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THE MIDWEST WINEGROWER

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Trellis end assemblies: a critical component of low maintenance, profitable vineyards

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Introduction

As the end assembly comes under more strain than any other portion of the trellis, a grower's choices for trellis end assemblies, system components, and installation methods have significant impacts on the longevity and profitability of a vineyard. End assemblies that fail may result in sagging trellis wires that make mechanized operations impractical or impossible, rows of grapes that are not harvestable by machine, and repairs that are at best inconvenient and costly, and at the worst make continued profitable operation impossible. To avoid these pitfalls, it's imperative that growers build trellises that offer a 25 year service life with minimal annual maintenance expenses. This can only be achieved through the selection of a properly engineered end assembly, the selection of high quality materials of adequate strength, and the use of optimal installation methods. Growers must examine trellising expenditures from a total cost standpoint, where the total cost includes initial material purchase price, cost

of installation, and maintenance or repair expenses over the system's serviceable life. When viewed in this fashion, growers should find value in the installation of properly designed, well constructed trellis end assemblies.

Types and Attributes of End Post Assemblies

In practice, the vine grower has three trellis end assemblies to select from: the externally braced tie-back or the internally braced "H-brace" or diagonal stay end assemblies. Each of these assemblies offers assets and liabilities that warrant careful consideration. Table 1 provides a brief summary of the attributes of each assembly.

The tie-back assembly (Figure 1) finds broad use in the Midwest grape industry and for good reasons – it is rapidly installed, economical, and of sufficient strength for most commonly used trellis systems in the region. Its principal disadvantage is that the external anchor slightly reduces plantable area of each acre of land. Additionally, the external strain assemblies must necessarily be placed in a position that invites damage by equipment impact. The tie-back system is commonly used for single-curtain trellises and is acceptable for use in rows up to 500 feet in length (United States Steel, 1982). Two primary components comprise this assembly - a stationary anchor and an end post, which is attached to the anchor with wraps of wire, heavy cable, or re-rod. For all but the shortest rows (under 200'), the author advises that the end post should be set no less than 3.5' in-ground, with 4' being preferable under high loads or where un-spaded metal end posts are

Table 1. Attributes of common vineyard trellis end assemblies.

Assembly Type	Approximate Load Capacity (lb) ^a	Relative Cost	Spatial Efficiency	Ease of Assembly
Tie-Back	2250	Low	Low	High
"H-Brace"	4500	High	High	Low
Diagonal Stay	6750	Medium	High	Medium

^a Adapted from Mollah (1997).

being utilized. While many growers' and the current author's experience suggests that reclining the end post approximately 30° off vertical (away from the vine row) increases the strength of this assembly, Mollah (1997) did not observe any significant differences in holding strength with canted posts over vertical ones. However, this may in part be due to the low-strength soils (wet and sandy) utilized in his studies, and perhaps also due to the fact that he did not test insertion angles greater than 10° from vertical. The perceived improvement in holding strength noted by growers may be attributable to the fact that with angled end posts, the combined forces of the strain and vine row wires may work in concert to counteract the lifting forces sometimes observed with vertical posts in weak soils.

Particularly where wooden and un-spaded metal posts are utilized as end posts, the stationary anchor provides the foundation for this end assembly. Many items have been used as stationary anchors for this system: screw-in earth anchors, various "dead man" assemblies, driven posts, etc. If screw-in earth anchors are to be used, it's advisable that they possess the following minimum



Figure 1. Tie back end assembly. Note the comparatively short distance between anchor and end post, single loop strain wire, and weak point in the post (saw kerf) at the point of wire attachment.

specifications: 1) 6" or larger diameter, fully-welded helix; 2) 5/8" diameter shaft no less than 36" in length; 3) weld-closed eye; and 4) galvanized to prevent corrosion. Longer anchors with larger helixes would likely be prudent under high-strain applications or in weak or wet soils. Earth anchors should be installed with the shaft of the anchor pointed directly toward the point of attachment on the end post, and in non-restrictive soils, this can be accomplished utilizing skid-loader or 3-pt.

mounted augers fitted with appropriate mounts to grip the anchor eyes. If driving the anchors at an angle isn't possible, or if restrictive soils prohibit "turn in" installation, an alternative installation method is to auger a vertical hole large enough to accommodate the anchor helix, then utilize a spade, crowbar or "spud bar" to form a narrow trench angled from the bottom of the anchor hole toward the top of the end post for the anchor shaft to lie in (Figure 2). This provides firm, undistributed soil for the helix to contact once tension is applied to the strain wire and prevents the anchor shaft from slicing through the soil toward the end post, which reduces strain wire tension and thereby necessitates frequent re-tensioning of the strain or trellis row wires.

As indicated above, a short (6') post of 5-6" diameter driven 4-4.5' also makes an excellent anchor, particularly when driven 30° off vertical, and some growers have found the driven post offers two additional benefits over screw-in earth anchors: the driven post can be installed more rapidly and provides a measure of protec-



Figure 2. Alternate anchor installation method for soils that prohibit "turn-in" anchor installation.

tion for the strain assemblies against implement impact near ground level. Additionally, the driven post may be installed successfully in stony soils if pilot holes of 2" diameter less than the post diameter are drilled with an auger or created with a water jet. Mollah (1989) pro-

vides specifications for several types of “dead man” anchors that performed better than screw-in anchors in his studies. In rocky soils, where auguring for or screwing in anchors is not practical, numerous proprietary “duckbill” style anchors are commercially available, but the holding strength of these units must be verified before they are selected for use. Regardless of the type of anchor selected, the distance between the base of the end post and the strain assembly attachment point of the anchor should be equal to or greater than the length of above-ground portion of the end post. This forms a structure similar to an equilateral triangle and helps maximize the holding strength of the anchor. Mollah (1997) advises the use of two full wraps of 2.8 mm (11 ga.) high-tensile wire to construct the strain assembly. When utilized in appropriate applications and installed correctly, the tie-back end assembly has been utilized with excellent success in the Midwest and many other viticultural regions. Failure of this assembly is often linked to one of four things:

Inadequate distance between end post base and anchor (Figure 3). When this distance is inadequate, the physics of the assembly are changed such that the load of the



Figure 3. Marginal tie-back assembly: note the leaning end post, short distance between post and anchor, and low strain wire attachment point.

trellis forces the end post to merely lift the anchor out of the soil instead of pulling the anchor directly through it.

Inappropriate application of the assembly. While the tie-back is a good end assembly when properly constructed, it is not adequate for high-strain applications unless tandem-anchor assemblies are utilized.

Inadequate anchors are utilized. Screw-in anchors with 6' helix and 36" shafts are true minimum standards, and as would be suspected, anchors with longer shafts and larger helixes typically offer greater holding strength. Weld-closed eyes are mandatory for screw-in anchors. Exercise good judgment and/or consult with an experienced, reputable supplier when selecting anchors – above-average loads (high yields, high wind loads, broad line post spacing) warrant larger anchors.

Inadequate strain assemblies (Figure 3) or tensioning methods are utilized. With the holding strength of the system being largely supplied by the anchor, but the load of the trellis directly transferred to the end post, the complete assembly is only as strong as the components transferring the load from the end posts to the anchor. Accordingly, the strain assembly components must be capable of withstanding much of the full load of the trellis on the end assemblies, which has been estimated at between 1575 and 3375 lbs. for a two wire trellis (Mollah, 1997; 1999). Therefore, growers must be certain that the components and methods utilized to construct strain assemblies are capable of withstanding these loads. Growers should remember that all knotting methods utilized for high tensile wire of 10 ga. and larger reduce wire strength by at least 25%, and reductions are generally greater as wire diameter is decreased (British Columbia Ministry of Agriculture, Food and Fisheries; 1984).

The “H-brace”, being a familiar structure for persons having built agricultural fencing, is a popular end assembly for Midwestern vineyards (Figure 4). It is particularly well suited for vineyards utilizing divided canopy training systems (GDC, Lyre, etc.) or where row length exceeds 500' (United States Steel, 1982). The theoretical strength of this structure is well documented but as Mollah (1997) noted, its performance in the field is somewhat limited by the tendency of either the horizontal stay or strain wires to break (utilizing oversized strain wires did not increase strength of the assembly due to horizontal brace failure in his studies). Nonetheless, Mollah (1999) identifies this assembly as one of the two capable of consistently meeting all foreseeable, typical loads on a vineyard end assembly. United States Steel (1982) provides the specifications in Table 2, be-

low, for single-span “H-brace” trellis end assemblies based upon anticipated loads for vertical trellises.

As for the tie-back assembly, the “H-brace” is prone to failure when certain conditions aren’t met. The primary pitfalls growers succumb to with this end assembly are

Inadequate horizontal brace length. When braces less than 8’ in length are utilized, lifting forces on the vertical end post can cause it to lift out of the soil (particularly in weak, non-cohesive soils), weakening

Table 2. Specifications for “H-brace” single-span end assemblies constructed with CCA-treated pine posts.

Row Length	End Post		Brace Post		Horizontal Brace Dimensions (dia. x length)	# Wire Wraps
	Dia.	Embedment	Dia.	Embedment		
10-500’	5”	3-3.5’	4”	3-4’	4” X 8’	2
500-2,000’	6”	3.5-4.0’	5”	4’	5” X 10’	2
2,000-4,000’	6-7”	4.0’	6”	4’	5” X 10’ or 6” X 12’	3

the structure to the point of failure (see Figure 5). Horizontal braces should never be less than 8’ for this end assembly.

Poor or missing strain wires (Figure 6). A properly constructed “H-brace” assembly features no less than 2 full wraps of wire (preferably 10-11 ga. high tensile wire or 9 ga. soft wire) to form a strain wire between the bottom of the end post and the vertical brace post at or slightly above the horizontal brace attachment point. These strain wires must be tensioned with a twitch stick or other durable tensioner to physically tie the two vertical posts together and keep them acting in concert with one another.

Inadequate post embedment depth. Given adequate post diameter and hence strength (United States Steel, 1982; Zabadal, 2006), the strength of this assembly is most limited by the strength afforded by the soil. Embedment depth is often the key determinant of success with the “H-brace” end assembly.

Inadequate attachment methods are used to join the vertical posts and horizontal brace. Growers should resist the temptation to “toenail” the horizontal braces in place for vineyard trellises. Although this practice is common in agricultural fencing, brace pins offer a more secure attachment method for trellis end assemblies.

The diagonal stay end assembly (Figure 7) is also used successfully in the Midwest. In addition to its increased strength over the “H-brace” under normal field conditions, which makes it a good choice for long rows, divided canopies and other high-strain applications, it offers the additional benefit that the diagonal stay counteracts some of the lifting forces imposed upon the end post when stays of adequate length are employed (Mollah, 1989; see Figure 8). Three principal factors



Figure 4. Well constructed “H-brace” end assembly.



Figure 5. “H-brace” end assembly with short horizontal stay – note the lifting force on the end post at soil level.

determine its strength: 1) diameter and embedment depth of the end (and brace) post(s), 2) length and diameter of the diagonal stay, and 3) the height at which the diagonal stay is attached to the end post. Smart and Robinson (1991) suggest the end post of this assembly should be of 6-7" diameter and driven 3' deep, although Mollah (1999) favors a post of 5-6" diameter embedded to a depth of 4'. As for the diagonal stay, Mollah (1997) noted that as the length of this member was increased, the strength of the assembly also increased. Accordingly, he recommends a stay post of 3-4" diameter and 10' in his 1999 publication, although the current author favors a stay of 4-5" diameter to assure adequate strength in high strain applications. The diagonal stay should be fixed to the side of the end post as close to the top as practically possible (but not directly to the top of the post), as Mollah (1997) noted significantly increased load-bearing capacity with increased stay attachment height. There are two principal methods of "fixing" the low (interior) end of the diagonal stay: 1) wedge it against a vertical brace post, or 2) attach a large "foot" to the low end of the diagonal stay and rest it upon firm, undisturbed soil. In the Midwest, the former method is most popular: a 4-5" or 5-6" X 5-6' post driven 3.5-4' serves adequately.

Historically, the diagonal stay has been somewhat tedious to construct, either because the end and brace posts had to be notched to accommodate the diagonal stay (which weakens both vertical posts), or due to the practical (but necessary) challenge of mating brace pins inserted in the center of the diagonal stays to the vertical end and brace posts. Metal brackets of adequate strength are now commercially available that provide a rapid method of joining the vertical posts and diagonal stay. As noted by Mollah (1999), the brackets reduce assembly time of the diagonal stay to below that of the "H-brace" assembly and preserve the holding strength of the assembly at a modest cost.

Post Selection and Installation

Growers today have many choices in selecting materials for trellis end assemblies. While the standard material in many regions continues to be CCA-treated pine posts, other materials such as metal posts and native wood species are also being employed. CCA-treated posts are standard materials for trellis end assemblies because their strength and longevity have been tested – both in the laboratory and in the field. They are sufficiently strong (provided posts of adequate diameter are utilized), offer good longevity when pressure-treated, and are straight – a key consideration because this facilitates installation with a post driver. CCA-treated posts should be treated to AWPA specification C-16, which specifies a retention level of 0.4 lbs. of preservative per



Figure 6. "H-brace" with missing strain wires – note the excessive post lean into the vine row.



Figure 7. Well constructed diagonal stay end assembly, except for the comparatively short stay length and the notched end and brace posts, which weakens them. Photo courtesy of Andy Allen.

cubic foot of wood (Zabadal, 2006).

Metal posts suitable for end post assemblies are also available, and many can be driven with hydraulic post drivers. The primary advantages of metal end posts are that their strength varies less between individual units than wooden posts, they are not prone to decay, and they are less bulky than wood posts which may afford some freight savings on large installations. They are also more easily and precisely installed in stony soils than wood posts. It is important to note that metal vineyard posts are available in a wide range of gauges and profiles, and that objective strength testing for some of these products is not readily available. Additionally, growers must consider the potential for weakening of untreated metal posts by corrosion due to soil and water

chemistry and/or fertilization practices. *Growers must be certain to purchase metal vineyard trellis products from an experienced, reputable supplier who can make recommendations for products and installation methods that produce trellises of sufficient strength in soils present on the grower's vineyard site.*

The majority of metal post products designed for end assemblies are most compatible with the tie-back assembly, but some are also adaptable to the "H-brace" and diagonal stay assemblies.

Traditionally, trellises were built utilizing native wood species, and these materials continue to find limited use in vineyard end assemblies today. Two primary limitations restrict the use of native species: 1) many do not



Figure 8. Diagonal stay end assembly with excessively short stay length, resulting in lifting of the end post and generally weak structure. Photo courtesy of Andy Allen.

produce straight posts, which commonly prohibit use of a post driver and may limit vineyard mechanization opportunities, and 2) many are not sufficiently rot-resistant to offer a 25 year serviceable life. Posts from Osage Orange ("Hedge"; "Bois d'Arc") and Black Locust trees are known to overcome the latter concern, and generally serve adequately as posts in hand-tended vineyards. Growers considering other tree species for vineyard posts should consult with a forestry specialist and inquire of their strength and rot resistance before selecting them for use. Regardless of the available species, growers are urged to consider all costs associated with acquiring and installing posts from native species – many growers opt for commercially-available products after

"pushing the pencil." Growers considering other, alternative materials for end assemblies must consider their strength, practical installation methods, and whether the materials are conducive to modern production practices (i.e., railroad ties are not compatible with some grape harvesters).

Grape producers pursuing organic certification have an additional limitation to consider: not all materials are permitted in certified organic production systems. Many wood preservatives and some galvanizing compounds have historically been disallowed for use in organic systems, which has eliminated most preservative-treated wood posts and some types of galvanized metal posts as acceptable trellising options for vineyards seeking organic certification. Accordingly, wood posts from native species and untreated metal posts have been common choices for certified organic vineyards (Oster, 2008). Persons intending to seek organic certification for their vineyard(s) are urged to contact their certifier prior to selecting trellising materials to obtain the most current information on allowed and prohibited materials. Because posts rammed into the ground resist overturning 1.5 times more than those set and tamped by hand into augured holes (Mollah, 1989), installing posts with hydraulic post pounders or "wobble drivers" is greatly preferred. This is so for all vineyard posts, but particularly true for end assembly posts where maximum holding strength is required. Driving posts instead of auguring and hand setting them increases holding strength by compacting the soil on the sides of the posts. In heavy, dense soils, it may be advisable to create pilot holes (diameter of 2" smaller than the posts) with an auger or water jet prior to driving posts. Posts driven into the soil should be inserted with the narrow end down to obtain the tightest possible "fit" between soil and post.

In situations where driving posts isn't possible, auguring and hand setting is the only option. If low diameter, round metal posts are being utilized, it will likely be necessary to set the posts in concrete to improve holding strength. Wood posts, however, should never be set in concrete as moisture can perch on top of the concrete and in the small spaces between the post and concrete, thereby accelerating the rate of decay in the post. Some growers report that hand-setting with crushed limestone rock rather than soil yields a firmer post more rapidly, and doing so would alleviate the decay concerns associated with concrete. Posts being backfilled into augured holes should be set with the large diameter end in the soil to take full advantage of the posts' strength.

Where metal end posts are utilized, it is advisable for the grower to consult with their post supplier to determine the available and preferred methods of attaching any

necessary strain wires and other trellis wires to the end posts. Where wood posts are utilized, staples are the customary method of attachment. Staples utilized in vineyard trellising should be no less than 1.75" long, barbed and galvanized with slash-cut points to facilitate longevity and provide adequate holding strength. Double-stapling is advisable on all strain wire assemblies to assure longevity of the installation.

Summary

As end assemblies suffer the greatest strain of any trellis system component, growers must select assemblies of adequate strength and install them correctly to assure the longevity of their trellises. The tie-back, "H-brace" and diagonal stay assemblies all serve well in the Midwest U.S. when utilized appropriately and installed correctly. Utilizing the correct assembly configuration, driving posts whenever possible, and utilizing adequate strain wires, anchors and stays are the keys to building trellis end assemblies that provide long service life with low total costs.

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The importance of pH during winemaking

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Abstract

Wine acidity measured as pH impacts both winemaking techniques employed and wine quality. Wine pH is known to influence parameters such as longevity, susceptibility to oxidation, color and susceptibility to wine spoilage organisms.

What is pH?

pH is a measurement of a wines acidity and is termed by some as true acidity (Ribereau-Gayon et al., 2006). pH is a scale measurement related to the concentration of hydrogen ions in solution. The range of pH scale is from 1-14, 1 being the most acidic, 14 the most basic or alkaline and a pH of 7.0 is considered neutral. Wine pH is commonly between 3.0-3.6.

The idea of pH is described mathematically as the negative log of the concentration of hydrogen ions (H^+) in solution (Ribereau-Gayon et al., 2006). Therefore a solution with a pH of 1 is ten times more acidic than one with a pH of 2.

Wine pH is influenced not only by the amount of acid (titratable acidity) but also by the concentrations of weaker acids such as malic acid and the presence of ions such as potassium and magnesium. High malate high potassium juice is commonly found to have high pH. In contrast high tartaric acid, low potassium juice commonly produces wines with low pH.

How do winemakers measure pH?

Winemakers measure pH using a pH meter. Different pH meters have slightly different procedures for calibration and will have a direction booklet and on screen directions on the meter to follow. A method based on (Iland et al., 2000) involves the following steps:

1. Calibrate the pH meter using commercial standard buffer solutions most commonly two, one at pH 7.0 and another at pH 4.0. Adjustments for temperature differences between sample and buffers may need to be undertaken.
2. Pour enough juice or wine in a small beaker (100mL) so that the volume of juice covers the tip of the electrode completely. Ensure that juice samples are free from solids which can interfere with the stabilization of

readings by interfering with the electrode.

3. Place the electrode in the middle of the beaker, without touching the bottom of the beaker.

4. Slowly stir the sample.

5. The pH value will display on the pH meter. Wait for the value to stabilize and record the value.

Rinse electrode with purified water and return to storage solution. Do not leave electrode immersed in water or wine for longer than necessary. Also it is important not to let the electrode to dry out.

The range of pH values for wines range from 2.8-4.0 (Ribereau-Gayon et al., 2006).

How does pH influence winemaking procedures?

Winemaking procedures are influenced by wine pH and winemakers may need to employ more rigorous strategies to prevent oxidation and microbial infection in wine. Such strategies include altering SO₂ (sulfur dioxide) addition rates, making acid adjustments and paying special attention to anaerobic winemaking and storage.

Low pH impedes the development of microorganisms and increases the antiseptic action of SO₂ (Ribereau-Gayon et al., 2006). At higher pH levels winemakers must make higher addition rates of SO₂. See Table 1 below for rates of free sulfur needed at different wine pH in white wines to give adequate protection from oxidation and bacterial infection under adequate storage and sanitary conditions.

Table 1. pH and corresponding free sulfur for microbial inhibition and prevention of oxidation in white wines from Rankine (2004).

pH	Free SO ₂ (ppm/mg/L)
3.0	13
3.1	16
3.2	21
3.3	26
3.4	32
3.5	40
3.6	50
3.7	60

Acid adjustments may be made to wines in order to lower a wine's pH if the winemaker believes it is necessary. In general white wine pH within the range of 3.0-3.4 and red wine higher 3.3-3.6 are thought to be within a stable range (Jackson, 2000). Outside these parameters

a winemaker may choose to acidify normally using tartaric acid to reduce wine pH. Tartaric acid is used preferentially as it is a stronger acid than malic acid and is not a substrate for lactic acid bacteria.

Winery gymnastics are often employed in Midwest commercial wineries to insure wine pH is within a reasonable range. During less favorable seasons it is common for winemakers to use grapes with both a high pH and high titratable acidity. Winemaking strategies employed include making acid additions at the juice stage to bring the juice within an acceptable pH range, putting wines through malo-lactic fermentation to soften the green acid flavor, followed by subsequent acid additions to again reign in a wines pH. Finally at the end of wine processing prior to bottling deacidify for flavor and balance! Not exactly winemaking for the faint hearted.

Anaerobic winemaking involves the purposeful exclusion of air during winemaking to prevent oxygen dissolving in wine causing oxidation. If a wine's pH is high then a winemaker will pay close attention to any exposure wine has to air as a wine with a high pH is less stable against oxidative reactions. The winemaker will be careful to employ the use of inert gas during wine storage and transfer as well as insure vessels are completely topped. Wines can suffer flavor flatness, off aromas and flavors, and browning when oxidation occurs.

How does pH influence wine quality?

High pH wines have been described by Ribereau-Gayon, Dubourdieu et al. (2000) as sustaining "a more or less anarchic bacterial growth of a large variety of bacteria and are thus susceptible to spoilage". Spoilage organisms do not normally grow in wines with a pH below 3.5 however their ability to grow increases significantly between pH 3.5 to 4.0 and above (Jackson, 2000). In addition to reducing growth rates a low pH makes SO₂ more active against spoilage bacteria such as *Brettanomyces* spp. organisms known to cause feral, barnyard off aromas. A free SO₂ level of 30ppm is known to completely eliminate active populations of *Brettanomyces* spp. after 30 days (Ribereau-Gayon et al., 2006). However, the addition of SO₂ after infection will not remove the off aromas already present from prior *Brettanomyces* spp. infection it will only serve to halt bacterial action and further spoilage.

Low wine pH increases red wine color through favoring the flavylium state of anthocyanins (Jackson, 2000). It is estimated that at a pH of 3.4-3.6 flavylium ions make up about 20-25% of the anthocyanin content in red wine (Jackson, 2000). By comparison a wine at a pH of 4.0 has only about 10% of the anthocyanin content in the red colored flavylium state (Jackson, 2000).

High pH enhances the wines potential for both red and white wine oxidation. Phenolic compounds are more susceptible to browning and the longevity of a wine is impacted. The rate oxidation of phenolic compounds increases at high pH levels. The auto-oxidation rate of a wine at a pH of 4.0 is nine times greater than a wine with a pH of 3.0 (Singleton, 1987). Wine oxidation negatively impacts the sensory profile of a wine including browning, harsh and acidic flavors and off aromas. It is not completely understood why a low pH appears to slow the rate of white wine aging. White wines have a much lower concentrations of phenolic compounds compared with red wines. Phenolic compounds are attributed with longer aging potential in red wines. The best understood is the effect that a low pH has on the anthocyanin pigments in red wine (Jackson, 2000). However white wine such as quality Rieslings are also known to have good aging potential. The reason behind the age ability of white wines is less understood. One thing white wines with long aging potential have in common is low pH. Other studies have investigated the effect of pH on the ester formation between alcohol and acid precursors in wine (Edwards et al., 1985). The esterification of tartaric acid in high acid low pH wines has been shown to soften wine acid making the wines more drinkable and approachable (Edwards et al., 1985).

Conclusion

Wine pH is an important factor in quality winemaking. Wines with a high pH are less able to age well, and are not as resistant to oxidative and microbial spoilage as low pH wines. More research as to the exact mechanisms behind low pH and wine longevity particularly in white wine production needs to be undertaken. More input and strategies need to be employed by the wine-maker to ensure a sound commercial quality wine is produced from high pH fruit. Under Midwest conditions it may be necessary for pH adjustments to be undertaken regularly during some seasons particularly when fruit ripens with high pH and high TA often as a result of high levels of malic acid and potassium.

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Scholarships

Eastern Section ASEV Scholarships Available

The Eastern Section of the American Society for Enology & Viticulture is proud to announce the continuation of their annual scholarship program. Funds for this program have been established through the generous contributions of the Eastern U.S. wine and grape industry and associated fund raising events. The ASEV/ES thanks all of the kind contributors to this scholarship program.

The Scholarship

At least one scholarship will be awarded for the 2009/2010 academic year in the amount of \$1000. Award(s) will be decided by June 1, 2009 and scholarship recipient(s) will be invited to attend the ASEV/ES annual meeting in Painesville, Ohio (July 20-22, 2009) with free registration and three nights lodging (meeting attendance is not mandatory for scholarship eligibility).

Eligibility

Eligible students include upper level undergraduates (third and fourth year students) and graduate students who must:

- 1) Be enrolled in an accredited college or university for the entire 2007-2008 academic year within the boundaries of the ASEV Eastern Section (all states east of the western boundaries of Minnesota, Iowa, Missouri, Arkansas, and Louisiana, and the Canadian provinces east of the Ontario-Manitoba border)
- 2) Be or plan to be enrolled in enology or viticulture, or in an allied curriculum that emphasizes a science basic to the wine (e.g., microbiology) or grape (e.g., entomology) industry, with a specialization in wine or grape studies.
- 3) Demonstrate scholastic achievement and provide transcripts of previous education.

Application

The application form can be downloaded from:

<http://www.nysaes.cornell.edu/fst/asev/>

For questions, contact:

Dr. Terry Bates

Phone: 716-672-2175

Cornell University Vineyard Laboratory

email: trb7@cornell.edu

412 East Main Street

Fredonia, NY 14063

Application Deadline

Completed applications must be received on or before

April 17, 2009.

Call for Abstracts or Papers

*Winegrowing for the 21st Century
Dealing with the stresses of a changing climate*

July 20-22, 2009

Renaissance Quail Hollow Resort

11080 Concord-Hambden Road

Painesville, OH 44077

*American Society for Enology and Viticulture Eastern
Section Call for Papers*

2009 Annual Conference; July 20-22

Painesville, Ohio

You are cordially invited to submit an abstract for a technical paper presentation on wine or grape related research at the 34th Annual Conference of the American Society for Enology and Viticulture-Eastern Section. The venue is the Renaissance Quail Hollow Resort in Painesville, Ohio. Please encourage students to participate in the student paper competition - they are the future leaders of our industry. One day of technical sessions is scheduled for Tuesday, July 21 and will consist of presentations by scientists and students conducting research in the fields of viticulture and enology. A post-conference symposium entitled "Winegrowing in the 21st Century: Vines and Wines in a Changing Climate" will be held on Wednesday, July 22, and feature presentations by national and international experts.

Instructions to Authors of Technical Paper Presentations

Those wishing to present a paper or poster must prepare an abstract of their presentation using the following prescribed format. Please submit your abstract and author information to Dr. Keith Striegler electronically at the

address below. After review by the Program Committee, accepted abstracts will be forwarded to the American Journal of Enology and Viticulture (AJEV) for publication in the Journal. Please contact Keith Striegler if you require further information or cannot submit an electronic version of your abstract.

Please send completed electronic abstracts to:

Dr. Keith Striegler

Institute for Continental Climate Viticulture & Enology

University of Missouri

108 Eckles Hall

Columbia, MO 65211-5140

Telephone: (573) 882-6681

FAX: (573) 884-8212

Email: stieglerk@missouri.edu

DEADLINE FOR ABSTRACTS: April 17, 2009

Authors will be notified of acceptance by May 15, 2009.

Call For Papers: ASEV-ES, 2009 Annual Conference, Painesville, Ohio

Appropriate presentation topics include:

- 1) **Viticulture**, including related aspects of pest management, agronomy, agricultural engineering, economics, new products and new technologies.
- 2) **Enology**, laboratory techniques, new processing technology and products, and sensory science, including related aspects of wine chemistry, flavor chemistry, and wine microbiology.
- 3) **Marketing**, sales, and health related topics.

Oral Presentations

Oral presentations will be limited to a total time of 20 minutes. Speakers should leave time at the end of their presentations for questions. Session moderators will be strict in keeping the program on schedule. If you have a special need for more time, (for tasting or demonstrations) please let us know. Visual aid equipment available will only include an LCD digital (PowerPoint) projector.

Poster Presentations

The main focus of our Annual Conference is the oral presentation of papers at the technical session with opportunity for questions and answers. We will schedule a poster session if the number of abstracts exceeds our oral presentation timeframe. However, the ASEV-ES Board reserves the right to cancel the poster session and schedule oral presentations only. Authors will be informed of such a decision well in advance of the meeting. Posters must be no larger than 4 feet x 5 feet (1.2 m x 1.5 m). They will be displayed in an assigned area, and the presenting author will be scheduled to attend their poster for a prescribed period to answer questions.

and discuss findings. Authors are responsible for mounting and removing their posters, using pins or Velcro adhesive. Prepare your poster to be legible from a distance of 3 feet (1 m) or more. A useful guide to poster preparation appears at the ASEV website at www.asev.org. There will be no materials available at the meeting to enhance your poster; it must be entirely prepared in advance.

Student Paper Award Guidelines

The ASEV-ES recognizes and awards exceptional student research. Two awards of \$500 each are offered - one for the best viticulture paper and one for the best enology paper. Student papers must conform to the instructions for oral presentations listed in this document. Student papers should take 15 to 17 minutes, and will be followed by 3 to 5 minute question period. Students may present more than one paper at the meeting; however, only one paper, designated on the abstract form, is eligible for competition. All competition papers will be presented at the same session. Student presentations will be evaluated by the Scholarship Committee of the ASEV-ES, and awards will be presented at the banquet. Presentations will be judged on three main points: scientific merit, presentation quality, and speaker's ability to respond to questions and comments. To receive an award, students must also attend the awards banquet.

In addition to the \$500 award, the ASEV-ES will cover recipients' costs of accommodation, meeting registration, meals and banquet ticket. Abstract and Author Information Form 34th Eastern Section ASEV Annual Conference July 20-22, 2009 Painesville, Ohio

Please submit an electronic copy of your abstract and author information via e-mail to Keith Striegler (strieglerk@missouri.edu) by **April 17, 2009**. Please utilize one of the major word processing programs such as Microsoft Word to complete information in parts A-F.

A. Title (in upper and lower case):

The title in **bold type** should reflect the important aspects of the article as concisely as possible, and preferably in no more than 100 characters and spaces. Do not use both common and scientific names in the title.

B. By-line (in upper and lower case):

List author(s) name(s) beneath the title. The presenting author(s)' names should be in **bold type** or underlined. The author to whom correspondence should be addressed should be noted with an asterisk (*). The corresponding author's complete current address should be given in a separate paragraph below the by-line.

C. Abstract:

The text of the abstract (250 words maximum) should start on the next line with no paragraph indentations and should state specifically and informatively the objectives of the research and the results obtained. Do not use indefinite statements (e.g., "the results will be discussed.")

Sample Abstract

Format for ASEV Eastern Section Annual Conference Abstracts

John Q. Smith, and Sandra E. Person*.

American University of Enology and Viticulture, 101 Vineyard Avenue, Finger Lakes, NY 10001-3456, U.S.A.

For a uniform appearance, it is important that the title be upper and lower case, as illustrated above, and that the author's names in the by-line appear (first name first) with the presenting author's name in **bold face**. An asterisk (*) should denote the corresponding author. The full address of the corresponding author (unabbreviated) should follow the authors' names. The text of the abstract (250 words maximum) should be started on the next line with no indentation. Accepted abstracts are forwarded to the American Journal of Enology and Viticulture (AJEV) for publication in the Journal.

D. Additional author information required by the Program Committee (not forwarded to AJEV):

- Mailing address
- Telephone
- Fax
- E-mail address

E. Please indicate your preference for an oral presentation or poster presentation.

F. Please indicate if the abstract is submitted for the **Student Paper Competition**.

DEADLINE FOR ABSTRACTS: April 17, 2009

ICCVE Update

2009 Midwest Grape and Wine Conference

The Midwest Grape and Wine Conference was held at Tan-Tar-A Resort in Osage Beach, Missouri from February 6-9, 2009. The conference included sessions on Introductory Viticulture & Enology, Viticulture & Enology and an Advanced Symposium on Sustainability in Vineyards and Wineries.

The conference hosted a number of internationally recognized speakers from key winegrowing regions all over the US and the world including Missouri, Washington, Oregon, California and Australia.

Introductory Viticulture

The Introductory Viticulture Sessions held on Saturday February 7, 2009 provided a strong basis for beginning grape growers which focused on vineyard management. Andy Allen, Extension Viticulturist from the ICCVE at the University of Missouri, moderated the sessions and spoke on berry development and grower/winery relations. Allen's presentation, 'Berry Development and Vineyard Management Influences' focused on the development and growth of the grape berry from fruit-set through harvest of the fruit. Allen's second presentation titled, 'Selling Your Grapes: Contracts and Grower/Winery Relations' addressed the different views of grapegrowers and wineries and discussed various elements often included in contracts and responsibilities of the parties involved.

Dr. Tim Martinson, Senior Extension Associate from Cornell University spoke on 'Vine Dormancy and Cold Hardiness'. Martinson discussed the changes that occur within the grapevine when entering and coming out of dormancy as well as how the vine deals with and recovers from winter injury with descriptions of healthy and injured tissues due to winter damage. Additionally, Martinson mentioned management strategies growers may employ to prevent and recover from winter injury.

Patrick Byers, Regional Horticulture Specialist from the University of Missouri, gave a detailed presentation entitled, 'Maintenance of Vineyard Drip Irrigation Systems' including components necessary for trickle irrigation and their function, designing trickle irrigation systems, and maintaining them throughout the year.

Eli Bergmeier, Viticulture Research Specialist from the ICCVE, drew in a full house for his presentation, 'Cutting Your Costs without Cutting Your Throat'.

Methods in cost savings discussed included increasing efficiency of your operation, eliminating certain tasks, and possible means of increasing revenues.

Jackie Harris, Viticulture Extension Assistant from the ICCVE, wrapped up the session with 'Rootstocks for Winegrapes'. The use of rootstocks historically and currently was covered along with why they may be needed in the Midwest and descriptions of common commercial rootstocks.

Introductory Enology

The Introductory Enology Sessions were held on Sunday Feb 8th from 8:30am- 11:30am and gave those interested in commercial winemaking an overview of some of the basics of commercial winemaking. The sessions were moderated by Rebecca Ford-Kapoor of the ICCVE.

Ford-Kapoor, Extension Enologist for the ICCVE, presented on basic winemaking procedures from crush to bottling for beginning winemakers, red winemaking procedures versus white wine and wine and juice analysis.

Dr Brent Trela, Associate Professor and Extension Enologist for Texas Tech and A & M spoke on equipment needs for wineries. Equipment choices from harvest to fermentation including destemmer crushers, tanks, cellar accessories and pumps were discussed.

Dr James Osborne, Assistant Professor and Extension Specialist for Oregon State University spoke on the importance of winery sanitation principles, developing a sanitation program, cleaning and sanitizing agents, CCP (critical control points) and sanitation monitoring.

Viticulture

The Viticulture Session was held on Monday, February 9, 2009 and was moderated by Andy Allen.

Dr. Mercy Olmstead, Viticulture Specialist from Washington State University presented on 'Attraction and Retention of Beneficial Insects in Vineyards'. The use of beneficial insects to control insect pests can reduce the need for pesticide applications and is an attractive alternative method of pest control for organic or sustainable vineyards. The attraction of beneficial insects requires the use of flowering cover crops that provide nectar or pollen for the insects. Olmstead discussed results of recent cover crop research in Washington state designed to increase the population of beneficial insects in vineyards.

Dr. Keith Patterson, Professor of Viticulture from Cali-

ifornia Polytechnic State University, spoke on the topic of yield and how it relates to quality in a presentation titled 'Hitting Your Sweetspot: Does Yield=Quality'. It has long been thought that yield has a direct linear relationship with quality, however, that may not be the case. Patterson refuted this idea and stated that it did not account for site to site variation. The consensus was that rather than measuring yield in terms of tons/acre a more precise determination of the yield-quality relationship could be made by measuring yield in terms of lbs/ft of trellis as this is probably a more accurate measure.

The final speaker for the Viticulture Session was Dr. Paul Schreiner, Plant Physiologist, from USDA-ARS in Corvallis. Schreiner gave an informative presentation titled 'Nutrient Uptake and Use in Grapevines'. Topics discussed were how nutrients were taken up from the soil with the assistance of mycorrhizal fungi, managing nutrition within the vineyard by scouting, tissue and soil nutrient testing, and concluded with a study on nutrient uptake based on the whole vine.

Enology

The Enology session was held on Monday February 9th from 1:00pm-4:00pm. The session was moderated by Rebecca Ford-Kapoor from the ICCVE at the University of Missouri.

Ford-Kapoor spoke about how to control oxidation during winemaking focusing on basic chemistry of oxidation, the effects of oxidation on wine quality, and practical winery procedures for controlling oxidation.

Dr Brent Trela presented on the chemistry of grape and wine acidity, how acidity is measured by winemakers and methods for adjusting acidity in must and wine.

Dr James Osborne presented on the importance of energy efficiency in the winery, the major areas of energy use in the winery, simple and advanced options for saving on energy use and gave some examples of energy use in some Oregon wineries.

The Advanced Symposium on Sustainability in Vineyards and Wineries

The theme for this year's two day Advanced Viticulture Symposium was Sustainability in Vineyards and Wineries. The session held on Saturday, February 7, 2009 was moderated by Dr. R. Keith Striegler, Director and Viticulture Program Leader of the ICCVE and the Sunday session was moderated by Eli Bergmeier.

Dr Cliff Ohmart, Director of Sustainable Winegrowing for the Lodi Wine Grape Commission spoke about what sustainable winegrowing is and from where the concept

came and also about the Lodi sustainable winegrowing program in California.

Dr Paul Schreiner presented on vineyard soil health and vineyard soil biota in relation to the variety of organisms in the soil, the principles of soil nutrient cycling and the biology of arbuscular mycorrhizal fungi.

Dr Mercy Olmstead spoke on current work being done in the Pacific Northwest to increase sustainability and environmental stewardship through the development of a group known as Low Input Viticulture and Enology (LIVE) and the main goals for this group. Also discussed were the research and extension efforts being done to increase sustainable practice use in the Pacific Northwest.

Dr Tim Martinson presented on New York's sustainable viticulture program known as VineBalance as an offshoot of earlier work establishing Agricultural Environmental Management (AEM) in the Finger Lakes region. A workbook called the New York Guide to Sustainable Viticulture Practices has led to growers assessing growing practices including areas of vineyard establishment, soil conservation, integrated pest management, and pesticide management.

Dr. R. Keith Striegler presented the project, 'Vineyard Best Management Practices for Missouri and the Ozark Mountain Region: Principles, Practices, and Progress'. This project involved monitoring for common regional pests and installing weather stations throughout the Ozark Mountain Region to aid growers in improving timing of chemical spray applications to reduce the number of sprays. This information was presented to growers at four rounds of tailgate meetings each year as well as management strategies to promote less disease and pest problems, improve fruit quality, and vineyard health. Striegler pointed out that growers were interested in the information, however, most did not have the time to monitor pests and run disease models. A new project was proposed to help provide the information to growers in a timely manner and use predictive software making it more assessable and useful for the grower.

Chris Savage, Senior Director of Global Environmental Affairs for E. & J. Gallo Winery gave his experience in reducing winery water use and energy. His presentation 'An Overview of Comprehensive Guide to Sustainable Management of Winery Water and Associated Energy' showed how both small and large wineries could reduce their energy and water use while at the same time saving money. It was emphasized that management personnel who determine the practices need to continually monitor and enforce them. In their particular situation, which

would vary from winery to winery they were able to see a savings of one third on their water and energy use costs.

Larry Lockshin, Head of Wine Marketing Group at the University of South Australia in Adelaide received confused responses to his title 'Marketing of Bio-Orgo-Carbon Neutral-Enviro-Sustainable-Fair Trade-Dynamic Wine. The title reinforced the purpose of his topic which concerned marketing wine made from these so called 'green' methods. The meaning of these terms is not often well understood nor is the difference between them. To determine what the consumers actually understood and which of these terms would cause them to be more likely to purchase or pay more for wine was tested by internet based surveys. Interestingly they determined that women are more concerned with environmentally friendly wines than men and if these wines are to be more accepted and favored marketing techniques need to be employed to educate consumers.

The 2010 Midwest Grape and Wine Conference to be held February 6-8 at Tan Tar A Resort, Osage Beach, Missouri.

2009 Midwest Grape and Wine Conference Proceedings Available

Proceedings for the Advanced Symposium on Sustainability in Vineyards and Wineries is available through

the University of Missouri Extension Publications web-site below:

<http://extension.missouri.edu/explore/winegrape/wg1003.htm>

2009 Spray Guides Available

The **2009 Midwest Commercial Small Fruit and Grape Spray Guides** are now available. Funding for purchase of the spray guides was provided by the Missouri Wine and Grape Board for commercial grape growers. Spray guides will be available at Best Management Practices Tailgate meetings in April and June. Spray guides may additionally be obtained from local University of Missouri Horticulture and Agronomy County Extension Specialists.

Missouri Regional Cuisines Project Concludes Successful Series of Organizational Meetings along the Missouri River

The MRPC held six organizational meetings over the fall of 2008, two in each new region along the Missouri River (Old Trail, Manitou Bluffs, Missouri River Valley). An average of 58 persons attended each meeting, events such as marketing and bus tours, a "passport" project, and engagement with farmers markets (Old Trails); an integrated information center with hard and cyber material including information on events, lodging,



Figure 1. The 2009 Midwest Grape and Wine Conference, Enology Session.

producer, products, and regional stories (Manitou Bluffs); and a logo, brochure, map and website (Missouri River Valley). An average of 91% of participants, when surveyed at the meetings, responded that strengthening their regional networking would have a “big, or very big” impact on regional tourism. Follow up meetings with regional leaders who volunteered to work towards these objectives will be organized in the coming weeks. For more information, contact Beth Barham at MRCP, (573) 882-7302.

2009 ICCVE Pruning Workshops

ICCVE pruning workshops this year were held in Missouri at Chaumette Vineyard and Winery on February 13th in Ste. Genevieve, OakGlenn Vineyards in Hermann on February 18th, and at Les Bourgeois Vineyards in Rocheport on February 19th. A networking lunch kicked off the workshop followed by presentations on grapevine pruning specific to the Midwest, assessing bud damage, and pruning safety. One and half to two hours were devoted to practical pruning demonstration and instruction within the vineyard. Speakers of the workshop included Eli Bergmeier (Viticulture Research Specialist), Dr Keith Striegler (Director and Viticulture Program Leader), and Jackie Harris (Viticulture Extension Assistant) from the ICCVE at the University of Missouri.



Figure 1. ICCVE Pruning Workshop 2009. OakGlenn Vineyard, Hermann Missouri. Photo courtesy of Jackie Harris.

2009 Missouri Wine Technical Membership and 2009/2010 Meeting Schedule

The MWTG (Missouri Wine Technical Group) is an industry-driven initiative to provide opportunities for

wine producers to share information in a closed and formal, blind, tasting environment with other winemakers from around the state of Missouri and the Midwest. This event is open to commercial winemaking and cellar staff only. Wines for assessment and discussion are to be either unfinished wines, or experimental wines.

We encourage all wineries from around Missouri and the Midwest, which produce wine to attend the workshops. Previous workshops brought forth constructive dialogue and created the impetus to produce ever greater quality wines from specific varietals. This is a great opportunity to evaluate other wines and get diverse opinions about viticultural and vinification practices.

Membership is open to all Missouri, Midwest & US commercial wine producers.

For more information:

Jacob Holman, Vice President

E: jacobh@missouriwine.com

P: (573) 424-9404

2009/2010 MWTG Meeting Schedule

2009 Meetings

April 14	2008 Chambourcin, ICCVE University of Missouri
June 9	Seyval, Traminette, Chardonnay, Corot Noir, Noiret
December 8	2009 Norton



Figure 1. 2008 Missouri Wine Technical Group Norton Workshop. Les Bourgeois Winery, Rocheport, Missouri.

2010 Meetings

February 6-8	2010 Midwest Grape and Wine Conference 2009 Chardonnay & Wine Faults Seminar
April 13 th	2009 Norton or 2009 Chambourcin
June 8 th	TBD from the following: Seyval, Chambourcin, Traminette, Problem wines, Chardonnay, Corot Noir, Noiret
December 14	2010 Norton

Upcoming Events

2009 ICCVE Basic Concepts in Winemaking Workshop
July 13

University of Missouri, Columbia MO

This is an essential one-day workshop for those considering winemaking as a career or starting a winery. This workshop was developed with the following aims in mind:

1. To introduce basic winery equipment.
2. To introduce basic concepts in wine chemistry.
3. To introduce basic winemaking procedures.

For more information please visit the ICCVE website:
<http://iccv.missouri.edu/events/>

2009 ICCVE Missouri Wine School
July 14-16

University of Missouri, Columbia MO

This is an essential three-day workshop for those with a basic understanding of winemaking who are seeking an intensive hands-on learning experience to developing their understanding and skills further. This workshop was developed with the following aims in mind:

1. To have winemakers undertake routine wine analysis.
2. To familiarize winemakers with basic cellar operations.
3. To familiarize winemakers with basic winery sanitation.
4. To familiarize winemakers with the steps in finishing wine and undertake a finishing wine procedure/lab trial.
5. To have winemakers undertake wine quality assessment.
6. To familiarize winemakers with wine faults, causes and treatments.
7. To familiarize winemakers with Missouri wine styles.

Numbers strictly limited to 48 attendees.

For more information please visit the ICCVE website:
<http://iccv.missouri.edu/events/>



Figure 1. Thin Layer Chromatography for Malic Acid Fermentation Monitoring. Routine Wine Analysis. 2008 ICCVE Establishing and Operating a Small Winery Laboratory Workshop. University of Missouri.

*2009 Missouri Viticulture Field Day
June 2*

The Missouri Viticulture Field Day will be held at Les Bourgeois Vineyard, Rocheport MO. Co-sponsored by Missouri Grape Growers Association and the ICCVE.

For more information please contact:

Sarah Schmidt

baltimorebend@yahoo.com

Ph 816-726-4978

Denise LeBegue

countshollow@sbcglobal.net

Ph 314-351-7774

Donations and Support for the ICCVE

The ICCVE would like to acknowledge and thank the following companies for their generous contributions and support of research and/or extension projects:

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Website: www.adampuchtawine.com

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Website: www.voestalpine.com/rfc/en

Vintage Nurseries

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Please support the companies that have supported our efforts during 2008.