



## Chapter 4

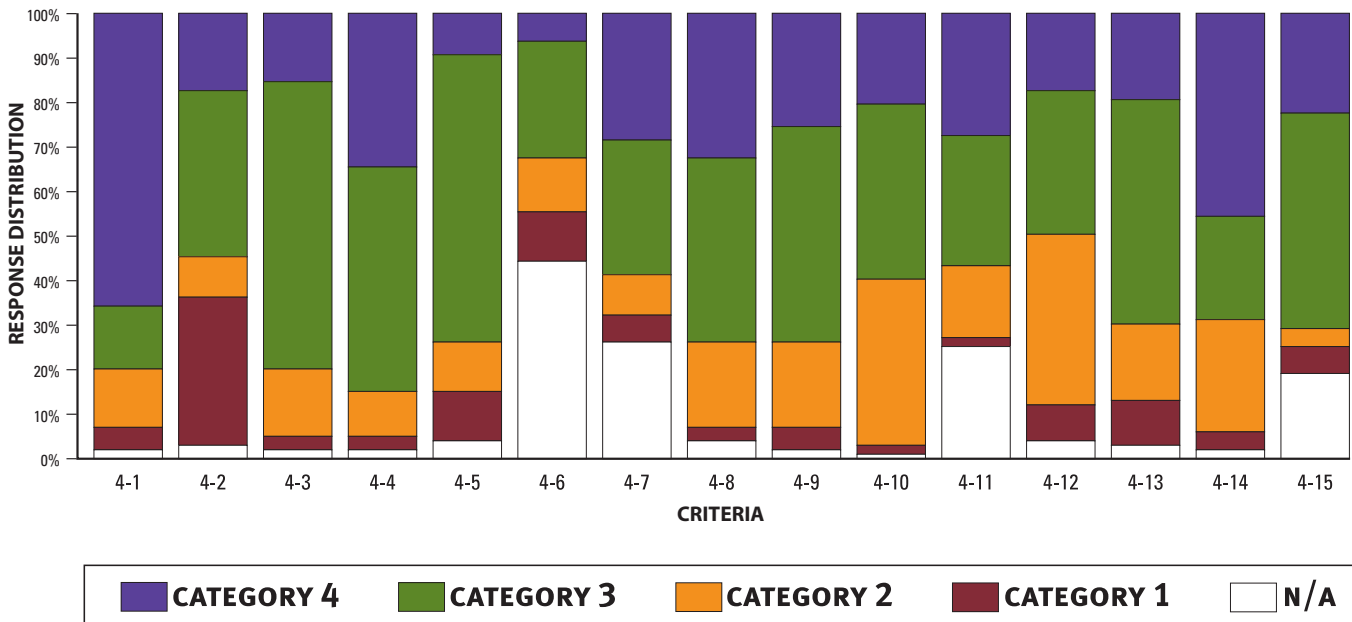
# **SOIL MANAGEMENT**

# Background

Healthy soil is literally the foundation of a sustainable vineyard. A third of the grapevine lives underground in the form of roots. Leaves feed the vines sugar but the roots feed everything else. The soil provides the roots with three vital elements: water, nutrients and air. These elements are best provided by soil with good structure and a vibrant population of microbes and worms that breakdown the organic matter. While no product or technique has been developed that can mimic or accelerate the process of microbes and worms, there are a number of ways that soil can be damaged in a short period of time. Improper or excessive tillage, compaction and lack of organic matter all reduce the quality of the soil and the ability of the roots to get the air, water and nutrients needed to fight diseases, cope better with soil pests and overcome other stresses.

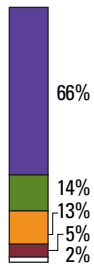
Growers can take advantage of the natural processes to improve vine health while allowing better access to nutrients. This translates into reduced need for increasingly expensive fertilizers in the field. One way to utilize nature is through the use of cover crops in the vineyard, which increases the turnover of organic matter, can add important nutrients and generally enhances the health of the soil. Awareness of this cycle helps the growers make better-informed decisions about fertilizers and soil amendments. Because cover crops can compete with vine growth, it is important to determine that the use of any cover crop or a specific cover crop mix is appropriate for the region and is likely to produce the desired effects according to individual vineyard characteristics.

## SOIL MANAGEMENT BENCHMARK DATA

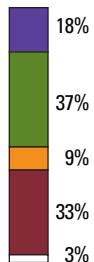


## Benchmark Data

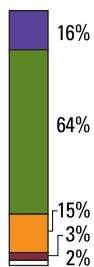
### Grower Response



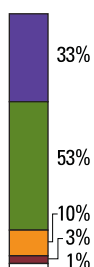
**4-1 PETIOLE ANALYSIS** Growers make their living from the quantity and quality of the fruit they produce. As a result most check the vine's nutrient status through petiole (stem) analysis to insure that nutrients are available in the plant to produce the desired crop. About 66% of the growers are proactive and send samples to a lab for analysis every year, with another 14% adhering to a two-year or three-year cycle for lab results. Of the remaining 20%, 13% respond to problems, 5% never sample and 2% replied N/A, not applicable or information not available.



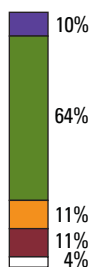
**4-2 SOIL ANALYSIS** The same proactive approach is needed when considering soil health. Since the cycle time for soil testing is so long, a method of recording test results is important for tracking the historic soil health of the vineyard. 55% of the growers sample on 5-year cycles if undergoing a soil amendment program. 18% also record the results using GIS/GPS technology. Another 9% sample soil every 7 years while 33% sample at some point. 3% replied N/A, not applicable or information not available.



**4-3 INTERPRETING RESULTS** But just getting the results are not enough to improve soil health. Interpreting the results and using that information in management decisions improve soil health. 80% use expert help to interpret the results, using the results in their vineyard management decisions. 16% can interpret the results for themselves. 15% of the growers accept the vineyard nutritional recommendations as given and while 3% don't take samples 2% replied N/A, not applicable or information not available.

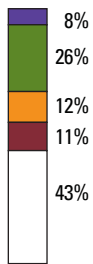


**4-4 NUTRIENT MANAGEMENT** Ensuring proper nutrients are available to the roots and vines begins in the soil. 53% of the growers use leaf petiole analysis, vine vigor, fruit quality, leaf symptoms and the history of the vineyard to make informed decisions. An additional 33% of the growers use this information with water quality test results to make site-specific nutrient applications. 10% of the growers are basing nutrient applications on broad deficiencies and 3% make decisions based on time of year or other type of established program that is not based on site-specific information. 1% replied N/A, not applicable or information not available.

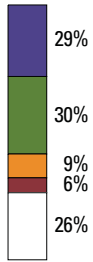


**4-5 NITROGEN MANAGEMENT** An important element in the nutrient mix is nitrogen. 64% take local conditions and water into consideration and apply nitrogen in at least two separate applications (never when the vine is dormant), and another 10% never add nitrogen because it is provided by cover crops. 11% of growers use the petiole analysis and vine vigor when deciding to add nitrogen. 11% apply nitrogen every year even though vine vigor is more than adequate. 4% replied N/A, not applicable or information not available.

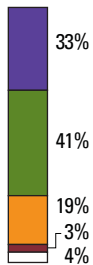
**Grower Response**



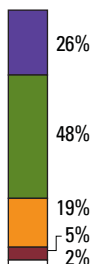
**4-6 AMENDMENTS FOR WATER PENETRATION** The health of the vine is dependant on water availability. 43% of the growers replied n/a which most likely means they have no problem with water penetration in the soil. When growers do notice a problem, 11% take no action, 12% add gypsum, 26% add manure or establish cover crops and 8% have a long-term plan that includes increasing the organic content of the soil through cover crops, manure and annual water quality testing.



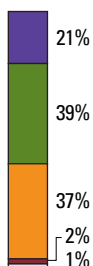
**4-7 AMENDMENTS FOR pH** Sometimes stomachs can get out of balance and not process food correctly. This can also happen to the soil if the soil pH is too high or low, impacting the vines ability to obtain nutrition present in the soil. 26% of the growers do not have a pH problem in their vineyards and answered N/A. 6% don't know if they do or not. Of those who have a problem, 9% don't do anything about it, 30% add more than half the recommended levels of amendments to correct it. 29% also build up the organic matter with compost and cover crops.



**4-8 ORGANIC MATTER** Organic matter is critical to the health of the soil. 33% add a combination of organic matter such as cover crops and compost, and reduce tillage to lower the rate of organic matter breakdown. Another 41% add organic matter to the soil annually through compost, manure or cover crops without changing their tillage rate. 19% don't add any organic matter or simply let the resident vegetation grow through the winter, with 3% of those growers also clean-tilling the vineyard. 4% replied N/A, not applicable or information not available.

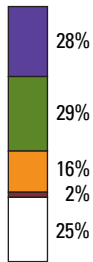


**4-9 SOIL COMPACTION** Soil compaction can affect the ability of the vine roots to access nutrients and water. 93% choose or modify equipment to minimize compaction of the soil. 48% also have an annual cover crop and minimize field activity during wet weather, while 26% maintain a non-tilled or reseeded cover crop and never go into wet fields. 5% don't take soil compaction into consideration when choosing equipment or working in the vineyards during wet conditions. 2% replied N/A, not applicable or information not available.

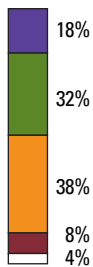


**4-10 KNOWLEDGE OF SOIL SERIES, WATER-HOLDING CAPACITY & EROSION POTENTIAL** Like the wine it will produce the soil in a vineyard has its own unique characteristics. Awareness of these characteristics can allow a grower to make smart choices for amendments, additives and pH balance. 60% of growers know the soil properties (erosion hazards, soil water holding capacity, wilting point and infiltration rate), and 21% have also consulted with a qualified erosion specialist if erosion is a potential problem. 37% know the type of soil but not its properties. 2% doesn't know what kind of soil they have and another 1% replied N/A, not applicable or information not available.

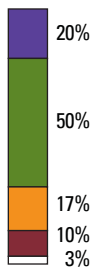
**Grower Response**



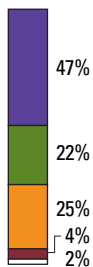
**4-11 SURFACE WATER DIVERSIONS** Erosion is not a problem for growers in flat valley lands, and 25% of growers replied N/A, not applicable or information not available. 57% have permanent or engineered drainage systems and minimal erosion issues, with 28% responding that they have no impacts from erosion. 2% have erosion problems they do nothing about while 16% use annual drainage structures and have moderate erosion issues in the vineyard and along roads.



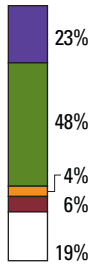
**4-12 NON-POINT SOURCE POLLUTION PREVENTION** Non-point source (NPS) pollution is an environmental issue of growing concern and a large number of growers are taking proactive actions to address the issue. 18% maintain a permanent cover crop, have a no-tillage practice, use permeability and runoff rates in their irrigation planning and have adopted a local soil erosion program that includes working with community groups interested in erosion control measures. Another 32% of growers have implemented water diversions and a NPS monitoring plan. 38% maintain a winter cover crop, have a tillage plan and are researching and planning to have a NPS monitoring program. 8% of the growers have no cover crop present and don't monitor for non-point source pollution. 4% replied N/A, not applicable or information not available.



**4-13 AIR QUALITY** Air quality is quickly emerging as an area of major concern for all of California agriculture and the regulatory pressures are increasing for growers in the state, especially in the Central Valley. Particulate matter 10 (PM10) is of increasing concern. Soil blown by the wind can be a source of PM10. 17% water their roads to minimize dust in the dry months while another 50% also maintain an annual cover crop and only burn vineyard residues. 20% maintain a permanent cover crop, practice no-till farming and do not do any burning. 10% of the growers have not implemented any actions to minimize soil loss through wind action. 3% replied N/A, not applicable or information not available.



**4-14 COVER CROPS & SOIL QUALITY** Cover crops provide many benefits for vineyards and growers. 94% of growers invest management time in cover crops with 22% also managing a seeded annual cover crop in the winter while 47% maintain a permanent cover crop in vine row middles. Another 25% allow an annual resident vegetation (non-seeded) to be there in the winter. Only 4% do not grow cover crops in the vineyards. 2% replied N/A, not applicable or information not available.



**4-15 CHOICE OF COVER CROP** Of the high percentage of growers using cover crops, 71% of growers select cover crops based on vigor of the site or erosion conditions while 23% also track the interaction between cover crops and vines to ensure no undesirable outcomes. 4% base cover crop selection strictly on the cost of seed. 6% don't know the interaction of the cover crop to their vines, and another 19% replied N/A, not applicable or information not available.

## Best Practices

**Statewide Strengths:** The majority of growers reported implementing practices that together form an excellent overall soil management program. This set of practices includes conducting the appropriate soil and plant monitoring techniques, building soil organic matter through cover cropping and other practices, managing nutrients to achieve balanced vines, reducing nutrient loss, reducing compaction, and limiting soil erosion.

John Simpson of Simpson Meadow Winery in Madera says that soil is the foundation of your farm. “A third of the grapevine lives underground in the form of roots. With proper monitoring of soil nutrients and the use of many worm-friendly products like our homemade liquid humus, water soluble gypsum, seaweed, we strive to maintain a healthy soil.” His motto for soil management is “Don't do anything to the soil that will hurt a worm. You know your soil is healthy when you have a live working population.”

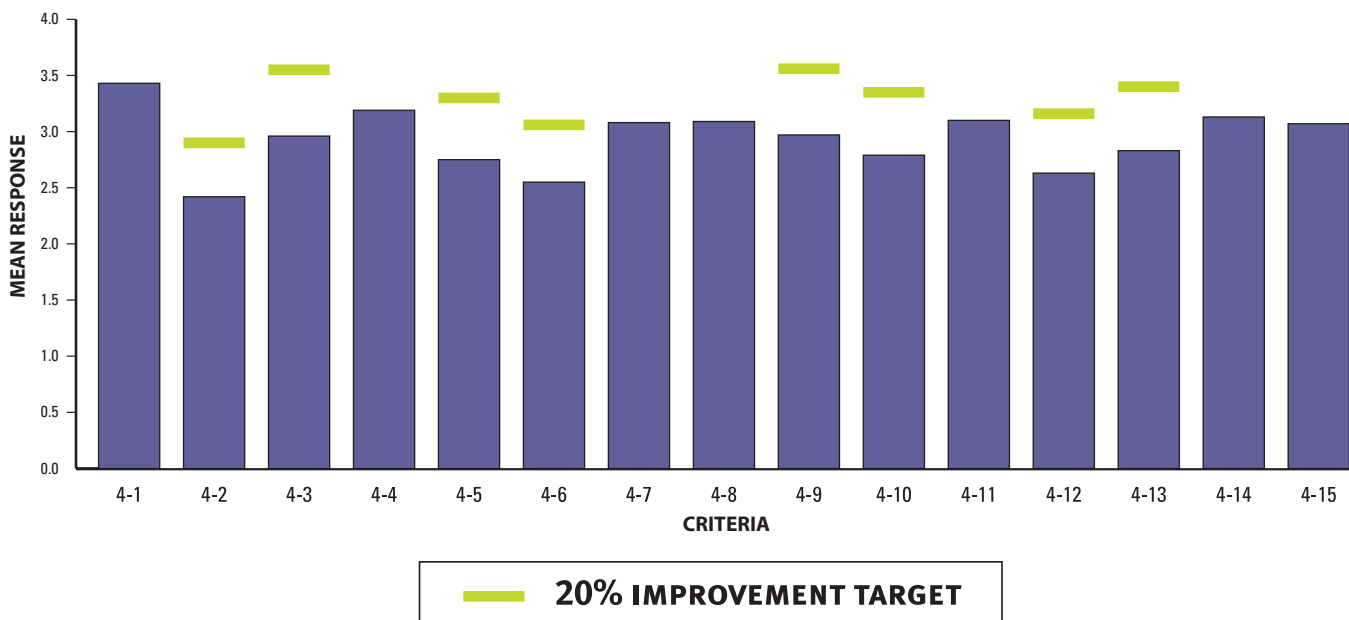


*Vineyard Manager Phil Coturri at Moon Mountain Vineyard in Sonoma checks the straw cover spread out on a hillside vineyard to help prevent soil erosion during winter rains.*

## Targets for Continual Improvement

**Statewide Opportunities for Improvements:** There is an opportunity to improve soil management practices for 20% to 50% of growers, depending on the practices. There is a particular need to improve knowledge of soil series (criteria 4-10) and expand non-point source pollution prevention efforts (criteria 4-12) for 40% to 50% of the growers.

The California Sustainable Winegrowing Alliance has set a desired goal of 20% improvement in the average scores indicated below that are less than 3. By harvest 2009, CSWA will strive to increase the average winegrower scores to the positions marked in green. For practices that are already 3 or above, CSWA anticipates that winegrowers will demonstrate continuous improvement by the 2009 harvest. To reach these goals, CSWA needs partners. If you are interested in improving soil management practices in the wine community, please email [info@sustainablewinegrowing.org](mailto:info@sustainablewinegrowing.org).



*“The workshop opened my eyes to a lot of farming practices that will help me in the future.”*

WORKSHOP PARTICIPANT, MADERA, NOVEMBER 2003