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Upcoming Events:

Feb 22-24th TWGGA Annual CONFERENCE

Feb 25th :Grayson Pruning Workshop –Denison

March 2nd: Disease and Pest Management -Somerville

March 10th: Pruning Workshop-Lubbock

March 10th: Disease Management Workshop-Canton

March 23rd: Pruning and Propogation-McKinney

April 13th: Grayson Vine Training-Denison

April 20th: Irrigation workshop-Denison

April 27th: NEWSOM GRAPE FIELD DAY-Plains

May 17th: Central Tx Grape Field Day -Lorena

For more information on times, locations or costs please contact your regional Viticulture Program Specialist

In this issue:

Thank you for your interest in reading our latest issue of Texas Winegrower. In this issue you will find several articles focused on the many aspects of winter pruning and how they relate to vine health, and disease. There is an information rich article by our newest program specialist, Brianna Hoge, on understanding the concept of vine balance. Our Specialists, Pierre Helwi, Justin Schriener, and Jim Kamas will address several aspects of winter pruning. Jim Kamas has written a brief article on understanding and recognizing winter injury and we conclude our newsletter with articles on identifying and controlling anthracnose by Fran Pontasch, and getting a jump on weed management by Michael Cook. We hope there is something here for everybody.

I would also like to take this opportunity to introduce you to our newest program specialist Brianna Hoge. She will be serving the Hill Country growing region and comes to us from North Carolina State where she recently completed her masters degree in the department of plant pathology, following her work with the North Carolina Mountain Horticultural Crops Research and Extension Center. She is a great asset to our team.

Additionally I would like to take a moment to congratulate Pierre Helwi for his recent promotion to the position of Asst. Professor and Extension Specialist Viticulture. Pierre will continue to serve the High Plains growing region while conducting applied research and Extension outreach programs.

Important tips to remember when pruning
Pierre Helwi

- ✔ Use sharp pruners or loppers for clean cuts. Loppers are used for large canes and cordons up to 2 inches. Sanitize tools regularly with a 25% bleach solution.
- ✔ Apply latex or pruning wound paint over fresh cuts or spray an appropriate chemical to prevent spread of canker infection
- ✔ Remove and burn any disease infected wood to prevent reinfection.

Use these practices to ensure the ability to recover lost cordons and spur positions

Spurs: at the time of pruning, choose shoots arising from the cordons instead of canes originating from last year's spurs. Choosing these canes place the spur lower, closer to cordon

Cordons: retain shoots near the upper part of the trunk to use as a potential cordon replacement for damaged and older vines.

Understanding Your Vineyard

Introduction to Vine Balance

Brianna Hoge

Vine balance is defined as the state at which vegetative vigor and fruit load are in equilibrium and can be sustained indefinitely while maintaining healthy canopy growth, adequate fruit production, and high fruit quality. It is a critical concept in professional vineyard management. Balanced vines have increased light in the canopy, resulting in minimized leaf and fruit shading, thus maximizing carbohydrate production for vegetative growth and fruit quality. Optimizing light and temperature can improve color, enhance flavor compounds, decrease pH and potassium content, and reduce vegetative aromas. Balanced canopies also have increased airflow, which helps reduce canopy moisture and improves spray penetration, both of which are crucial to reducing disease risk. All these factors lead to healthy, productive vines capable of producing high quality fruit. Unfortunately, there is no one-size-fits-all recommendation that can be implemented.

Factors that Impact Vine Balance

- **Environmental Conditions**
- **Rootstock and Cultivar Selection**
- **Vineyard Management Practices**

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Environmental factors impacting balance revolve around characteristics such as soil depth and type and nutrient and water availability. Vineyards with deep fertile soils and relatively unlimited moisture and sunlight are at greater risk of growing excessively vigorous vines. This type of vine produces shoots with large leaves, long nodes, and excessive lateral shoot development. The abundance of vegetation means that the fruit and renewal zones are shaded, resulting in poor bud development for the following year's crop, inferior fruit quality, higher disease pressure, and poor periderm formation, decreasing cold hardiness. These same vines, with proper management practices will be able to produce a balanced ratio of fruit to canopy allowing for quality fruit production as well as plentiful nutrient storage reserves to promote winter hardiness and sustain post-budbreak growth the following season.

On the contrary, vines planted in soils with limited water and nutrient resources will be able to produce less canopy and will have lower carbon levels. Therefore, they will not be able to sustain as large a crop load. Drought, shallow soils, weed competition, insufficient nutrients, and disease pressure can lead to insufficient vigor- sparse canopy with little or no ability to ripen a crop. Another route to the same problem can be found in overcropping. Excess crop load without enough canopy to support it can cause insufficient photosynthetic capacity, poor fruit maturation, and increased cold susceptibility. The short-term benefits of high yields must be weighed against the negative impact on fruit quality and the long-term effects this stressor may have on vineyard health and longevity.

Rootstock and scion (cultivar) also play a role in vine growth and development. Many rootstocks have beneficial qualities, such as increasing and decreasing vigor of various grape cultivars, which demonstrate a range of vigor on their own. Research has shown that rootstocks have the potential to affect not only growth potential, but fruiting potential, pest resistance, water efficiency, and nutrient uptake, all of which influence vine growth and development (Skinkis and Vance, 2013). This should be taken into account when selecting rootstocks in order to maintain proper vine balance.

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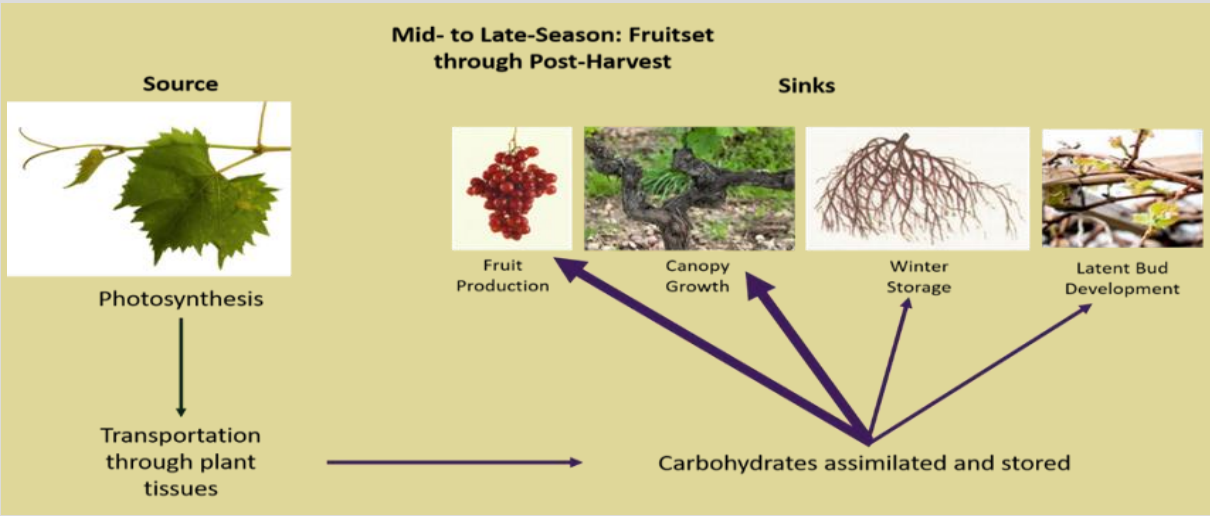
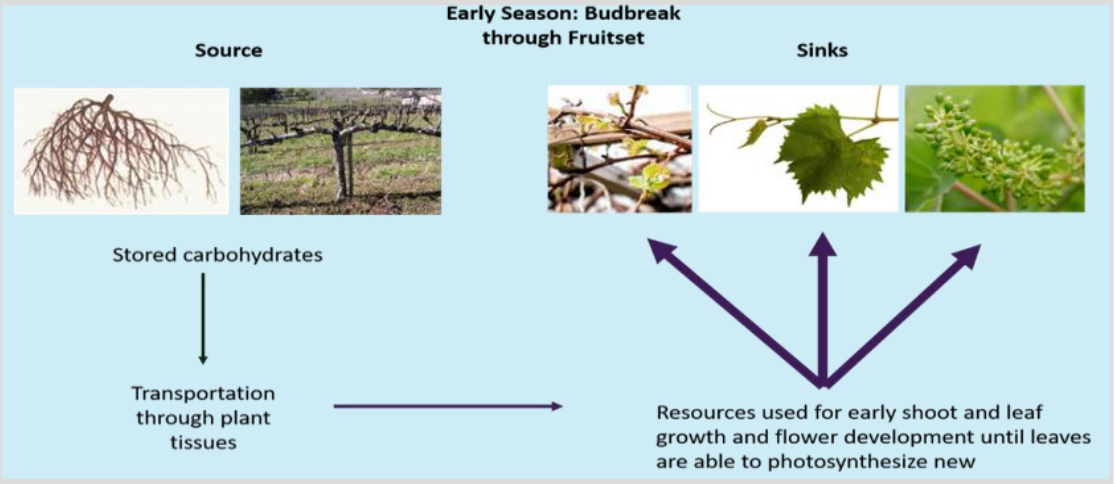
Understanding Your Vineyard

Vineyard management practices which affect vine balance include irrigation, fertilization, pruning, thinning, and vineyard floor management. All of these practices, conducted strategically can either enhance or decrease vine balance. High vigor vines may benefit from competition with cover crops for nutrients and water keeping growth in check, while lower vigor vines may be unable to obtain adequate resources for healthy growth and fruit development. Similarly, fertile soils with good water holding capacity are likely to produce high vigor vines, and will not require the fertilization and irrigation inputs a site with low vigor vines and lower nutrient and water availability would. Management practices should be site specific and keep cultivar characteristics in mind in order to be effective in steering vines towards balance.

Balance of Source vs. Sinks

To understand vine balance, we need to understand grapevine physiology and the concept of carbon sources and sinks. During the growing season, carbon is produced through the photosynthetic activity of the canopy (source). Before vegetative growth is adequate to supply the rest of the vine, the carbon reserves stored the previous season function as a source to support early season shoot growth and flower development (sinks). The major carbon sources and sinks within a vine changes over the course of growing and dormant seasons as depicted below.





Understanding Your Vineyard

Remember : Imbalanced vines lead to lessened ability to transition into dormancy via shoot lignification and cold hardiness reduction. Overly vigorous vines continue to grow past véraison and have excess canopy shading and less shoot lignification late in the season. Research suggests that vine hardening is influenced less by crop load than canopy shading caused by excess vegetation, so canopy management in addition to crop load is critical to preventing frost damage (Howell and Shaulis, 1980; Reynolds et al., 1986).

Measuring Vine Balance

Pruning weight and yield reflects the final size of vines given environmental factors and management practices. It should be noted that if crop thinning is done at lag phase, data can be collected at the time of thinning to calculate potential total crop load and compare it to actual crop load at harvest (Skinkis and Vance, 2013). A Ravaz value of 5-10 is considered optimal for *Vitis vinifera* cultivars in warmer climates. Values at the low end of the range are considered under-cropped or highly vigorous, and there's a larger canopy size compared to fruit yield. Conversely, values at the high end of the range are considered over-cropped or low vigor and have larger fruit yield compared to canopy size. In either case, vines are unbalanced, resulting in unsustainable vine growth and fruit quality.

Vine balance can be measured several ways, but the two most common are use of the Ravaz index and the leaf area to fruit yield ratio. The Ravaz index, also known as the crop load method, is the most common and practical for commercial growers. It's calculated using fruit yields at harvest and dormant pruning weights during winter following harvest.

Ravaz value	=	vine yield	/	dormant pruning weight	
12	=	12	/	1 lbs pruning weight	Over-Cropped
4	=	12	/	3 lbs pruning weight	Under-Cropped
6	=	12	/	2 lbs pruning weight	Balanced

Implementing Good Practices

Canopy management through direct and indirect methods. Direct methods include shoot thinning, leaf removal, and crop thinning; while indirect methods include irrigation, fertilization, and vineyard floor management.

Vineyard floor management, including weed control, and cover cropping can alter vine vigor by changing nutrient and water availability. High vigor vineyards benefit from the use of cover crops, as they reduce vine growth and restrict potential rooting volume. Research conducted in high vigor vineyards showed a reduction in vine vigor and natural yield, producing vines that were more balanced than those in tilled, non-grass cover treatments. For moderate or lower vigor vineyards, certain cover crops may enhance vigor by increasing soil moisture or nutrition. For instance, alternating legumes or grass cover and tillage in alleys can enhance soil nutrient and moisture levels, while providing a more moderate level of competition, for better vigor management.

Crop management through shoot thinning is performed after budbreak and before shoots are 6 inches long. It assists in optimizing fruit production and canopy density. Typically, 3-5 shoots per linear foot of row is recom-

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mended. Shoot thinning reduces competition among shoots for carbohydrate and nutrient reserves for growth and development before carbohydrate accumulation begins in spring. For weak vines, leaving fewer shoots can produce better growth. On a vigorous vine, removing too many shoots can lead to increased vegetative growth of remaining shoots and less than ideal yields. The reduction of fruit that occurs as a result of over-thinning in vigorous vines can lead to less than ideal yields and out of balance vines.

Leaf removal around the cluster zone is often conducted to allow for sunlight exposure and airflow. This practice should be done earlier in berry development, when flavonoid compounds are which act as a sort of sunscreen are produced. If conducted late in the season, fruit may become sunburned, as there are lower levels of these protective compounds at or around véraison. Increased airflow, as a result of leaf thinning provides the added benefit of reduced incidence and severity of diseases such as powdery mildew or Botrytis bunch rot. In heathy vines, leaf removal doesn't greatly affect carbohydrate production when implemented early in the season (shortly after fruit set), and it can enhance the production of secondary metabolites that enhance wine quality.

Crop Level Management by fruit thinning adjusts yields to obtain a balance between canopy growth and crop load, while enhancing fruit quality. Vigorous vines with large canopies are usually capable of ripening more fruit than low vigor vines. Environmental and management practices must also be considered in determining the amount of crop to remove during thinning. For instance, in cooler climates, a greater leaf area to fruit ratio is needed to properly ripen a crop compared to warmer climates. For low vigor vines, light thinning may be sufficient, but if the vine is also unhealthy, heavy thinning is recommended to ensure adequate carbohydrates are being produced to ripen fruit and store for dormant season reserves. It is generally believed that removal of fruit increases canopy growth and fruit quality, but this may differ depending on circumstance (Vance et al., 2013).

When appropriate, thinning can enhance ripening. Timing of crop thinning is very important to maintaining vine balance. While dormant pruning reduces the potential number of clusters developed, cluster thinning may be also be required depending on the level of balance in a given vine. In lower vigor vines, late thinning (at véraison) may result in heavy competition between shoots and fruit for carbohydrates and push vines further out of balance. This type of vine should be thinned between inflorescence and fruit set. In higher vigor vines, waiting to thin until véraison may help keep canopy growth in check and reduce canopy management throughout the season.

If carbon sources are limited, inflorescences and flower number per inflorescence can be reduced, resulting in lower yield the following season. However, crop level alone may not compete for resources enough to reduce fertility. Research has shown that timing of thinning can impact effectiveness. Early thinning resulted in greater bud fertility, while thinning at véraison had no effect. This may be due to the fact that there is less competition for carbon resources early in the season, and latent buds initiate as early as pre-bloom (Howell, 1999; Vance, 2012).

While achieving Vine Balance can be a complex task, working toward this goal will offer both short term reward of maximizing both fruit quality and yield as well as the long term reward of a healthy and productive vineyard that is resistant to injury and disease.

Pruning and Managing Injury and Disease

Guidelines for Pruning Wine Grapes

Pierre Helwi

Grapevines require yearly pruning for satisfactory grape production. Dormant pruning refers to the annual removal of the previous year's fruiting wood and excess undesired one year old canes (dead, diseased or crowded canes). This operation is one of the last vineyard practices that remains un-mechanized and is considerer the single most important task annually performed by the grower. The quality of a vineyard pruning practices influence not only the current year's production, but also that of the following years.

Dormant pruning aims to manipulate the potential quantity and quality of the crop, maintain the balance between shoot and fruit growth known as vine balance and sustain the training system.

When to prune?

Vines can be pruned between leaf drop in fall and budbreak in spring. Pruning is mainly dependent on vineyard size and the availability of labor. However, fall-pruned vines are more susceptible to winter injury than vines pruned in late winter or early spring.

Delaying pruning until late winter or early spring allows the grower to adjust the pruning level to compensate for winter injury losses and reduces vine susceptibility to spring freeze injuries. Removal of unwanted wood should be completed before budbreak. If pruning continues after budbreak, once inflorescence has initiated, removal of those flowering buds can dramatically reduce that year yield.

If it is difficult to completely prune a vineyard before budbreak, double pruning can be a solution. It involves hedging dormant canes early during dormancy, leaving four to six buds on canes and once the vines are closer to budbreak, they are fine pruned to the desired final bud number. Double pruning can effectively delay budbreak of the buds near the base of the cane by several days to two weeks. Pruning during dry and warm periods is encouraged to limit risks of infection by wood canker diseases.

What to remove?

Dead, diseased, crossed and crowded wood. If canker is found in the wood, cut 6-8 inches below the cankered wood.

Awkward positioned spurs

Dead spurs: a failed spur does not resurrect

Canes shaded inside the canopy, and bull canes should be removed as they are cold sensitive and unfruitful.

What to retain?

Wood with brown color periderm without any mechanical damage or signs of disease.

Canes with:

- Short internodes: 4 to 6 inches
- Moderate diameter: ¼ to ½ inches

Canes close to the trunk or cordon

Pruning and Managing Injury and Disease

Pruning level and number of buds to retain

Grapevine pruning is a method to achieve a balance between shoot growth and fruit production. If too many buds were retained during dormant pruning, vines will be characterized by a crowded canopy that increases shading on next year developing buds, potentially reducing bud fruitfulness in the following year. Yield will be high and grape clusters will inadequately ripen decreasing the overall quality. Conversely, if vines are pruned too severely, canopy will be characterized by an inadequate number of primary fruit-bearing shoots with excessive lateral growth increasing shading. Yield will be low with poor fruit quality.

The number of buds to retain in order to achieve vine balance can be assessed by:

- Visual observations: retain few buds if canes are weak and more buds if canes are vigorous.
- Using balanced pruning formulas (mainly for *Vitis vinifera* and Native American varieties).
- Determining Ravaz index: yield to pruning weight ratio: kg fruit/kg pruning wood.

Cane pruning *versus* Spur pruning

A **cane pruned** vine is characterized by one permanent trunk from which new arms are used each year. Two types of canes are selected in cane pruning: fruiting canes to produce a fruitful shoot at each of its buds in the up-coming season; and renewal spurs which will replace the fruiting cane while pruning in the next season. Renewal spurs are ideally positioned below the fruiting cane and are pruned back to one or two buds. An alternate method does not retain a separate renewal spur. Instead, it is assumed that in the next dormant season, a good basal cane from last season's fruiting cane can be selected as the new fruiting cane. Typically, fruiting canes are pruned to 10-15 buds, depending on the variety, vine vigor and vineyard site (Fig.1A).

In a **spur pruned** vine, the arms are permanent and horizontal, called cordons. Fruitful shoots grow from spurs that are evenly spaced along the length of the cordon and oriented in the proper direction. During pruning, the one year old cane and the most distant from the permanent cordon is generally removed and the closet one cut back to one or two buds. However, the distal shoot may be preferred if it is positioned better and if the lengthening of the arm is not a disadvantage (Fig.1B).

1. Cane pruning (A) and Spur pruning (B). Photos courtesy of Justin Scheiner

Pruning and Managing Injury and Disease

Pruning and training young vines - Cordon-trained, spur-pruned system

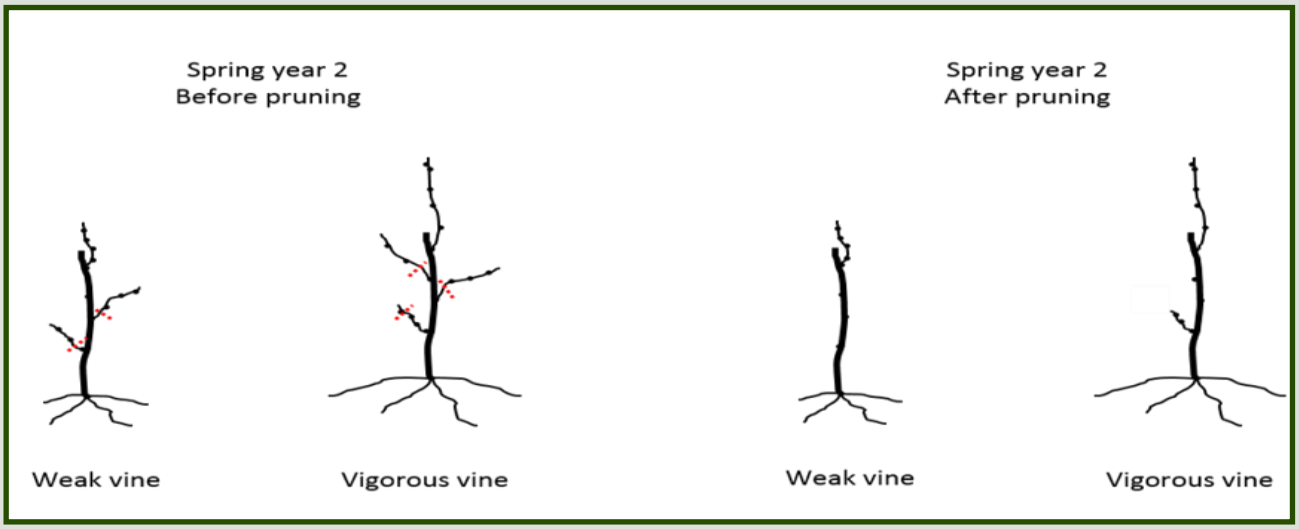
Cordon-trained, spur-pruned system is the most common system used in Texas (85-90%). Therefore, it is deeply elaborated in the following section. *Illustrations adapted from Wolfe, T. K. (ed.) 2008.*

In the spring of the second growth year and depending on factors such as variation in moisture or nutrient availability, two scenarios can occur:

1) Vine development is slow and characterized by weak structures: prune the vine to 3-4 buds and treat it as a new planting (Fig. 2A).

2) Vine growth is normal and shoots reach the cordon wire: retain the longest cane with adequate diameter (~1/2 inch) as a trunk and remove all extra shoots **(Fig. 2A below).**

Fig. 2A. Spring of year 2 before and after pruning. Pruning cuts are shown with dashed red lines.

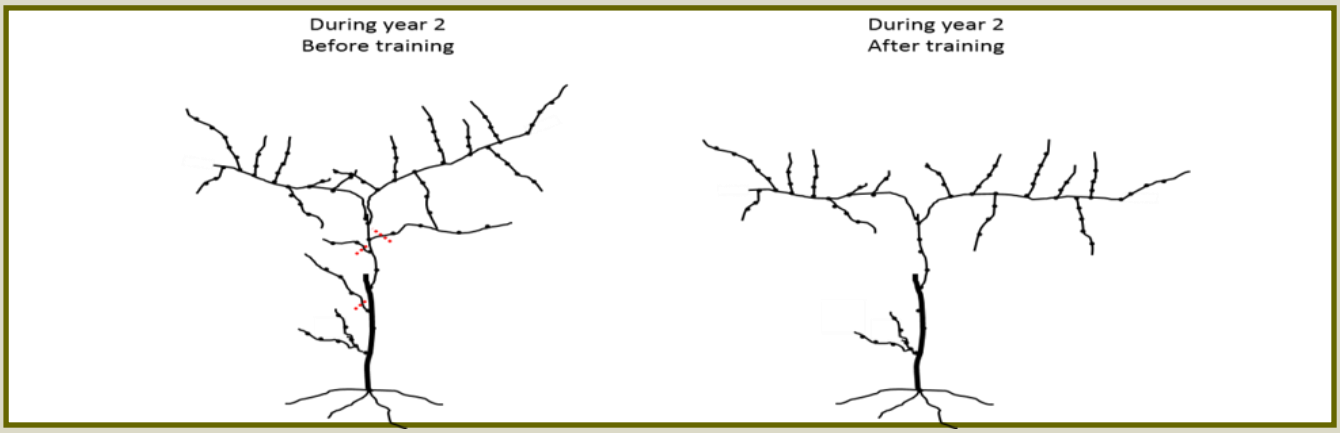


Cordon establishment can begin in the second year by tying on the cordon wire the top 2 canes developing from the trunk. Shoots arising from the cordon can be positioned and tied to the trellis wires forming the spurs the following season. Shoots developing below the cordon or suckers are removed, an operation known as suckering **(Fig. 2B on the following page).**

It is recommended to establish the cordon in 2 steps with a first extension (about 16 inches) during year 2 and a second extension the following year in order to guarantee a good growth of mid-cane shoots.

Pruning and Managing Injury and Disease

Fig. 2B. During the season of year 2 before and after training. Cuts are shown with dashed red lines.



In the spring of year 3, canes retained as spurs can be pruned to 1-2 buds (**Fig. 2C below).** During the growing season, the retained buds will develop shoots that can be positioned and tied to the trellis wires constituting the canopy **(Fig. 2D below).**

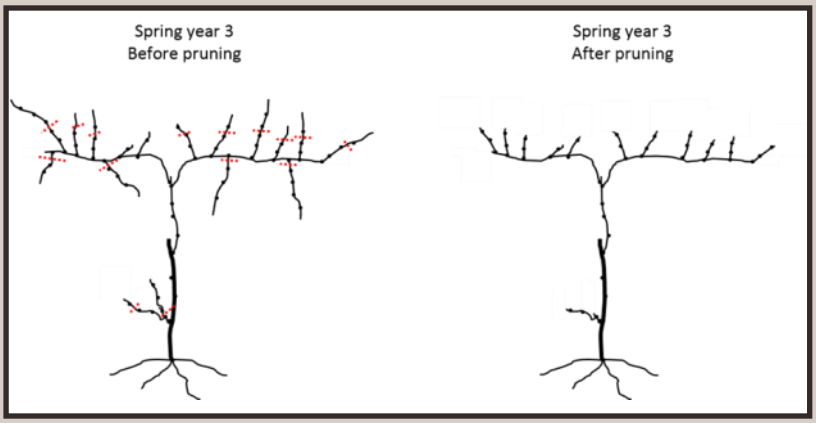


Fig. 2C. Spring of year 3 before and after pruning. Pruning cuts are shown with dashed red lines.

In the following years, vines are pruned as described in the spur pruning section (Fig. 2D)

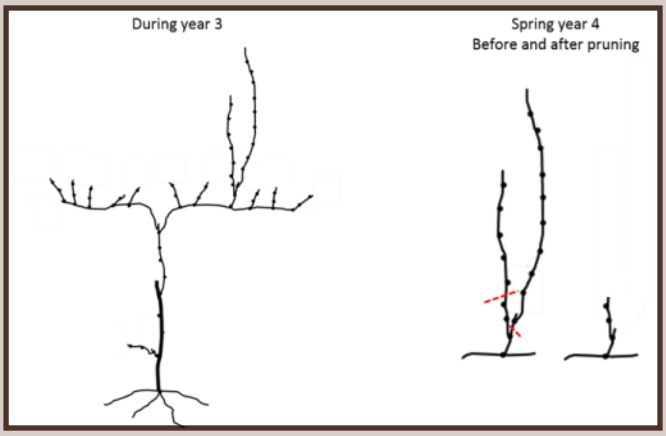


Fig. 2D. During year 3 (left) and spring of year 4 before and after pruning (right). Pruning cuts are shown with dashed red lines.

Pruning and Managing Injury and Disease

Benefits of Long Pruning and Managing GTD

Justin Scheiner

Long pruning has become a common practice among Texas grape growers, and for good reason. Some growers refer to the initial or first round of pruning spur pruned vines as pre-pruning, rough pruning, or even trash pruning, but no matter the name used this practice can save time when time matters most, delay bud break if done correctly, and reduce the risk of grapevine trunk disease (GTD).

Before expounding on the benefits of long pruning, it's important to understand just what we are talking about. Long pruning is simply cutting the canes on spur pruned vines back to somewhere around 8 to 12 nodes or around 12 to 24" in length. This includes pulling the brush out of the trellis which is often the most time consuming aspect of dormant pruning. A final pruning is conducted closer to budbreak.

Long Pruned Vines

Long pruning can be done in mid to late winter before the time crunch that comes with completing dormant season tasks just ahead of spring. By completing the majority or at least the most time consuming aspect of pruning early, you will increase the likelihood of completing the final pruning at the most desired time. Long pruning generally does not require a great degree of skill, but it may be necessary to mark vines that need cordon replacement or retraining if unspecialized labor is utilized.

The wood that is removed during pruning should be taken out of the vineyard and destroyed, or chopped up on the vineyard floor with a flail mower so that it will break down rapidly. Why go through the trouble of removing or chopping the brush? Certain insects and fungal diseases overwinter on the bark of grapevines and leaving wood on the vineyard floor can increase the risk of future infestations or infections.

Pruning and Managing Injury and Disease

As a result of correlative inhibition, holding off on final pruning until budbreak or slightly later can delay budbreak in the basal region of the spur, particularly the buds that will ultimately be retained for fruit. How? Budbreak generally begins at the most apical or highest points on upward positioned canes/spurs. This is due to a hormonal interaction in the plant that suppresses more basal or lower growth.

By leaving long spurs or short canes at long pruning, budbreak occurs at the tips of the canes first, suppressing budbreak on the lower buds. Once those distal tips are removed with final pruning, budbreak will occur (if it hasn't already) on the lower buds. This technique does not guarantee a delay in budbreak, but it's common to achieve a delay of up to a week or slightly more. That could be just enough time to escape the last frost.

If budbreak is suppressed in the lower buds, why not just leave the long spurs/short canes until well after the risk of frost has passed? At some point, the fruitfulness of the still dormant buds begins to decline. In 2017, Texas A&M AgriLife Extension carried out an experiment in the Gulf Coast with several Pierce's Disease tolerant grapes to evaluate the impact of delaying final pruning until 4 weeks after budbreak. Depending on the variety, fruitfulness decreased by 5% to over 80%. The take home message here is that long pruning followed by final pruning at budbreak (aka double pruning) has the potential to delay budbreak, but it is possible to overdo it by waiting too long to final prune.

Four-bud spur expressing correlative inhibition

Another benefit of long pruning is the potential to reduce the incidence of grapevine trunk diseases (GTDs). GTDs are a serious problem in vineyards worldwide. In Texas, several fungal pathogens capable of causing fungal trunk disease (aka canker) have been identified. These pathogens enter grapevines through wounds, particularly pruning wounds, and begin to colonize the vascular tissue. Once an infection begins, the fungus grows slowly through the conductive tissue blocking the flow of water and nutrients, ultimately causing tissue death. GTDs often go unnoticed until spur positions and cordons begin to die. During dormant pruning GTDs are often recognized by dead and discolored tissue where an infection has occurred.

With the exception of esca which is incurable, GTDs can be removed through vine surgery or removing the infected tissue from the vine. However, this generally does not occur until after production has begun to decline so prevention of GTDs is critical. Long pruning can provide an opportunity to significantly reduce the susceptibility of pruning cuts to infection. How? GTD infections or cankers produce and release spores in the spring, particularly with moisture from rainfall or high humidity. These microscopic spores are blown by the wind and splashed by rain, and if they happen to land on a susceptible pruning wound the spore germinates and an infection ensues.

Several research studies have reported that pruning cuts made in early to mid-winter are more susceptible to GTDs and remain susceptible a longer period of time compared to pruning cuts that are made in late winter to

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early spring. Delaying final pruning until closer to bud break reduces susceptibility to GTDs, and any infections that occurred after long pruning was conducted are removed with final pruning. However, pruning alone should not be the only strategy for GTD control. Three fungicide products (Mettle 125ME, Rally 40WSP, Topsin M) labeled for GDT control are available. Applications should be made within 24 hours of final pruning and a follow-up application two weeks later may be beneficial, particularly if wet conditions persist after pruning. Pruning should not be conducted in the rain or if wet weather is imminent.

Dead necrotic tissue from a GTD infection

See https://aggie-horticulture.tamu.edu/vitwine/files/2017/04/Grapevine-Trunk-disease.pdf for more information on GTDs.

Using Pruning Weights to Track Vineyard Production Potential

Jim Kamas

Among perennial deciduous fruit crops, grapevines are the most heavily pruned. Unlike many other perennial crops, measurements of one year old growth removed after dormant pruning is a common way to measure vine vigor and a vineyard's ability to produce a crop the following season. In many vineyard experiments such as fertilizer or rootstock trials, this parameter is a vital part of the information gathered that can describe how a given treatment affects vines. Commercial growers can use this technique to measure how a vine has fared given the previous season's crop load and environmental conditions to help achieve a balanced and uniform block of grapevines. We have witnessed vineyards cropped at say six tons per acre per year progressively decline in vine vigor while the grower was unaware that the annual yield and the decline in vine size were related.

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Pruning and Managing Injury and Disease

While in experiments, pruning weights are collected from every vine, that practice is certainly not practical for commercial growers. Many experienced growers do, however mark "sentinel" vines in every block of grapes to prune, weigh and record weights on every year. Alternatively, the best means of getting a picture of what is happening in an entire block is to do a random sample of vines for a whole block comparison. The difficulty is that in order for this technique to work properly, it is essential that the selection of vines from one year to the next actually be random, a process that can be confounding for people not accustomed to this type of measurement. Either way, vines on the ends of rows, or vines that are not typical for environmental or cultural reasons should be avoided. By actually weighing vine pruning weights every year, this exercise helps calibrate a grower's eye to discern subtle differences between varieties or sections of vineyards. A practical rule of thumb is that vineyards with less than 0.125 pounds of annual prunings per linear foot of row are considered to have undesirably low vigor while vines exceeding 0.4 pounds of prunings are considered to have excessive vigor.

Identifying and Managing Winter Injury in Vineyards

Jim Kamas

Grapevines vary in their ability to withstand cold winter temperatures, but in Texas, weather conditions preceding any freeze event typically have more to do with bud and vine survival than the cold hardiness of the variety itself. The process of vine acclimation for the next winter actually starts with the shortening of day length after the summer solstice. As the days shorten, vines start to form periderm on current season's growth and decelerate the rate of vegetative growth. In late summer and fall, healthy vines continue to photosynthesize and store carbohydrates in buds, roots, trunks and canes. This late season carbohydrate loading is important in maximizing the hardiness of grapevines. This is why it is important that water not be cut off following harvest as it is needed to maintain the canopy and photosynthetic action necessary for this carbohydrate formation. As temperatures cool through autumn, leaves begin to senesce and fall with the first hard frost or freeze.

With the onset of winter and falling temperatures, vines go deeper into rest and reach their ultimate hardiness where they are capable of withstanding temperatures into the teens and even single digits. Not all grape varieties enter dormancy at the same time. 'Cabernet Sauvignon', for example, is a late acclimater and can be injured by early hard freezes in autumn when other varieties receive no injury at all. There are relative degrees of ultimate hardiness among varieties, so in some locations, that hardiness or lack of hardiness needs to be a part of the decision whether a variety gets planted or not.

Grapevines acclimate very slowly, but they de-acclimate very rapidly. Unseasonably warm periods in January and February can cause vines to quickly begin to de-acclimate making them susceptible to injury at temperatures they could have withstood before the warm weather. Whether it's very low temperatures themselves or a hard freeze after vines have de-acclimated, cold injury can occur on buds, canes, cordons and trunks. Identifying this injury early can help a grower take appropriate measures to minimize the financial impact and take appropriate corrective measures.

Acute winter injury can be observed early in the season when buds fail to force and vines respond with a flush of suckers from the trunk or ground. At this point a grower should realize that the crop has been badly damaged

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and even if some primary or secondary buds were not killed, the vascular tissue of the vine has been so badly harmed that it cannot support a canopy through the high transpiration of rates of mid-summer.

Internal inspection of the vascular tissue can confirm that vines have been damaged, but the browning of internal tissue may only be visible after a period of warming temperatures after the freeze event. If vines have been severely damaged, growers should consider retaining three or four suckers and train them up and on to the cordon wire to replace the existing trunk and cordons. Only leaving one or two will most likely result in replacement canes with excessive vigor (bull canes) that will have limited fruitfulness and most likely be cold tender in the following winter.

Severely damaged grapevine forcing suckers in mid-spring

In some situations, stunted shoot growth can signify cold injury

More subtle injury in some ways is much more difficult to identify and manage. Buds may force, but stunted vegetative growth typically means there is damage to the "plumbing" somewhere, either on the cordon or trunk. In other cases, vines appear to force and set fruit normally, but collapse during the heat of summer when the compromised vascular system can no longer transport enough water to support the canopy it has produced. In these cases, growers thinking that there was no problem commonly remove suckers in spring which will limit the ability to generate new shoots for vine reconstruction.

In years like this one where mid-January temperatures were in single digits in much of the state, cold injury may have occurred in some vineyards. Even though temperatures preceding this cold spell were not warm and vines should have been well acclimated, growers might consider pealing back small patches of bark to look at the vascular tissue.

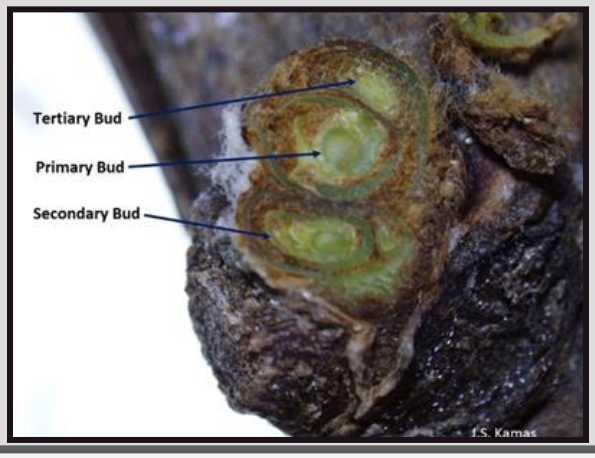
In some seasons, damage to vascular tissue can only be seen after vines collapse in the heat of summer

Pruning and Managing Injury and Disease

Galling of grapevine trunks from Crown Gall, Infection

Brown or grey coloration indicates injury while healthy tissue is bright green. Because of preferential heating of tissue by direct sunlight, southern and western parts of vines can be more quickly de-acclimated and are commonly more prone to injury than the north side of the vine. With serious trunk and cordon injury, re-training vines is a necessary task to return the vineyard to productive status. There is really no hurry to cut out freeze injured tissue on injured trunks. Let the vines force and reveal exactly how profound the injury is. If there are a dozen or more competing shoots, selectively thin them out in summer, but remember summer pruning is a dwarfing action and removing a third or more of the vines vegetative tissue will most likely stunt the vine and stop growth. Winter injury can also cause trunk splitting and can provide entry wounds for crown gall or trigger gall formation in vines already infected with *Agrobacterium*.

In some years, cold temperatures may not be low enough to cause injury to the vine's primary structure, but primary fruiting buds may have been killed or injured. Purists would object to the use of the term "bud", because on grapevines, everywhere a leaf is attached on a shoot is actually called a node, which has three buds. The primary bud is the most fruitful and is why growers refer to leaving a given number of buds per vine after pruning. In addition, each node has a secondary bud which can be somewhat fruitful and a tertiary bud which is not fruitful. Growers typically depend on surviving primary buds to produce the coming season's crop and plan their pruning programs to leave the appropriate number of nodes to produce a crop at a target tonnage. Cold events that cause primary bud loss commonly affect yield the following growing season. If growers know an approximate level of damage, they can adjust their pruning practices to compensate for the loss. With a very damaging freeze, or after a spring frost takes out primary shoots, secondary buds can force and produce a partial crop. In years with potential damaging events, growers should consider cutting dormant canes of each variety for examination. Bright green coloration indicates healthy buds while killed or injured buds take on a brown or blackish hue. Knowledge of bud survival can help growers make final pruning decisions that may include leaving more "buds" up than average to compensate for primary bud loss due to freeze.



Using a razor blade or other sharp knife, growers can cut and examine grape buds to assess damage

Pruning and Managing Injury and Disease

Identifying and Controlling Anthracnose in Humid Texas Vineyards

Fran Pontasch

In hot, humid south and east Texas, anthracnose can be a major problem to our hybrid variety vines, for which Blanc Du Bois is especially susceptible. Lenoir, Lomanto and other hybrids are susceptible as well, but to a lesser degree.

Anthracnose is a damaging fungal disease that attacks new tender, green growing tissue including: leaves, stems, and young, developing clusters. Anthracnose was one of the most serious problems in Europe before downy and powdery mildew, and phylloxera were introduced. The disease was likely brought to us on imported European *Vitis vinifera* cuttings, according to the Compendium of Grape Diseases, Disorders, and Pests. Anthracnose is problematic to humid vineyards in Asia, where the grape breeders of Japan and Korea are breeding for anthracnose resistant varieties.

The anthracnose pathogen, *Elsinoe ampelina*, is a very persistent pathogen that overwinters in a dormant state between seasons on infected canes and berries. The primary infections occur in spring, as temperatures rise and vegetative structures (sclerotia) on infected canes become active. The sclerotia produce infectious fungal spores (conidia) that are spread by water droplets to new tissue. Spores infect leaves, shoots, berries, and tendrils where they become a secondary source of inoculum for spreading anthracnose during the growing season. The intensity of disease outbreaks increases with the amount of rainfall during the earlier months of the growing season, before tissue becomes toughened by wind and heat.

Identification: Tissue of the entire cluster - rachis, pedicel, and young berries - is vulnerable to infection. Lesions are likely first visible as small reddish brown spots on berries. Infection of the pedicel and rachis will appear as small round lesions with sunken centers.

Small reddish brown lesions are symptoms of early anthracnose

As lesions continue to grow larger, the lesions become large black irregular circles that surround gray necrotic tissue. Infected berries fail to ripen and must be removed.

Solving Common Vineyard Problems

Leaf lesions are small circular brown spots. The spots in older lesions develop brown black margins with gray necrotic centers. The gray tissue often falls away leaving holes, known as shot holes, surrounded by dark tissue. During the progress of leaf symptoms, affected tissue continues to fall away and leaves often take on a deformed, puckered appearance.

Shoot lesions are small isolated angular lesions with a purplish brown margin.

Shoot and leaf symptoms

Evidence of anthracnose is most distinct on shoots and berries. Leaf symptoms can be less dependable in identifing anthracnose infection as they can appear similar to other disease symptoms such as Phomopsis.

Management : Controlling an outbreak of anthracnose begins by keeping the vineyard clean and spraying fungicides.

Dormancy

- Burn or remove infected canes at dormant pruning. Infected canes are the primary source of the disease inoculum.
- Spray lime sulfur on dormant vines, *before budbreak* and preferably after pruning (to avoid noxious smells during pruning.)

Growing Season

- Spray fungicide applications vigilantly from budbreak until pea size berries.
- Mow frequently and control weeds to increase airflow and decrease the relative humidity around vines.
- Remove infected berries before they fall on the vineyard floor. Diseased canes and berries harbor spores that can be splashed or windswept onto green growing tissue during the growing season.

Fungicide Options to Control Anthracnose.

Sclerotia, the overwintering structures of anthracnose, are hard and dense masses of mycelium that are capable of remaining dormant for long periods of time. Once a vineyard becomes infected with anthracnose, the disease will

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return year after year unless the sclerotia are destroyed.

Lime sulfur is a critical step in effective control of anthracnose because it is capable of destroying these tough fungal structures. It is destructive to young buds, and its' caustic nature poses a serious risk to skin, eyes, and the sense of smell, so it must be applied carefully according to the label directions *before budbreak*.

Other fungicides labeled for control of anthracnose, such as Pristine, Abound, and Quadris Top are useful in the event that infection has never gained foothold and the spring weather is dry. However**, repeated application of these excellent fungicides increases the risk that pathogens will develop a resistance to their chemistry**.

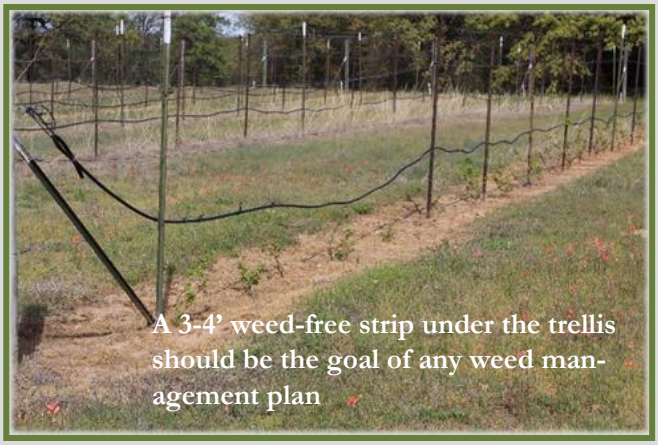
Effectively Controlling Weeds in the Vineyard

Michael Cook

It is that time of year again, after a seemingly brief reprieve from the day to day work in the vineyard diligent growers are preparing for the 2018 growing season. Weed management is one that is on the minds of growers across the state, or at least it should be.

Weed management control strategies will be different from vineyard to vineyard due to growing conditions as well as weed species present. Nevertheless, weed management principles remain the same. It boils down to implementing appropriate practices at the right time to effectively prevent and eradicate weed species. Weeds compete with vines for water, nutrients, and even sunlight in young vineyards. Dense stands of weeds in the vineyard are unsightly and can restrict critical airflow throughout the vineyard, encourage pest populations, and even make it difficult for crews to conduct work down the rows. Heavy weed pressure, especially in young vineyards can be detrimental to the establishment of healthy and productive vines. In order to minimize the negative impact weeds can have on a vineyard, the vineyard manager must be able to identify weed species as well as be aware of the tools at his or her disposal to prevent and eliminate specific weeds. The methods of prevention or eradication of weeds can be categorized into two major groups: cultural and chemical.

Cultural. Controlling weeds by cultural means can be done mechanically with machine or by hand as well as by restrictive barrier. The greatest limitation to controlling weeds by hand is the investment in labor and time it takes to accomplish the task. While mechanical weeders, tillers, or discs are efficient in regards to labor requirements, they are generally not recommended since they disturb the topsoil, can injure the trunks, and often destroy the shallow roots vital to a vines health. Due to the frequent tilling required to remove weeds during the growing season erosion can also be a major issue with such a strategy. A more recent mechanical method of eradicating weeds in the vineyard is with an agricultural propane torch. This can be effective but poses a great risk of fire and still requires a large dedicated labor source. One of the



A 3-4' weed-free strip under the trellis should be the goal of any weed management plan

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Solving Common Vineyard Problems

best ways to keep weeds at bay in the vineyard is with the use of chemical controls in tandem with row middle management. Maintaining your row middles with a thick low-lying ground cover, such as native grass, is an important component of a weed control plan. If mowed frequently, broadleaf weeds will have difficulty multiplying in the vineyard. It is important to note that while the convenience of a hand-held weed-eater is tempting, it should never be used in the vineyard. Many stories have been told between growers who nicked their vines, activating the bacterial infection known as crown gall for which there is currently no cure. The last method that can be used to control weeds which is not chemical in nature is the installation of a polyvinyl weed barrier fabric or the use of natural mulch. Vines benefit from a weed free strip about two feet on each side of the trellis and growers who mulch typically apply a 3-4" thick layer in that zone. While a thick layer of mulch can help conserve water and can be effective at minimizing weed pressure, cost to source mulch and spread it out can be cost prohibitive for some operations.

Chemical. The use of chemical herbicides is by far the most commonly used method of controlling weeds and is often the most efficacious due to the potential for excellent control at a relatively low cost. Timing is very important and understanding what weed species are present in your vineyard is critical. Herbicides can be broken down into two groups; pre-emergence and post-emergence. Pre-emergence herbicides are excellent options for vineyard managers because they prevent weeds from germinating in the first place. There are multiple labels available to Texas growers but care must be taken to follow and abide by the label as there are vineyard restrictions in certain circumstances depending on the label used. Also note that pre-emergence herbicides require a specific amount of rainfall shortly after application to move the herbicide down into the soil profile where the weed seeds reside. The second class of herbicide are post-emergence herbicides. They are applied once the weed has germinated and is growing in the vineyard. Glyphosate is a very popular non-selective post-emergence herbicide that has the potential to systemically kill any plant it comes in contact, including grapes. Much care must be taken to prevent particle drift of glyphosate in the vineyard, especially with young succulent vines. The use of grow tubes, which many growers are now starting to put out onto their vines that are three years old or younger, is recommended in many cases and will help protect your vines from vertebrate feeding as well as spray particle drift from herbicide applications. Again, just as with pre-emergence herbicides timing is important as well as applying the correct amount of product under appropriate conditions.

Use of a "grow-tube" in a young vineyard in the High Plains of Texas

There are many control options available to the grower when it comes to minimizing weed pressure and competition but not all strategies are a good fit for every vineyard. A grower should develop and implement a weed control plan that includes both mechanical and chemical means if at all possible. While it may seem unimportant, controlling weeds via prevention and eradication techniques will ensure a sustainable vineyard that is productive for many years to come.

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We hope you have enjoyed this issue of our statewide newsletter. Our goal is to provide timely information on topics of relevance to winegrape growers in Texas. We strive to provide updates on scientific research, expert information on pest and disease management, vineyard best practices, and information on opportunities to attend Extension program events.

First and foremost, we want to produce a newsletter that is relevant and provides information that you as part of the winegrowing community are interested in. We welcome your comments and suggestions and are particularly interested in topics you would like to see covered in future issues. Please let us know what you think.

Thank you for your support of our program, and allowing us to help you to address your growing needs.

Cheers,
Jacy L. Lewis
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