

## A Case Study in Sustainable Vineyard Practices: The Benefits of Rice Straw for Erosion, Natural Weed Control and Reducing Irrigation Needs

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**AT HINMAN & CARMICHAEL**, we are interested in all facets of winery operations, including sustainable vineyard management techniques. Many of these techniques can be required as a condition of the purchase of grapes by sophisticated buyers, and the use of straw for erosion control and improved yields is one such proven technique.

There has been considerable research and a few experimental trials in vineyards, particularly in Australia and here in California, searching for new, successful and sustainable practices. Developing sustainable viticulture practices is imperative in today's changing environment. This article discusses a case study in a high-altitude vineyard in California's North Coast that used rice straw as a sustainable practice. The overall conclusion from the trial is that using rice straw under vines not only provides the expected erosion control, but also provides natural weed suppression, significant reduction in the amount of water needed for irrigation, improved soil quality and, perhaps best of all, improved yields of high-quality grapes.

In developing a new high-altitude mountain vineyard, the vineyard owners only planned to use the sustainable practices they had developed in their

existing hillside vineyard but also looked to new research to better achieve the goal of a more sustainable vineyard that prevents soil erosion, decreases the use of herbicides and conserves water.

As part of the planning process, the owners brought in consultant Dr. Richard Smart to assist in the development of this high-altitude vineyard. He introduced them to the large volume of viticulture research developed in Australia, a country where water conservation is key. They traveled with Smart and other California vineyard owners to each of the key Australian viticulture areas to observe several innovative irrigation control and water use practices used in these vineyards. One practice of particular interest was the use of straw in the vineyards.

After returning to California, they reviewed research on the pros and cons of straw use in the vineyard. Although wheat straw was commonly used to prevent erosion, it could also be expensive to spread and difficult to keep in place, particularly in windy areas. The research, however, did demonstrate that many types of mulch under the vines had enough important benefits to convince them to incorporate some on a trial basis in the new vineyard.

### The Rice Straw Program

Wheat straw was an unsatisfactory choice, particularly for a high-altitude vineyard because it is light and easily blows away. For alternative mulch, they looked to the Sacramento Valley. California is the second largest rice-growing state in the United States, and 95 percent of that rice is grown on 500,000 acres in the Sacramento Valley on land unsuitable for other crops. Rice straw is a waste product that, for decades, was burned after harvest to clear the fields. The California Air Resources Board began controlling the ability of rice producers to burn these large quantities of rice straw, and in 1991 the California legislature passed the Rice Straw Burning Reduction Act that required a phase-down in the amount of rice straw that can be burned. The phase-down is now complete and burning rice straw is banned (with a few narrow exceptions). The result is that large quantities of rice straw are available for other off-field uses. The purpose of this vineyard trial was to determine if rice straw would be a good alternative mulch.

### Results of the Rice Straw Trial

The trial was conducted over five years to monitor the different possible benefits. In comparing rice straw with lighter wheat straw, the rice strands are finer, longer and more intertwined than wheat straw. The trial demonstrated this composition helps keep the rice straw together and from blowing away. After five years of monitoring, the overall conclusion was that rice straw provided all the benefits of wheat straw that the mulch research cited but was also easier to work with, did not blow away and reduced costs related to both weed suppression and irrigation. In addition it naturally enhanced soil quality and improved both the grape crop yield and quality.

### To summarize:

- Because the rice strands are long and intertwined, rice straw was easier to spread under the vines than wheat straw. Placing the rice straw bales at fixed spaces down the vineyard rows eliminated the need for special equipment to spread the straw. Unlike wheat straw that commonly requires special equipment to spread in the vineyard, spreading the rice straw only required walking down the rows while pulling 4- to 5-inch flakes off a large bale and tossing them under the vines. The flakes gradually settled into a permanent position under the vines.
- A definite benefit of rice straw is that the straw flakes must be replaced only every four to five years unlike wheat straw, which needs to be replaced annually.
- Rice straw has excellent insulating properties and maintains a constant soil moisture and temperature underneath the vines, which helps reduce the irrigation required and slows and reduces evaporation on hot days.
- The rice straw trial included continued monitoring of the rice straw's effect on soil and vine moisture to better control irrigation. The constant soil moisture and soil temperature combined with reduced daytime evaporation ultimately allowed a 50 percent reduction in the water needed for irrigation, promoting a healthy, high-quality crop.
- Further, because rice straw was so resilient and long-lasting, it proved to be an excellent natural weed control and dust reducer (including dust mites).
- Much of the research found that using a mulch under the vines increased the number and activity of soil invertebrates, particularly earthworms, to naturally improve soil quality. Without digging to "count" invertebrates under the soil, the trial nevertheless demonstrated that the rice straw program did facilitate a healthier soil composition and contributed to good vine growth and quality fruit.
- As described in the research, above the ground the rice straw encouraged larger populations of generalist predators (spiders, beetles, flies, wasps, etc.), which exert natural control of pests, such as vine moth, mites, weevils, vine scale and mealy bugs.
- During the trial, pruning weights were recorded, and berry counts and weights were recorded during harvest. The records showed that after the first year, crop yield was increased without sacrificing any fruit quality.

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- 1 Richard Smart is an Australian viticulturalist and leading global consultant on viticulture methods. (See [smartvit.com.au](http://smartvit.com.au).) Selected References are included below.
- 2 "The Facts About California Rice Production," *Environmental Sustainability Report* prepared by the California Rice Commission, May 2012.
- 3 The wines from this vineyard trial consistently received high scores with one wine selected as a Top 100 Cellar Wines of the Year by *Wine Enthusiast* magazine.
- 4 In "How to Get Mulch to Stay on a Slope" (Carolyn Csanyi, July 17, 2017), the author lists the time-consuming and expensive methods used to keep wheat straw from blowing away, including peg and twine anchors and rolls of netting.
- 5 Irrigation needs varied both among blocks and within blocks. Adjusting the size of the emitters worked to balance the varying irrigation needs among different sections of the vineyard.
- 6 See, for example, "Earthworm activity and soil structure changes due to organic enrichments in vineyard systems," G. Peres, D. Cluzeau, P. Curmi, V. Hallaire, *Biology and Fertility of Soils* (1998) 27: 417-424; "Effect of Living or Straw Mulch on Weed Management and Soil Quality in Grape Vineyards," Craig A. Dilley, Gail R. Nonnecke, *Iowa State Research Farm Progress Reports*, 679. [http://lib.dr.iastate.edu/farms\\_reports/679](http://lib.dr.iastate.edu/farms_reports/679).

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#### California Rice Straw

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