the cover crop to attract beneficial insects, spiders, and mites. This strategy has proven successful since it reduces the competition of the cover crops for water and nutrients in late spring. For the same reason, every row is disked in April during exceptionally dry springs. According to Berkowitz, this alternate row strategy has improved wine quality by reducing the "green characters" of their sparkling wines.

As with most growers, not all Domaine Chandon's experiments with cover cropping have been successful. In one vineyard, according to Berkowitz, 'Zorro' fescue was planted in the fall between rows of vines that were to be planted the following spring (the vineyard was to be managed without tillage). During the first year, the vines grew poorly and many of their leaves had fallen by late summer. The vines were again stressed in the second spring. Then the vineyard manager decided to disk part of the vineyard in early June, after which the vines appeared to recover rapidly. He cautions that, if possible, growers should hold off on cover cropping until about the second fall after planting the vines in order to avoid stressing them. If cover crops are used from the start, he notes, growers should consider disking alternate rows early in the spring, adding extra nitrogen and potassium, increasing the proportion of legumes in the mix, or planting the cover crop in a narrow band between vine rows.

Robert Mondavi Winery

Like many grape growers, vineyard managers at Robert Mondavi Winery are actively developing and promoting sustainable agricultural practices. One of the most important practices used is cover cropping, which they began to explore in the late 1980s. Mondavi has 1,500 acres (600 ha) of vineyards on three ranches in Napa and Sonoma Counties, and many of these acres are planted to cover crops. The cover cropping program has taken place under the direction of Daniel Bosch (fig. 12-3), who has been the vineyard technical manager since 1989. Bosch advises ranch managers on pest management, irrigation, fertility, and general viticulture.

One of Mondavi's first attempts at cover cropping involved 3 cover crop species ('Berber' orchardgrass, California brome, and 'Zorro' fescue) planted separately in a nonirrigated Cabernet Sauvignon vineyard. According to Bosch, there was a dramatic improvement in wine quality. In each case, the wine produced from cover-cropped blocks was preferred in taste tests over the block without cover crops (disked). Also, the vines in the disked block grew more than the cover-cropped treatments. After 3 years, the trial was terminated due to excessive reduction of vine vigor in these blocks. Cover cropping in this vineyard had apparently weakened the vines, which were already suffering from phylloxera damage.

Bosch then initiated a cover cropping trial in a dry-farmed vineyard with excessive vigor. The between-row spacing in this high-density vineyard was 6 feet (1.8 m). The following perennial species and mixes were sown in solid plantings (in middles and under vines): Meadow barley, blue wildrye, dwarf perennial ryegrass–creeping red fescue, and blue wildrye–'Molate' fescue. Most tasters preferred wine produced from cover-cropped vines. Also, vine vigor again declined after 1 to 2 years due to competition.

As a result of these trials, Bosch is now investigating a new strategy in cover crop–water management to control vigor. He hopes to determine the ideal amount of water to apply to the vines. He is testing the effects of disking every other row and varying the amounts of irrigation water applied.

Bosch and the vineyard managers have also tested various winter annual cover crops. They found that subterranean clover sown one year usually reseeds quite well in subsequent years. However, allowing it to mature and reseed dried the soil excessively, stressing the vines. Bosch notes that vetches, many of which cost less than subterranean clover, have also performed well. Mondavi mows and disks the vetch in the spring at the same time as areas without sown cover crops. This practice reduces the competition for water by the vetches.

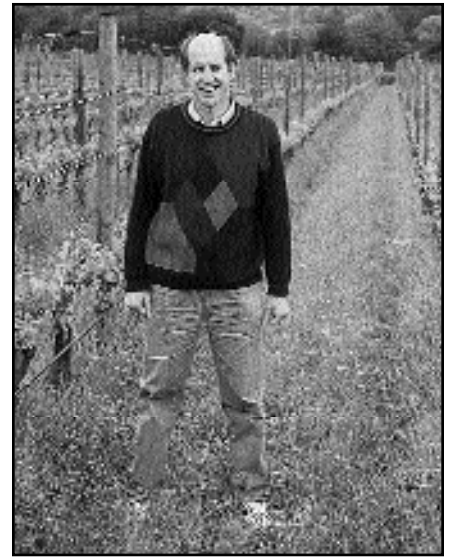


Figure 12-3. Daniel Bosch, Robert Mondavi Winery.

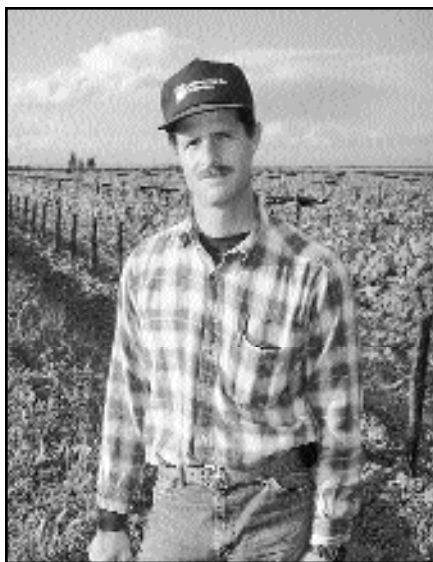


Figure 12-4. Todd Berg, Sutter Home Vineyards.

Sutter Home Vineyards

In 1992, Sutter Home Vineyards made a big change. The company, with 3,000 acres (1,215 ha) of vineyards in Amador, Colusa, Glenn, Lake, Napa, Sacramento, San Joaquin, and Santa Barbara Counties, began to convert to organic production because of concern for worker safety. By 1996, almost all their vineyards, which include Zinfandel, Chardonnay, Cabernet Sauvignon, Merlot, and Barbera cultivar, were being farmed organically. Cover crops of many types are being planted at all ranches as an integral part of the whole-farming system.

With such a large geographic diversity, many distinct growing conditions exist as a result of the different soil types and climates. Therefore, different cover crops are used based on the conditions and desired results. According to Todd Berg (fig. 12-4), vineyard technical specialist since 1993, Sutter Home uses both annual and perennial cover crops, although the majority of most ranches is planted to winter annuals.

By far, the cover crop planted most often at Sutter Home is a green manure mix. A 6-foot (1.8-m) strip is planted in every other middle to add nitrogen and organic matter, enhance soil microbial activity, cycle nutrients, and provide habitat for beneficial insects.

The standard green manure mix contains ‘Cayuse’ oat (30 percent), common and purple vetches (40 percent) and either ‘Magnus’ peas or bell beans (30 percent). Based on the tissue analysis and vineyard vigor, Berg adjusts this blend to add more nitrogen (by using more legumes) or tie up nitrogen (by using more oats). He notes that bell beans are used in areas with milder winter temperatures and peas are used in the colder areas. He no longer uses ‘Lana’ vetch because of its high hard-seed content and its potential to become a serious weed problem.

In the alternating rows a grain is planted (ryegrass, oats, or barley) as part of the rotation. Each year, the middles that are planted with green manure mix are switched with those planted with grain. Previously, a legume mix was planted to every row, but the current strategy of alternating a green manure mix with a grain cover crop seems to maintain optimum growth in the vineyards.

A considerable amount of biomass is produced by these cover crops, and Berg feels that learning how to control growth by proper timing of mowings is very important. Typically, the middles planted to the grain cover crop are mowed down prior to the threat of frost. These middles are then used for equipment access for early-season mildew control.

Berg prefers to allow the green manure cover crops to grow as long as possible into the spring to maximize their benefits, preferably until they bloom. However, the timing of incorporation is dictated mainly by spring weather conditions and soil moisture. He notes that in vineyards without sprinklers for frost protection, the cover crop must be incorporated before the soil becomes too dry for disking. Where sprinklers are available, the cover crop is typically allowed to remain longer.

Yellow mustard is being planted in every other row at ranches in Lake and Napa Counties. In addition to being aesthetically pleasing, yellow mustard cycles nutrients efficiently, is fast maturing, grows well in colder climates, and can be disked earlier in the spring.

On sites that tend to be very wet in the spring, perennial cover crops are often planted to help use some of the excess moisture and dry the soil. Access into these sites is greatly improved in both the spring and fall compared to tilled soils. In the Sacramento Delta area, native perennial grasses have been useful for this purpose, and ‘Salina’ strawberry clover has also performed well under the same conditions. These species are lower growing than the green manures and can be mowed closely during the spring, thereby reducing the frost hazard. Under very wet conditions, the perennial cover crops are usually planted in every row. At some drier sites they have been planted in every other row.

Lodi-Woodbridge Winegrape Commission

The Lodi-Woodbridge Winegrape Commission is a marketing and research organization for its growers in Crush District 11, which includes much of San Joaquin and Sacramento Counties. As of 1996, the commission included 650 growers who farm over 45,000 acres (18,200 ha) in the area, which produces more premium wine grapes than any district in California. According to Dennis Culver (fig. 12-5), the Commission’s former IPM program consultant, some growers were already using cover crops when he arrived in May 1992. He notes that the growers had two primary reasons for using cover crops. First, cover cropping was viewed as an important strategy for increasing the diversity of beneficial arthropods in the vineyards. The second goal was to improve the soil and vine root environment by building soil organic matter and improving water penetration.

Culver has developed specific recommendations depending on the method of irrigation, soil type, and nutritional needs. With furrow irrigation, he recommends an annual clover mix (subterranean, crimson, and rose clovers with barrel medic) or a legume green manure mix (bell bean, field pea, common vetch, and ‘Lana’ woollypod vetch), sown in alternate middles the first year. The unplanted middles are used for furrow irrigation. Depending on the grower’s preference, alternate middles can be sown each year or the same middles can be used. If the same middles are used, growers are finding that the annual clover mixes in particular are reseeding themselves quite nicely. According to Culver, the best strategy to facilitate reseeding is to allow the cover crop to go to seed, shred it down in late spring (rather than disking it under), and after the first substantial fall rain, run a springtooth harrow lightly through the middle.

Where drip irrigation is used, perennial native grass mixes are often planted, including ‘Molate’ fescue, Idaho fescue, and pine bluegrass. These perennial grasses compete only minimally with the vines for water and nutrients during the critical late spring and summer months. Overhead sprinkler irrigation gives growers the flexibility of planting either annual or perennial cover crops. For vineyards with very heavy or very sandy soil, or where a hardpan is present, Culver recommends ‘Merced’ rye or barley to help improve these soils.



Figure 12-5. Dennis Culver, formerly of the Lodi-Woodbridge Winegrape Commission.

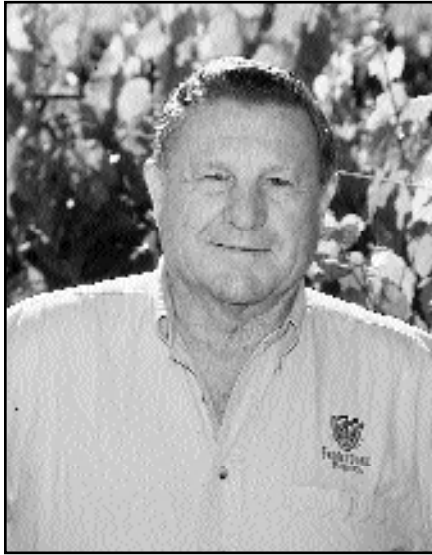


Figure 12-6. John Kautz, Kautz Farms.

Other mixes are also being used by growers in San Joaquin and Sacramento Counties. Some growers have planted various “insectary” blends, which contain species attractive to beneficial insects, spiders, and mites. A number of these mixes have been unsuccessful in this area because the stands compete poorly with cool-season weeds. Also, it has been difficult to judge whether these mixes are attracting sufficient beneficials to significantly reduce leafhopper and mite populations.

John Kautz (fig. 12-6), owner of Kautz Farms and Kautz Ironstone Vineyards in San Joaquin, Sacramento, and Calaveras Counties, prefers to use wheat or other inexpensive winter annual cereals. His father used mostly sour clover (*Melilotus indica*) on his 15-acre (6-ha) Tokay vineyard near Lodi before the vines were ripped out in 1951. In 1968, he began planting wine grapes and has since tried many different cover crop species on his 3,500 acres (1,400 ha) of drip-irrigated vineyards.

Kautz settled on the use of cereals because he believes that it is vitally important to renew the soil’s tilth, which requires the addition of large amounts of organic matter each year. However, producing this biomass is problematic because the maximum cover crop growth occurs in the spring, just when vegetation must be brought down for frost protection and vineyard access. He currently tries to have the cover crop mowed and disked before vine budbreak, which can take several days and is not always possible.

Kautz has also tried many other cover crop species. For example, in order to control weeds in the vine row (he does not use pre-emergence herbicides), he grew ‘Cahaba White’ vetch on the berms. Although it was fairly effective on the weeds, many vines were damaged or killed by meadow voles, which hid in the vetch. Also, the vetch strongly competed for water through the spring because it was allowed to mature; as a result, the vines became noticeably stressed. Kautz also tried alfalfa in 3-foot (91-cm) strips in alternating middles in order to attract beneficial insects that feed on the alfalfa aphids. However, the alfalfa had difficulty becoming established under drip irrigation.



Figure 12-7. John Ledbetter, Vino Farms.

John Ledbetter (fig. 12-7), owner of Vino Farms, grows over 3,000 acres (1,215 ha) of wine grapes under drip irrigation and has planted native grass blends on about 400 acres (162 ha). Ledbetter uses native grasses to reduce dust, reduce soil compaction, and improve access on wet soils. Although native grasses are initially expensive, Ledbetter notes that they pay for themselves in about 4 or 5 years by simply eliminating five passes per year with a disk. He says that weeds are largely choked out by the grasses. Also, he believes that the grasses enable him to grow higher-quality grapes with vigorous cultivars such as Cabernet Sauvignon because the grasses use soil moisture, effectively slowing growth.

Ledbetter is so pleased with the benefits of native grasses that he plans to sow the grasses in more of his bearing vineyards each year. To simplify planting, he purchased a specialized drill that is capable

of planting native grasses. He uses the adjustable drill in vineyards with 10-foot (3-m) row spacing, planting a strip that is 6.5 to 7 feet (1.8 to 2.1 m) wide, leaving a herbicide strip 3 to 3.5 feet (0.9 - to 1.1 m) wide. He has had some problems with weed growth along the edges of planted strips because the preemergence herbicide leaches into the cover crop root zone and kills or stunts it. He is currently testing a method of overlapping the spray a few inches into the cover crop and may need to widen the strip every 2 or 3 years.

Randy Lange (fig. 12-8) of LangeTwins, Inc., has planted over 300 acres (121 ha) of vineyard to a mix of various native grasses. Initially concerned about the effects of dust from tillage on mite predators and leafhopper parasitoids, he first started using resident vegetation (“weeds”) as ground cover. However, some of the weed species became unmanageable and many became very competitive with the vines.

To prepare the soil for planting native grasses after harvest, Lange applies 2 tons per acre (4.5 t/ha) of compost and then disks twice and uses a float to level the soil. Two weeks after the first disking, he sprays glyphosate (Roundup) on the berms to control the germinating weeds. In late October, he plants the seed blend at a rate of 20 pounds per acre (22.4 kg/ha). He calibrates the drill frequently because he wants to ensure uniform seeding and because of the high cost of the seed. He then sprinkle-irrigates the vineyard for 3 hours and does not enter the vineyard until it is mowed in late winter. The berms are treated with Roundup in early March. At this time he also mows, after which the thin green lines of the drilled grasses are clearly visible. No further irrigation is usually needed until early April.

Lange notes that a major benefit of the perennial grasses is the removal of excess soil moisture by the grasses in the spring, which slows down the vigor of Cabernet Sauvignon and improves the quality of the grapes. Another benefit is greatly improved vineyard access when the soil is wet. Also, no buildup of nematodes has been detected as a result of using the native grasses.

Carrillo Organic Farm

Oscar Carrillo (fig. 12-9) has farmed his 20 acres (8 ha) of Flame Seedless table grapes organically since 1987. The Fresno County vineyard has clay loam soil, and water is applied by furrow irrigation. He also owns 20 acres (8 ha) of organic plums, and he manages another 120 acres (48 ha) of grapes and plums.

Carrillo needed an organic source of nitrogen fertilizer but was unwilling to use fresh manure because of its weed seed content and rapid release of nutrients. In 1988 he planted the vineyard to a perennial cover crop of strawberry and white clovers. But during this drought year, he was unable to supply adequate water to the vines due to competition for water by the clovers. He then used a disk and French plow to eliminate the clovers. In 1989, he tried a different approach, which he has used ever since. His new strategy, which was successful on a neighboring vineyard, involved the use of berseem clover and composted chicken manure.

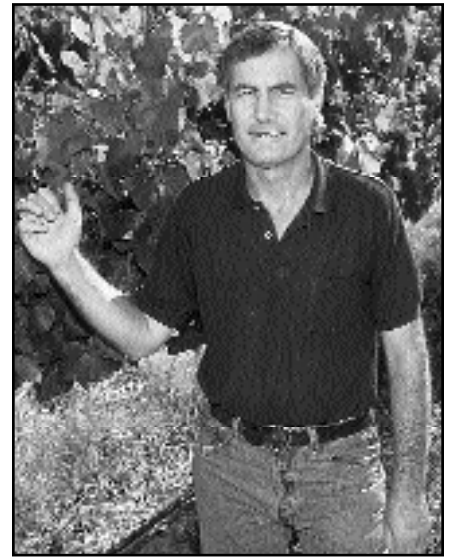


Figure 12-8. Randy Lange, LangeTwins, Inc.



Figure 12-9. Oscar Carrillo, Carrillo Organic Farm.

His cover cropping strategy is simple and straightforward. In mid-October, he disks once and then disks again 1 week later. He then broadcasts berseem clover seed at 10 pounds per acre (11.2 kg/ha) in alternating rows (he alternates the seeded row each year), after which a ring roller is used to bury the seed. He usually relies on winter rains to germinate the seed. In the fall he also side-dresses 500 pounds per acre (560 kg/ha) of compost in the nonseeded rows and applies 2 tons per acre (4.5 t/ha) of gypsum each year. In late February or early March, he mows the aisles; shortly thereafter he uses a French plow in the vine rows. After using the French plow, only a 3-foot (0.9 m) cover crop strip remains. Eventually, Carrillo hopes to replace the French plow with a berm mower to preserve more of the cover crop and to reduce tillage. He then periodically mows the clover through the spring and then disks it by late spring.

Carrillo has found that berseem clover adds nitrogen and effectively outcompetes weeds. He notes that vine growth is optimum and petiole samples reveal adequate nutrition. Most importantly, yields and quality have usually been quite high.



Figure 12-10. Max Jehle, Marko Zaninovich, Inc.

Marko Zaninovich, Inc.

The use of cover crops is by no means limited to small-scale grape growers. According to Max Jehle (fig. 12-10), IPM coordinator at Marko Zaninovich, Inc. based in Delano, this company used winter cover crops every year until the 1960s, when agrochemicals largely replaced them. But starting in 1988, they began planting winter annual cover crops on about 4,500 acres (1,820 ha) of their table and wine grape vineyards in Kern and Tulare Counties.

Cover cropping was revived in the Zaninovich vineyards in order to provide habitat and a food source for beneficial arthropods and to help reduce pesticide applications. Jehle notes that he has found many species of beneficials in the cover crop but has trouble quantifying their effect on vine pests. He has been able to document increases in lacewing eggs on the vines shortly after disking the cover crop. He has also found large populations of bigeyed bugs (*Geocoris* spp.) and minute pirate bugs (*Orius* spp.) on the cover crop, but this does not translate into increases of those species on the vines. Most importantly, Jehle notes, there are lower overall pest populations (especially mites) and they peak at lower thresholds than where no cover crop is used.

Because of several problems that have been encountered, cover crops are now grown on only about 1,500 acres (607 ha). The biggest problem results when the cover crop is left in too late in the spring, especially during dry years. If disked late, the cover crop competes with vines for water and nutrients, greatly reducing vine vigor. Also, the soil may be too dry to easily incorporate the cover crop properly. Another potential problem with late incorporation is that Western flower thrips (*Frankliniella occidentalis*) in the cover crop may migrate to the vines at bloom, causing oviposition marks on the developing fruit.

Another problem involves labor and equipment availability at

the time of planting. Jehle notes that workers need time off after the long harvest period, which extends into September and October with some cultivars. Also, since the cover crop should be planted by late October or early November, there may be insufficient planting equipment to cover large acreages. Another problem is gopher activity, which greatly increases in the cover-cropped middles on sandy soils.

Jehle has tested several different cover crops over the years, including bell beans, mustards, insectary mixes, 'Cahaba White' vetch, turnips, and summer annual cover crops. Bell beans do not tolerate traffic. Mustards, which attracted aphids (and subsequently lady beetles), dried the soil excessively. Insectary blends have resulted in poor stands and excessive weed competition. The use of 'Cahaba White' vetch, which has been shown to have some nematocidal activity, did not result in a reduction of nematodes during the years it was tested. Jehle could find no apparent benefit from using turnips because of the high cost of the seed. Finally, summer annual cover crops required too much management during the growing season. However, summer annual weeds provide ample cover on furrow-irrigated vineyards.

Jehle has settled on a mix of common vetch, 'Austrian Winter' pea, and either barley or 'Merced' rye sown at a rate of 100 pounds per planted acre (112 kg/ha). The mix is sown in 4-foot (1.2-m) bands. To reduce costs, it is planted in every other middle; on hillside vineyards, it is planted in every row. After planting, the seed is watered along with the postharvest irrigation. Jehle believes that the benefits of growing a cover crop are worth the associated costs, but only if it is disked in before the soil dries out, usually in about mid-March.

Three Sisters Vineyards

Joe Soghomonian (fig. 12-11) grows cover crops on nearly 500 acres (202 ha) of organic raisin, table, and wine grape vineyards just south of Fresno. Soghomonian, who has owned and managed the vineyards since 1965, has farmed organically since 1981 and has sown cover crops since 1985. Like many growers, he uses cover crops to provide habitat for beneficials and to aid in water penetration.

Soghomonian continues to use the same winter annual mix he used when he first started cover cropping: common and hairy vetches, field peas, oats, and cereal rye, with some wildflowers for color. While most of the vineyards are on drip irrigation, furrow irrigation is also used periodically to germinate the cover crop in the fall. After preirrigating, he drills the cover crop seed in 3-foot-wide (0.9-m) strips in the middles. He cultivates for weed control in the vine rows. Because the cover crop is allowed to reseed each year, he uses low seeding rates. For 2 years, he used the summer annuals buckwheat and cowpea but discontinued their use because of the time commitment. In his raisin vineyards, he disks up to three or four times in early July before terracing. He notes that this extra preparation is necessary to thoroughly incorporate the cover crop residues and create a smooth terrace.



Figure 12-11. Joe Soghomonian, Three Sisters Vineyards.

Soghomonian has encountered a few problems with cover cropping. In some years, cover crop germination rate is low, especially when he plants after about mid-November. Also, if the cover crop grows too tall in the spring, heavy winds may blow it over into the furrow, impeding the flow of water. The mown clippings may also hamper water movement. To avoid this problem, he now mows the cover crop high one or more times in the spring. He also periodically disks alongside the planted strip to control weeds and pulls furrows after every one or two irrigations. After the cover crop reseeds in July, he mows it close to the ground and then disks it in. Soghomonian has also encountered difficulty shredding the vine prunings if he waits too long after pruning to mow. The mower sometimes “bogs down” with the canes and a tall cover crop.

San Bernabe Vineyards

Since the late 1970s, cover cropping has been part of the yearly cycle in the farming operations at San Bernabe Vineyards. The ranch, located near King City in Monterey County, is being slowly converted to drip irrigation (about two-thirds of the ranch is drip irrigated as of 1995). The area receives about 12 to 14 inches (30.5 to 35.5 cm) of rainfall per year. According to vineyard manager Bill Petrovic (fig. 12-12), a barley cover crop was initially used for erosion control on the hillside vineyards, or about half of this 7,000-acre (2,830-ha) ranch, while the flatter ground was kept clean by disking. The cover crop was incorporated into the soil by mid-May to reduce competition with the vines for water. The vineyard soils, which are mostly sandy to sandy loam, were very low in organic matter and the addition of the vegetative matter improved the tilth and stability of the soils.



Figure 12-12. Bill Petrovic, San Bernabe Vineyards.

In the early 1980s, San Bernabe Vineyard managers tested other winter annual cover crops, such as bell beans, clovers, forage mixes, and grasses. As a result of these tests, a 50/50 blend of crimson clover and annual ryegrass was selected as the cover crop of choice. The early-season growth of ryegrass helped in erosion control and the clover added nitrogen to the soil after disking in the spring. This combination provided all the advantages of the barley cover crop without the main disadvantage of high nitrogen use. While the cost per pound of the seed mixture was higher than barley, the seeding rate was lower. Seed cost was similar in both systems.

In 1991, vineyard managers began using ‘Blando’ brome on much of the acreage that was converted to drip irrigation. Although more expensive than the crimson clover–ryegrass mix, it was selected because it has several advantages: it reseeds effectively (no blocks sown to ‘Blando’ brome have had to be reseeded); it develops excellent thatch after mowing, which reduces soil compaction; and

it is competitive with many weeds. Water use was minimal because it matures and dies by late May in most years. In 1994, there were 1,800 acres (729 ha) of established 'Blando' brome on the ranch; another 1,100 acres (445 ha) were planted in 1995. In addition, 3,400 acres (1,376 ha) of the crimson clover–ryegrass mix was planted and 160 acres (65 ha) of resident grasses were left as a cover crop. The remaining acreage was kept clean with tillage.

The 'Blando' brome (as with all cover crops at this vineyard) is seeded by airplane. Seedbed preparation involves two passes with disks; one pass with a springtooth harrow is used to incorporate the seed. Preemergence herbicides are used to control weed and cover crop growth on the berms. The 'Blando' brome is usually mowed twice—once in February or early March before flowering and again after reseeding in early summer. According to Petrovic, seeding by air became a distinct advantage in 1991 when 'Blando' was used as a permanent cover crop in the blocks that were converted to drip irrigation. The seed is bulky and light and tends to form bridges in conventional seeders, but flows well out of the airplane hopper.

In 1995, vineyard managers began using chemical mowing with low rates of glyphosate (Roundup) instead of tillage on most of the crimson clover–ryegrass acreage, and he notes that the results looked excellent. With this practice, the cover crop is stunted in the spring, but with correct timing the clover reseeds effectively. Chemical mowing was used on the crimson clover–ryegrass blend in drip-irrigated vineyards; where sprinkler irrigation is still used it is disked in the spring. Chemical mowing has saved at least one mowing and reduced the noxious weed growth in the established cover crops. Petrovic notes that, while this practice has been effective, the ultimate goal is to find cover crop species and management strategies that require no chemical treatment.

According to Petrovic, the advantages of cover crops are quite apparent, especially in the wet 1994/95 winter. In spite of the rains, no erosion occurred in the vineyard except on roadways. Where flooding from the Salinas River went into the vineyard, the cutting action of the floodwater was effectively reduced by the cover crop. With phylloxera present in the vineyard, the practice of cover cropping in the middles and spraying the berms eliminates the movement of soil and phylloxera associated with in-row and under-vine tillage equipment.

Petrovic notes that the optimal cover crop would cover the entire vineyard floor, provide habitat for beneficial insects, choke out noxious weeds, supply nitrogen, and die or go dormant during the summer months. San Bernabe plans to keep experimenting to find species and management practices that come as close as possible to this optimal system.



Figure 12-13. Ric Fuller, Rancho Tierra Rejada.

Rancho Tierra Rejada

Situated in the rolling hills east of Paso Robles in San Luis Obispo County is Rancho Tierra Rejada, owned by Continental Vineyards. The soils vary from fine sandy loam to heavy black clay, and the yearly rainfall averages 9 to 11 inches (23 to 28 cm). The 500-acre (202-ha) vineyard includes Cabernet Sauvignon, Merlot, Chardonnay, and Zinfandel. Ric Fuller (fig. 12-13), vineyard manager since 1977, says that the only constant thing at this ranch has been change: changes in vineyard floor management, changes in equipment, and changes in attitude. Another big change was the recent switch from sprinkler to drip irrigation.

Fuller first began using cover crops in the early 1980s for erosion control. After disking, the vineyard soils would seal up, reducing water penetration. Using gypsum proved to be beneficial but time-consuming and expensive to apply. Working with the U.S. Natural Resources Conservation Service, Fuller planted 50 acres (20 ha) each of ‘Blando’ brome and ‘Zorro’ fescue. These species proved to be quite successful because they reseeded effectively and required little cultivation. The following year, he planted 200 acres (81 ha) more to these species in monocultural stands. However, because Fuller soon developed severe hay fever symptoms when ‘Blando’ brome flowered, that spring he disked them in before they set seed. After that, he did not use cover crops for several years.

In the early 1990s, Fuller began evaluating the high costs of clean tillage, including tractor use and soil erosion. He was also concerned about the potential loss of insecticides and he felt that cover cropping might help. He planted barley on half of the ranch in the fall of 1992. The following spring, he found far more spiders in cover-cropped areas than in disked areas. Where barley was planted, there were also very low grape leafhopper levels. As a result, no insecticides were needed.

Because barley was so successful and because it was produced cheaply on the ranch, Fuller planted the entire ranch to barley in 1993. The seed was drilled in after using a chisel plow with a ring roller behind it. Planting a barley cover crop rather than disking proved cost effective: the bill for diesel fuel decreased in 1994 and unusually few repairs were needed on the tractors. He decided not to replant with barley in 1994 because he observed a healthy resident weed population, which he believed would hold the soil in place as effectively as barley. While barley did not effectively reseed the following year, the winter annual weeds did produce substantial growth. Although a large number of spiders were observed in the vineyard in 1994, a massive leafhopper infestation occurred, requiring an insecticide treatment.

In the fall of 1993, Fuller and University of California Cooperative Extension Agronomy Farm Advisor Michael Smith established a replicated trial, planting 10 middles to each of the following cover crops: ‘Zorro’ fescue, bur medic, Ladino clover, broadleaf trefoil, and a mix of the native perennial grasses California brome, meadow barley, and California barley. Vetch was tested in 1992, but was abandoned because it was killed by a fall frost. The native grass mix

remained green all summer because of sprinkler irrigation. ‘Zorro’ fescue did well where soil fertility was low; it also had excellent seed production. Medics grew quite successfully, even with very cold weather. White clover and trefoil were successful after slowly becoming established, and they withstood the “dry-down” period before grape harvest. They have also performed surprisingly well under drip irrigation.

As a result of these trials, in the fall of 1995 Fuller seeded the entire ranch to a mix of three bur medic cultivars, which proved to be an excellent cover crop. He has also planted ‘Ladino’ clover in several low areas in the vineyard to remove excess soil moisture during the growing season and to control erosion. This practice has been so successful that he hopes to use a grass seed attachment to plant the clover in swales, with reseeding bur medic throughout the rest of the vineyards. Perennials may also be important for early-season erosion control, since most annuals do not become well established until winter.

Fuller believes that the changes in vineyard floor management practices have been well worth the effort. The use of cover crops has resulted in reduced fuel costs and equipment maintenance, reduced soil erosion, and improved wheel traction.

LaRocca Vineyards

Phil LaRocca (fig. 12-14) of LaRocca Vineyards has carved a niche for premium organic wines. According to him, 70 percent of the effort in making good organic wine is in producing quality grapes; so he allows his grapes to attain a relatively high sugar content. LaRocca and his extended family farm 70 acres (28 ha) of Cabernet Sauvignon and Merlot vines on red clay soil east of Chico, near Forest Ranch, at an elevation of 2,600 feet (792 m). They also farm 130 acres (53 ha) of Chenin Blanc, Chardonnay, and Zinfandel at the foot of the Sutter Buttes in Yuba County. In the Yuba vineyard, they sow a mixture of barley, rye, and ‘Lana’ vetch each year. This cover crop is disked under as a green manure in early spring.

LaRocca bought the dry-farmed mountain vineyard in 1984, and he now drip-irrigates about half of it. The previous grower strip-sprayed the vine rows and disked the middles, which led to severe erosion from winter rains in years of 80 inches (203 cm) or more of rain. Since he was determined to use only organically acceptable practices, the first year he brought in truckloads of horse manure and chicken manure. However, the manure was very expensive to transport, and it also tied up zinc upon incorporation into the soil.

The following year, he planted his first cover crop after reading about green manures from a Rodale Press book. Yet it was clear that he would not be able to disk each year because of the erosion-prone soil. He began working with a cover crop seed supplier who recommended a nontillage mix of ‘Zorro’ fescue, ‘Blando’ brome, barley, ‘Lana’ vetch, and crimson, red, and subterranean clovers. He still uses this mix but has cut back or eliminated the vetch in some blocks, especially those with low vine canopies. In areas of extreme



Figure 12-14. Phil LaRocca, LaRocca Vineyards.

weed competition, he has used very high seeding rates, effectively suppressing the weeds. In 1995 he sowed subclover seed at a high density on the berms and was pleased with the weed control.

Because reseeding cover crops did not produce satisfactory stands, LaRocca sowed seed each year. When he first began using cover crops, he simply broadcast the seed from a cart pulled by an all-terrain vehicle. Now he obtains the best results by using a crawler-type tractor and rips shallowly to prepare the seedbed. As a result, the block that he first seeded to cover crops now self-reseeds each year. He hopes to be able to avoid sowing his entire vineyard if the cover crops effectively regenerate each year. In the Yuba vineyard, he is planning to disk the cover crop in every other row and to allow the alternating rows to reseed before mowing. In erosion-prone areas or areas of sparse cover crop growth, he places oat straw on the soil for protection. He considers this a very important erosion control technique, one that also helps the cover crop germinate after seeding.

LaRocca believes that his winter annual cover crops have little affect on water availability to the vines. In fact, he notes that even where the cover crops have been the most vigorous, grape yields remain high, even under dry-farming. LaRocca is pleased with the erosion control and soil-building benefits of cover crops. In fact, he hopes to eventually be able to use compost to fertilize primarily the cover crop rather than the vines.