Southern Cover Crops
2016 CONFERENCE FACT SHEET

# Perennial Grass Cover Crops Can Optimize Wine Grape Growth

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Fig 1. Perennial grass planted under trellis and in the row middles as living mulch with standard herbicide-treated vine rows on the left. Photo Gill Giese

Fig. 2. Excessive grapevine growth is associated with increased fungal disease and may require remedial canopy management. Photo Gill Giese

Vineyard cover crops or 'living mulch' consists of either sown or native vegetation, grown in vineyard row middles and/or inclusive of the area under the vine trellis (Fig. 1). Although cover crops can increase pest pressure (arthropods and voles) and vineyard management costs (Karl, 2015), benefits of cover crops include: erosion and weed control, reduction of herbicide use and mitigation of *excessive* vine vigor. Excessive vegetative growth is a common problem in grafted wine grape vineyards in the humid eastern and Midwestern United States. Such vines are described as being "out of balance" (Fig. 2).

Wine grape producers seek to match or "balance" vine vegetative growth with reproductive growth. Vine "balance" is defined as matching a vine's capacity to its crop load (Vasconcelos and Castagnoli, 2000) and is associated with improved berry composition and wine quality (Smart and Robinson, 1991). Balanced vines typically produce sustainable crops of "quality" grapes that have minimal fungal disease infection and that provide the requisite flavor and aroma compounds desired in wine production.

Cover crop competition with grapevines for water and nutrients is the probable cause of vine growth reduction when cover crops are present (Giese et al., 2014). For example, previous research in arid growing regions has demonstrated that vineyards with cover cropped row middles use 19 to 46% more water compared to a vineyard with a bare floor (Ingels et al., 1998) and vines growing with cover crops produced less annual pruning weights (Tesic et al., 2010, Wolpert et al., 1993). Given these findings, we established a study in a warm, humid region to evaluate the ability of ground covers planted to the entire vineyard floor, including, directly under the trellis in the vine row, to compete with grapevines for water and nitrogen. Five complete vineyard floor cover crops were compared to the standard practice of sod row middles with a herbicide strip vine row in an established Cabernet Sauvignon (SO4 rootstock) vineyard in the Yadkin Valley of North Carolina from 2005 through 2010, with parts of it continuing through 2015. The five perennial grasses we used were KY-31 fescue, Aurora Gold (glyphosate-resistant) fine fescue, perennial ryegrass, orchardgrass, and Elite II fescue.

The amount of one year old wood removed from the vine every year during dormant pruning is a measurement we used to assess vine balance, and that is available to growers. Dormant cane pruning weights in excess of 0.50 lb per foot of cordon (semi-permanent vine arm) are associated with excessively vegetative vines (Kleiwer and Dokoozlian, 2005). In our North Carolina experiment, dormant cane weights were reduced each year across all cover crops, over the ten-year study period. There was a significant reduction in pruning weights with all cover crop within *most* years of the study, with little or no yield penalty due to cover crops. By 2010, there was an overall reduction in vine size compared to vine size measured at initiation of the experiement in 2005. Overall, dormant cane pruning weights were reduced 44% in Elite II vines from 2005 to 2010 and 63% from 2005 to 2013 in those same vines, relative to vines exposed to the herbicide strip. Elite II vines consistently produced pruning weights below the desired threshold of 0.50 lb/ft (Fig. 3).

However, by 2010, there was a less pronounced reduction in vine size due to cover crops as indicated by pruning weights. This suggests that vegetative growth as measured by dormant cane pruning weights is more affected by seasonal rainfall than cover crops in some years. Also, after ten consecutive years, the vines appeared to have acclimated to cover crop competition. Any alteration in the vine root system was apparently not drastic enough to reduce vine growth compared to vines grown with herbicide vine rows. With the exception of 2015, all dormant cane pruning weights were collected after vines were "hedged" (excessive shoot growth removed) during the growing season. Vines were not hedged during the 2015 growing season and pruning weights collected that year reflect an increased biomass regardless of cover crop (Fig. 3).

We concluded that vine size reduction was not directly attributed to competition for soil moisture by grass cover crops, as under-trellis soil moisture measured with a capacitance probe and vine water stress did not differ in vines exposed to cover crops compared to vines grown with the herbicide strip from 2006-2010. However, inadequate amounts of nitrogen in a grapevine can induce similar effects or symptoms as a water deficit (Keller, 2005). Cover crop competition for nitrogen was observed in our study, as some cover crops reduced vine petiole N measured at bloom in 2009. Furthermore, lower fruit N, as yeast available nitrogen (YAN) was measured in vines grown with under-trellis cover crops in 2009 (Table 1).

Although all cover crops favorably reduced final shoot length compared to vines grown with the herbicide strip, vines grown with orchardgrass had the greatest shoot length reduction. Final shoot length was reduced by 39% and rate of shoot growth by 46% in vines grown with orchardgrass compared to vines grown in the herbicide strip in 2007 (the driest year during the study). Canopy density reduction was minimal, but was consistently improved in vines grown with perennial grass cover crops compared to vines with no under-trellis cover crop present.

There are inconsistent differences in berry chemistry (titratable acidity, soluble solids and pH), berry skin color and phenolics in fruit due to cover crops compared to fruit from vines exposed to the herbicide strip. The amount and type of differences suggest specific influences of cover crop species, vineyard site, grape variety and rootstock (Giese et al. 2015, Hickey et al., 2016). Complete vineyard floor cover crops offer mitigation of erosion on steep sites, an alternative to repeated herbicide application and can improve vine balance and impact berry composition via: significant reduction in pruning weight and shoot growth and re-

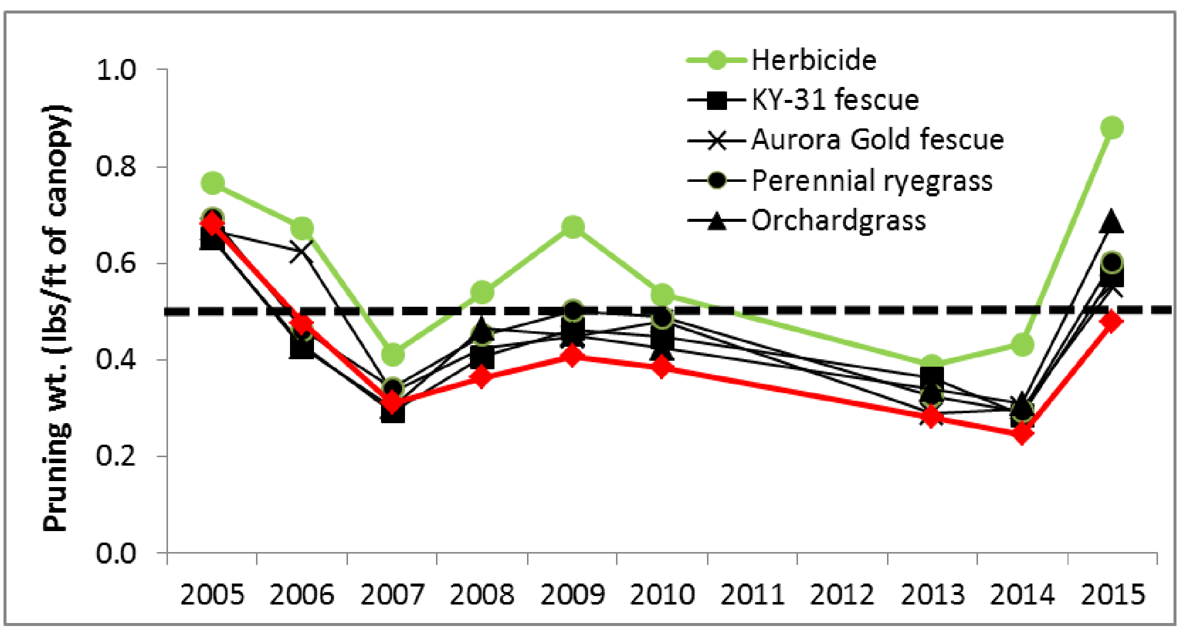


FIG 3. Dormant cane pruning weights (lbs/ft) of Cabernet Sauvignon vines, 2005-2011 and 2013-2015. Dotted horizontal line indicates maximum desired pruning weight (0.5 lb/ft.). Pruning weights were not collected in 2011 and 2012.

duction in % of petiole N and YAN. Growers can expect minimal reduction in soil water percentage due to cover crops at sites with deep soils and high water-holding capacity that are planted to vigorous varieties/rootstocks. Regardless of site characteristics, vineyards with cover crops should be monitored for possible yield reductions, vine water stress and nutrient deficiencies inclusive of YAN levels in grapes at harvest.

**Table 1. Yeast available nitrogen (YAN) of Cabernet Sauvignon grapes harvested from vines exposed to various cover crops or herbicide strip in 2009, Dobson, NC.**

| Cover crop | Yan (ppm)* |
|---|---|
| KY-31 fescue | 163 b ** |
| Perennial ryegrass | 188 ab |
| Orchardgrass | 180 ab |
| Herbicide strip | 210 a |

*Desired YAN levels for successful fermentations in most cases is 140 to 200 ppm, dependent on wine style, yeast strain and Brix or sugar level of the must.

** YAN values within a column followed by different letters are differ-

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This product was developed with support from the Southern Sustainable Agriculture Research and Education (Southern SARE) program, which is funded by the U.S. Department of Agriculture—National Institute of Food and Agriculture (USDA-NIFA). Any opinions, findings, conclusions or recommendations expressed within do not necessarily reflect the view of the Southern SARE program or the U.S. Department of Agriculture. USDA is an equal opportunity provider and employer.