# Benefits and Drawbacks of In-Row Cover Crops in Vineyards

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Cover crops in vineyards in the Monterey County low rainfall production district are typically grown in a narrow band in the row middles. The berms under the row vines are typically kept free of vegetation by a combination of herbicides and mechanical cultivation. Cover crops are an important component of a comprehensive vineyard floor management system. They provide multiple benefits to the soil plant system by increasing levels of soil organic matter, nutrient cycling and water infiltration. Cover crops can also reduce levels of nutrient and sediment loss during winter storms. In a five-year study conducted in Monterey County from 2001-2005 we observed significant improvements in soil health parameters in the row middles where the cover crops are grown. There were increased levels of soil organic matter and microbial activity where the cover crops are grown, but few of these benefits occurred under the adjacent vine row (Smith et al, 2008). In addition, we observed that the majority of the roots occurred under the vine row where the drip emitters were located (root systems are probably limited due to our dry climate). As a follow-up to this study we conducted two trials evaluating the use of cover crops under the vine row in order to bring the soil benefits of cover crops to the soil under the vine where most of the roots are located. However, a key concern of growing cover crops under the vine row was the competitive effect of the cover crops on the growth of the vines due to competition for nutrients and water. In a real way, a cover crop under the vine row would act like a weed. In a low rainfall area such as Monterey County, any water used by the cover crop would have to be replaced by irrigation, which could have negative economic consequences for crop production. As a result, two trials were conducted to evaluate management of vine row cover crops to minimize the detrimental aspects of the cover crops and maximize the benefits that they can provide crop production and vineyard management.

**Methods:** Two trials with vine row barley cover crops were conducted from 2006 to 2010: 1) A small plot kill-date timing trial with five treatments - cover crops killed with glyphosate at the following heights: 0, 6, 12, 18 and 24 inches tall. And 2) a large scale trial with three treatments – standard cover crop in row middles and strip sprayed vine row; bare row middles and strip sprayed vine row; and cover crop planted in row middles and vine row, and vine row cover crop allowed to grow to 12 inches tall and then killed with glyphosate. The treatments were evaluated for the effects on soil and plant nutrition, soil microbial biomass, levels of soil moisture throughout the year, and crop yield and berry composition.

***Small plot trial:*** This trial allowed us to carefully examine the impact of allowing cover crops to grow in the vineyard for various periods of time. Allowing cover crops to grow to 24 inches tall was clearly detrimental to crop growth, and also reduced levels of nitrogen in the plants (Table 1). Interestingly, potassium levels in the plant were increased with cover crops allowed to grow for longer periods of time. Levels of soil moisture were reduced in the 24 inch treatment in the

late spring which may have accounted for the reduced growth observed in this treatment (Figure 1).

***Large plot trial:*** The small plot trial showed that allowing the cover crop to grow to 12 inches tall did not adversely affect the growth or yield of the vines. As a result, in this trial we allowed the in-row cover crop to grow to 12 inches tall and then killed it with glyphosate. As was observed in the small plot trial, there was a significant reduction in nitrate-N in the petiole tissue at bloom (Table 2). The cover crops increased the levels of soil organic matter in the berm by the third year (2008). Also, there was an increase in potassium and phosphorus. There was no affect of the cover crop treatment on yield. The in-row cover crop did reduce the amount of soil moisture in 2007 in early spring (Figure 2), but increased the levels of soil moisture during the end of the growing season in 2007 and 2008. The increase in late season moisture in the in-row cover crop treatment may have been due to improved infiltration of applied drip irrigation water. We were not able to directly measure greater infiltration in the treatments, but did observe less runoff of water where in-row cover crops were present (Photos 1 & 2).

**Conclusions:** In-row cover crops have the potential to compete with the vines in low rainfall areas such as Monterey County. In this sense, they can act like a weed. However, if carefully managed, they can provide long-term benefits to the soil under the vines where most of the roots are located. In these studies, we observed that killing the cover crop when they are 12 inches tall safeguarded the yield of the vines and increased the levels of soil organic matter by the third year of the practice. In-row cover crops do reduce the levels of nitrogen in the crop and care must be taken to offset this negative impact. We are not sure why, but in-row cover crops increased the potassium and phosphorus levels in the crop at bloom. We have indirect evidence that the in-row cover crops improved irrigation water infiltration from drip emitters as we observed high levels of soil moisture in the in-row cover crop treatments during the summer irrigation season.

Table 1. Small plot trial: Tissue nutrient levels (at bloom) and vine growth parameters, 2008

| Cover Crop Treatment | Petiole NO3-N ppm | Blade nitrogen percent | Petiole potassium percent | Blade potassium percent | Pruning weight kg/vine | Shoot weight grams |
|---|---|---|---|---|---|---|
| Standard - no cover | 591 a | 2.69 a | 1.81 c | 1.02 c | 1.33 a | 34 a |
| 6 inches tall | 504 a | 2.66 a | 1.94 bc | 1.04 bc | 1.28 a | 31 ab |
| 12 inches tall | 456 a | 2.70 a | 1.96 bc | 1.05 bc | 1.28 a | 31 ab |
| 18 inches tall | 608 a | 2.70 a | 2.15 ab | 1.09 ab | 1.33 a | 34 a |
| 24 inches tall | 149 b | 2.47 b | 2.35 a | 1.15 a | 1.05 b | 28 b |

Letter followed by the same letter do not differ. Mean separation by Duncan's multiple range test, 5% level.

Figure 1. Small plot trial: Soil moisture during the winter and spring

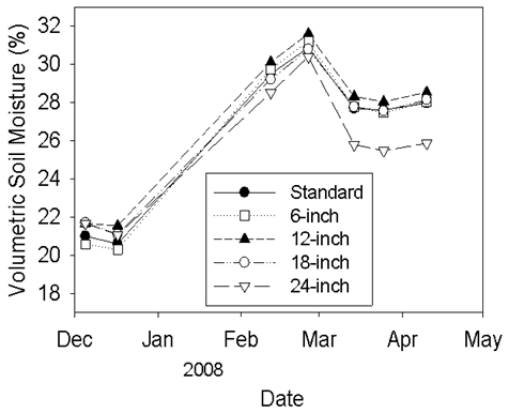
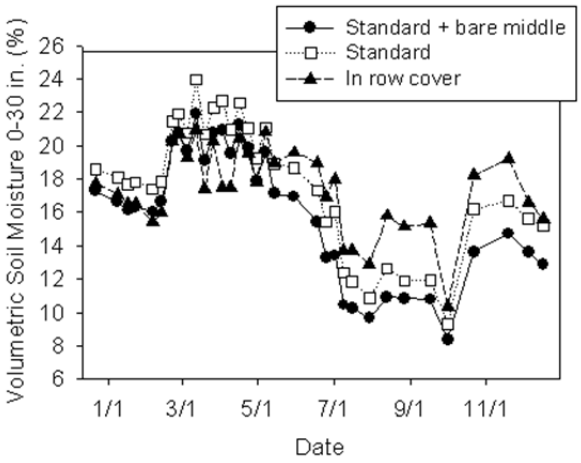



Table 2. Large plot trial: Tissue nutrient levels (at bloom) and vine growth , 2008

| Cover Crop Treatment | Petiole nitrate ppm | Petiole potassium percent | Petiole phosphorus percent | Soil organic matter % | Pruning weight kg/vine |
|---|---|---|---|---|---|
| Standard<br>Strip spray with cover crop in row middles | 900 b | 2.30 b | 0.43 b | 1.00 b | 1.60 a |
| No vegetation<br>Strip spray with bare row middles | 1238 a | 2.26 b | 0.39 b | 1.02 b | 1.54 a |
| In-row cover crop<br>Killed when 12" tall | 435 c | 2.66 a | 0.52 a | 1.12 a | 1.46 a |

Letter followed by the same letter do not differ. Mean separation by Duncan's multiple range test, 5% level.

Figure 2. Large plot trial: Soil moisture during the winter and spring and growing season



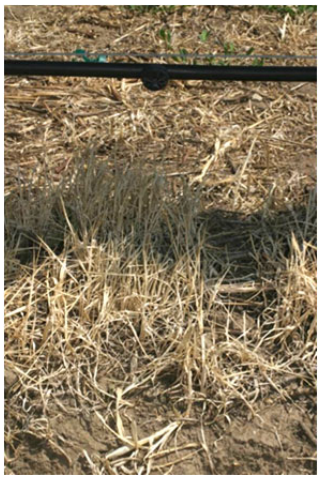



Photo 1. In-row cover crop

Photo 2. Standard bare berm
Note evidence of runoff below drip emitter