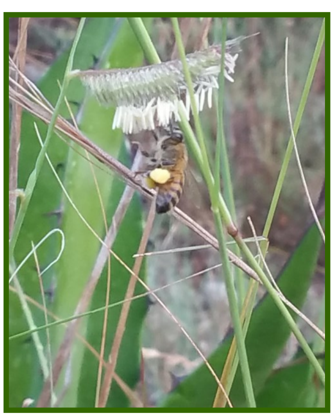
Oct 20th 2017

Special Supplement II

Texas Winegrower

A Quarterly Publication of the Texas AgriLife Extension Viticulture and Enology Program

Inside this issue:



SUSTAINABILITY

Understanding Sustainable Viticulture Practices

In this issue:

A common question among winegrape growers in Texas is **"how do we balance high quality fruit, reasonable yields and profits with the need to be good stewards of our environment and our communities?"**

This is not always an easy question to answer. Agriculture by it's very nature imposes unnatural processes on the natural environment. It has traditionally been an endeavor where low profit margins have made it difficult to provide high living standards for those working in the field. With better understanding of how agriculture impacts the environment, new technologies and systems innovating how we produce crops, and consumer recognition of the ecological and social importance of producing sustainably; growers are in the best position they have ever been in to make profits while being cognizant of the environment and society at large.

While it was not possible in a single newsletter to provide a comprehensive treatment of Sustainable Viticulture, we have attempted to provide some background, along with some of the basic principles and ideas important to choosing and developing a sustainable approach to viticulture practice.

We hope this opens a discussion on how to increase and improve Sustainable practice in our state and encourage a conversation on how we go about making sustainable production the norm in Texas vineyards and wineries.

Sustainable Agricultural Practices

Understanding Sustainable Agricultural Practices
Jacy L. Lewis

The terms "organic" and "sustainable" are at times used interchangeably in the general population, but growers who are choosing to practice sustainable agriculture should understand these terms are distinct. In order to understand what "Sustainable agriculture" is, it is important to understand what it is not. While sharing many of the same principles and practices, Organic and Sustainable agriculture differ in some foundational principles and desired outcome measures. Many practices that meet the outcome measures for Sustainable production may not meet the rigid requirements for Organic certification. Likewise, while many Organic practices meet outcome measures for Sustainable production under a given set of conditions, all do not. It is entirely possible to meet criteria for Organic certification while not taking the most "sustainable" approach to producing a given crop.

In understanding what Sustainable agriculture is, a good place to start is with generally accepted definitions.

There are uniform national standards for the labeling of any food products as Organic. According to the USDA:

"***Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony."***

Alternatively, there is no legal definition of Sustainable practice nor are there any nationally or Texas state recognized uniform standards required of a grower who chooses to practice sustainability in their operation. While there are some state and grower groups that have adopted standards for their area, Texas has not done so. That does not mean there are no definitions or guidelines which one can follow in efforts to practice sustainable farming.

How does the USDA "define" sustainable farming practices? In the 1990 Farm Bill it is defined as:

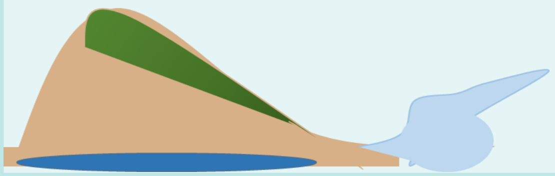
"***an integrated system of plant and animal production practices having a site-specific application that will, over the long term:***

- ***satisfy human food and fiber needs;***
- ***enhance environmental quality and the natural resource base upon which the agricultural economy depends;***
- ***make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;***
- ***sustain the economic viability of farm operations; and***
- ***enhance the quality of life for farmers and society as a whole. "***

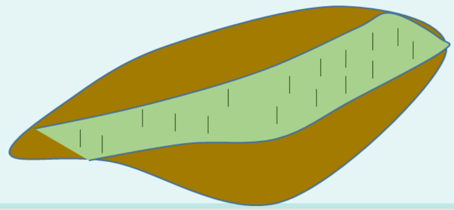
Sustainable Agricultural Practices

One key difference here is the term "site-specific". Sustainable practices take into account the notion that what is an ecologically sound practice on one site, may not be so on another. As an example:

Site (A) may be on a slope that runs into a stream or may be in an aquifer recharge zone.



Site (B) may be 100 miles from the nearest surface water or on highly impermeable soils.



Considerations regarding "run-off" or leaching could be very different for these two sites. Sustainable agriculture takes those site specific differences into account.
Another example is that of a vineyard that has frequent guests who may walk in or near it, such as in close proximity to a winery or vineyard used as a venue for weddings, parties etc. vs a vineyard that is on an isolated tract in a rural area. The potential for human chemical exposure is very different for these two vineyards.

Another method or term some growers may have some familiarity with is "Integrated Farming". Integrated Farming or "IF" is explained by the European Initiative for Sustainable Development in Agriculture in this way:

"Integrated Farming offers a whole farm policy and whole systems approach to farm management. The farmer seeks to provide efficient and profitable production, which is economically viable and environmentally responsible, and delivers safe, wholesome and high quality food through the efficient management of livestock, forage, fresh produce and arable crops whilst conserving and enhancing the environment. At the core of IF is the need for profitability. To be sustainable, the system must be profitable."

As you can see, this bears a striking similarity to how the USDA defines Sustainable Agriculture and for practical purposes, one could use the terms interchangeably in a colloquial way. Here we will use the terminology that the USDA has chosen with the understanding that in principal these practices are substantively very similar to those outlined by and described as "Integrated Farming".

Sustainable practice forces one to take a very detailed look at any given site and make determinations about environmental and social impacts of varying practices for that specific site and crop. It weighs the impacts of various farming practices on the humans who are both directly and indirectly impacted by those methods heavily in decision making, taking into account quantifiable factors as well as considerations of social equity.
Because Certified Organic production and Sustainable Production share so many common values and outcome measures, in order to fully understand Sustainable practice, it can be informative to compare the two practices to examine how they differ.

Sustainable Agricultural Practices

1. Sustainable practice can be more complicated in terms of decision making than pure Organics. With more options, more considerations and looser specific guidelines, the decision making process has the potential to become extremely cumbersome. Organics provides growers with more specific guidelines; streamlining and simplifying production decisions.
2. Currently Texas has no 3rd party that regulates practices for farms that consider or advertise themselves as Sustainable. It requires a grower to "self-assess". This puts more of the burden on the grower and additionally offers no oversite or reassurances to consumers. This can work against a grower who may be spending more effort and money than their Organic competitor while limiting opportunities to charge a premium for their products. This can also make it more difficult for consumers to identify farming practices and food products produced in the most responsible manner available. Organic labeling relieves the consumers of the burden of researching individual operations, knowing there has been some oversight in practice for how a given good is produced.
3. Sustainable practice offers more of the necessary flexibility to be environmentally sensitive, profitable, and sensitive to human needs while accounting for the long term sustainability of their operation than may be the case for growers seeking Organic certification. While limiting the type and quantity of off farm inputs, sustainable practices will allow for these inputs on occasions when they may be necessary to salvage a crop or perennial planting, placing the importance of providing consumers with a product both seasonally and long term over that of maintaining Organic certifications. Sustainability also allows growers to choose chemicals that have a narrower target group and/or can be used in smaller quantities over Organically approved chemicals that may have a broader spectrum of activity and may require larger or more frequent applications to achieve efficacy.
4. An important aspect of sustainable practice is economic viability. Any practice that does not allow a grower to adequately profit from their work is not considered sustainable. Organic regulations do not take factors of profitability into account.

Sustainable practice requires a holistic approach that includes many science based Organic practices while adding social equity, economic feasibility and site specific ecological impacts to decision matrices. While less rigid than seeking Organic certification, developing a sustainable agriculture program has the potential to be highly complex, requiring a grower to be introspective in determining their own values with regard to how their production impacts a variety of areas from social, to ecological, to economic. It has the flexibility to allow growers who may be producing crops that do not lend themselves well to organic production, such as wine grapes; the opportunity to develop a production plan that is environmentally conscious while producing a superior product.

Winegrape growers in cooperation with the wineries that they supply are uniquely equipped to educate their consumers about their dedication to sustainable practice and what that means. Similar to farmers who sell in farmers markets, wineries have a direct line of communication with their consumers. Due to the fact that the majority of Texas wineries sell direct to consumers, consumers have the opportunity to develop relationships with vineyard/winery operations and can be educated regarding the environmental and health benefits a sustainable viticulture operation has to offer. With very little Organic labeled competition Texas grape growers are well positioned to be leaders when it comes to Sustainable agricultural production.

Should you feel a sustainable production plan is right for you; there are a number of strategies that can and should be employed when building a sustainable practice program for your operation.

Sustainable Agricultural Practices

When faced with making decisions about what production method to follow, growers must take careful stock of a variety of factors such as production goals, market, as well as personal and professional values. In gaining

1. **IPM** "*integrated pest management requires an understanding of the ecology of the cropping system, including that of the pests, their natural enemies, and the surrounding environment…… knowledge about the ecological interrelationships between insects and their environment is critical to effective pest management.*" From the Cornell IPM program guide. A firm grasp of IPM strategies including the use of the "EIQ" is probably the single most important tool a grower needs in order to develop a sustainable protocol for their vineyard. (EIQ is covered extensively in another article in this newsletter)
2. **Water Conservation Strategy**, a well-developed strategy for protecting available water resources not only in the vineyard but in the winery as well.
3. **Soil Fertility Management**, this should include considerations of soil structure and microbiota, as well as inorganic nutrient and micronutrient composition.
4. **Protection** of local landscapes, ecosystems and wildlife.
5. **Fair Work Practices** (for some general guidelines to get you started, see the Fair Food Standards Council and Fair Food Code of Conduct.) Many U.S. consumers are showing a willingness to pay more for agricultural products in order to raise living standards of farm workers. Let your consumers know what you are doing to make your operation a humane and equitable place for your employees.

insight into what system best suits an individual grower's ideal production philosophy, there are some very specific questions that should be considered. The overreaching question is Why am I considering a given approach, what are the priorities that are behind that consideration, and how do the various production options answer those priorities? When answering this question be specific. Here are just a few factors to consider:

The important thing to remember is **impact free agriculture is a fantasy**. All agricultural operations will have an impact on the local and global environment. The question is how far reaching is that impact both geograph-

1. **Health and safety of farm workers**. This includes exposure to chemicals, environmental exposure, and physical exertion especially in adverse conditions.
2. **Stewardship of the environment and local ecology**. Includes both biotic and abiotic components of the geographic area in and affected by your vineyard.
3. **Chemical residuals** in the end product presented to consumers.
4. **Long term vineyard health and productivity**. How does your approach impact your long term goals for production and plant health?
5. **Worker compensation**. How does your plan effect the ability to compensate your workers in an equitable way?
6. **Profitability.** When taking into account environmental and social responsibility, is your operation profit-able?
7. **Meeting consumer interest and demand**. Does one practice give a grower a substantial market advantage over another?

Sustainable Agricultural Practices

ically and temporally? Is that impact necessarily negative? There are many agricultural practices that can have a net positive effect on the environment and the humans and other creatures that occupy it. The goal of sustainable agriculture is to reduce negative impacts and increase positive impacts while meeting the needs of producers and the consumers their products serve.

Sustainable Fertility Programs:
Justin Scheiner

In the first article of this newsletter, the term sustainable was defined and differentiated from organics. This article will attempt to apply those concepts to vineyard fertility, one of the most complex aspects of viticulture. Fertility is an extensive topic, so we will not be able to address all important areas. Rather, the goal here is to provide an overview of a sustainable fertility program .

Grapevines, like other crops, require at least thirteen nutrients to survive. To prevent or correct a nutrient deficit, a grower may add any of these nutrients in the form of a fertilizer. Within a sustainable viticulture program growers have the option of choosing to use certified Organic or "conventional" formulations of plant nutrients. Is one option any better? Functionally, are they really different? The answer is both yes and no.

Organic fertilizers are derived from naturally occurring organic materials often with minimal processing, and by their nature, contain multiple plant nutrients. These nutrients are generally released at a slower rate than most conventional fertilizers because the organic material they are derived from has to decompose for nutrient release to occur. Conventional fertilizers are also derived from naturally occurring materials, but they are synthesized in order to chemically extract and/or combine the nutrients from these materials resulting in a more chemically pure product that is more quickly released or available to plants.

Urea ammonium nitrate (UAN) is a solution of 2 molecular compounds. This solution serves as a source of nitrogen for plants.

Urea– a neutral crystalline compound, the nitrogenous product of protein metabolism in mammals

CH_4N_2O rapidly converted to ammonia or ammonium by soil borne bacteria.

Ammonium-less toxic positively charged cation form of ammonia (a common nitrogenous waste product)

NH_4^+ Converted to nitrite by bacteria via nitrification process

Nitrate– a salt of nitric acid, a negatively charged molecule consisting of Nitrogen and Oxygen. It is naturally formed when bacteria convert nitrite to nitrate.

NO_3^- Combined with ammonium it becomes ammonium nitrate—NH_4NO_3 It is worth noting, in industry this compound is formed by combining (ammonia) HNO_3 + (nitric acid) NH_3

These chemicals are molecularly identical to and composed of the same elements <C, O, H,N> as those in Organic fertilizers.

Sustainable Agricultural Practices

That said, the industrial process of producing these "conventional" fertilizers can come with some objectionable environmental impacts.

In the soil, bacteria can convert urea to ammonium and ammonium to nitrate. Nitrogen atoms from these molecules can be taken up and utilized by the plant. This "conventional" option gives the grower control over what they are feeding their plants. In this case "nitrogen". It is worth noting that Urea, a primary component of this compound is an organic molecule which is naturally broken down into the other two components by soil microorganisms.

In order to be called a fertilizer by law, a soil additive must have a guaranteed composition or analysis. Many organic sources of nutrients are not called fertilizers because they do not have a guaranteed composition or analysis.

Organic or "less refined" sources of nitrogen invariable contain other nutrients, whether they are desired or not. This could be good or bad depending on the abundance of various nutrients in the soil and the needs of the plants. Growers are left somewhat in the dark with regard to exactly which nutrients and in what quantities they are supplying their plants. How important is this? It depends. What is the current state of fertility of the soil vs. the plants needs? Is the soil already high in a nutrient that could become phytotoxic at high levels or inhibit the uptake of others? Is the soil fertile enough to adequately supply the plant with needed nutrients allowing time for the nutrients in organic fertilizers to become available?

Can plants tell the difference between nutrients from an organic source versus a synthetic fertilizer? With respect to the actual nutrient(s) supplied, the answer is no. Plants can only use specific molecular forms of each nutrient, therefore there is no difference between nutrients, such as nitrogen, that came from an organic source like manure versus a synthetic source like UAN. An atom of N is an atom of N regardless of the source.

Additionally, organic sources of nutrients are often more expensive on a pound for pound basis of nutrient supplied, and are typically more bulky and laborious to apply than synthetics. Therefore, conventional fertilizers usually have an advantage of greater purity, lower cost, and easier handling, but that's not the end of the story.

As mentioned, organic fertilizers release nutrients as the organic material is broken down by soil organisms. This is true of any organic material added to the soil whether it be compost, manure, grape canes, or even grass clippings left behind after mowing. All agriculture soils are teaming with microbes, most of which rely on carbon and other nutrients in dead plant and animal tissue for growth. The USDA indicates that one teaspoon of healthy soil contains more microbes than there are people on the planet earth. This microbiome or ecological community of commensal, symbiotic, and pathogenic microbes has become a very active area of scientific research, and scientists are understanding more and more about the importance of the soil microbiome to agriculture. Together, countless species of fungi, bacteria, viruses, and protozoans that dwell in the soil provide benefits to soil health such as reducing soil environmental degradation and nutrient cycling.

Good soil health is the foundation of optimal production in farming.

Relying strictly on organic sources of plant nutrients requires developing a fertility program that synchronizes nutrient release from organic materials with the requirement of the crop. As you can imagine this requires careful attention to production practices and an intimate knowledge of the soil on site. There is no argument to be made against or substitute for a carefully calculated fertility program or learning about the soil on your site.

Sustainable Agricultural Practices

The organic matter added to the soil by organic growers has the potential to provide a range of benefits from increasing soil nutrients and water holding capacity, to improving soil structure and internal drainage. When we discuss soil organic matter, what exactly do we mean? Soil organic matter consists of carbon rich, plant and animal material that is in the process of decomposing. Decomposition takes place when soil organisms physically breakdown and chemically transform organic constituents into smaller organic and inorganic molecules in successive steps. As decomposition occurs, any excess nutrients not used by the microbes present are released into the soil where plant roots can access them. Eventually, the organic material is decomposed into a complex organic matter called humus. Humus cannot be used by many microorganisms so it is more persistent in the soil where it provides the benefits to soil structure, water and nutrient holding capacity previously described .

Do you have to add organic "fertilizers" or soil additives to increase organic matter? Well, the answer is once again yes and no. When organic matter is added to the soil, plant nutrients will eventually be released, but the concentrations of different nutrients and speed at which they are released varies widely by source. The rate at which decomposition occurs and thus nutrients are released is a function of the microbes present, the physical environment (presence of oxygen, moisture, temperature), and the type of organic material. Because Texas soils remain relatively warm for most of the year, the organic matter concentration in native soil is relatively low compared to areas of the country where the soil freezes, greatly slowing or halting decomposition.

In general, soil microbes require 1 unit of nitrogen for every 24 units of carbon they consume. Both nitrogen and carbon are important building blocks of their cells, and when sufficient concentrations of nitrogen are not available in the organic material for carbon consumption, microbes will either remobilize it from another source in soil or decomposition will stop. Thus organic materials such as manure that have relatively low carbon to nitrogen ratios (C:N) release nitrogen to the soil rapidly because there is more nitrogen relative to carbon than required by the microflora. In contrast, an organic material with a high C:N ratio such as wood chips (80-400:1) requires an external source of nitrogen resulting in a slower decomposition process and temporary removal of nitrogen from the soil that was once available for plant growth. Thus, organic materials added to the soil may provide or consume nutrients depending on the source. It is vital that growers understand the composition of any organic matter utilized in their vineyard.

Grapes are not generally considered to be heavy feeders compared to other crops, over-fertilization is not only a waste of money in fertilizer costs, it can also reduce profitability by necessitating additional canopy management practices and disease control, as well as reduce fruit quality and increase weed growth. If one is aiming to avoid runoff and leaching, excess application of nitrogen can be problematic in this respect as well. Therefore, a sustainable fertility program, organic or conventional, seeks to apply the correct nutrients at the correct time at the correct rate, and that requires decision making guided by knowledge of plant nutrition, soils, and careful plant monitoring. This creates a significant challenge for organic only fertility programs where nutrient release is often slow, in unknown quantities, and single nutrient additions are not always available.

Determining precisely when to fertilize, and what fertilizer materials to use is the cornerstone of sustainable production systems and this should begin even before the first vine goes in the ground. Undoubtedly you have heard that your soil should be tested, especially when starting a vineyard. Soil tests tell you not only what concentrations of nutrients are present in the soil, they also provide information on their availability for uptake by grapevines. In a sustainable system this should guide pre-plant soil amendments, rootstock selection, and potentially vine spacing

Sustainable Agricultural Practices

and training system. Once the proper pre-plant soil amendments have been made, soil monitoring is not over. It is suggested that soil tests be repeated the following season if significant amendments were required to ensure their effectiveness, and successive soil testing should occur at least on a three-year basis.

In the second leaf, biannual plant tissue testing can commence. Tissue testing is the most accurate and direct way to monitor grapevine nutrition. Soil testing gives you an indicator of what's available, but tissue testing shows what was actually taken up by the vines. Why isn't soil testing alone good enough? Nutrient availability in the soil is affected by soil properties such as soil pH. The textbook ideal soil pH for nutrient availability is around 6.5-6.8, but most Texas vineyards do not fall in this range. Outside of the ideal pH range, forms of certain nutrients that are unavailable to plants dominate. Iron is a good example. In the soil, iron exists in ferrous (Fe^{2++}) and ferric (Fe^{3+++}) forms. The ferrous form is most readily taken up by plants. Under alkaline soil conditions, the ferric iron compounds predominate. This is because high pH environments facilitate oxidation of Fe^{2++} to Fe^{3+++}, rendering additions of ferrous iron ineffective. This ferric form of iron has low solubility in the soil solution making it less available for plants. A soil test may indicate that ample iron is present in the soil, but under alkaline conditions it may not be in an available form. Tissue testing can confirm this iron deficiency in your vines.

Some plants are able to lower the soil pH at the soil root interface by excreting acid from the roots and some others excrete organic compounds that convert ferric iron into ferrous compounds allowing them to access iron even under alkaline soil conditions. Perhaps this is the basis for grape rootstocks with alkaline soil tolerance. Rootstocks derived from *Vitis berlandieri* such as 1103P, 5BB, 5C, etc. are better adapted to alkaline soils than other rootstocks. Thus, you could grow Cabernet in the same soil, but on two different rootstocks and have very different nutrient statuses and fertilizer needs. This is precisely why a standardized tissue testing program is necessary to understand the true nutrient status or needs of a vineyard. Each rootstock and scion cultivar should be tested separately each year at the same phenological timing using the same method.

By sampling on a biannual basis, a grower is able to monitor changes in nutrient status from year to year so as to determine if nutrient levels are stable, if additions are needed, and if previous additions were effective. This gives a grower the opportunity to dial in their fertility program. For example, if a nutrient is decreasing in concentration in a plant over time the grower can recognize this change before a deficiency is visible and react appropriately rather than waiting on visual symptoms to appear. Once a deficiency is visible, vine performance has already suffered. Therefore, systematic nutrient monitoring is an important aspect of any sustainable production system.

Although it may be tempting for small growers to pick up a few bags of triple thirteen (13-13-13) fertilizer at the box store to supply the nitrogen needs of their vineyard, the practice of adding unneeded nutrients should be limited due to the potential for unwanted effects. Triple thirteen and many other fertilizers have multiple nutrients that may or may not be desirable. For example, excessive potassium fertilization can contribute to elevated juice and wine pH which is already a challenge for hot climates like Texas. Excessive phosphorous can be problematic. Unlike nitrogen, which is not persistent for long periods in the soil and must be replenished, phosphorous is relatively immobile. This means unused phosphorous accumulates over time and excessive levels of phosphorous could reduce the availability of certain micronutrients such as zinc. Since organic fertilizers contain multiple nutrients, it can be challenging for growers to meet the nutrient demands of their crop without adding unneeded and perhaps unwanted nutrients when using organic fertilizers and soil amendments. This is just as true when using conventional combination fertilizers without a clear fertility program in place and an understanding of the components in the mix.

The over application of fertilizers to row crop farmland in certain parts of the U.S. has led to algal blooms or eutrophication of the Mississippi River Delta and Gulf of Mexico. When agricultural soils that are high in phosphorous and/or nitrogen erode and end up in lakes and rivers, the algae present uses the newly abundant nutrients resulting in rapid growth and oxygen depletion in the water. The 8,776 square mile dead zone in the Gulf of Mexico is at least partially the result of this type of agricultural run-off and underscores the importance of careful fertility practices in a sustainable program. This again presents a challenge for organic only systems where there is less precise control of nutrient additions. The effects of nutrient run-off are identical, irrespective of whether the source is organic or conventional.

In summary, a sustainable fertility program relies on careful nutrient monitoring to guide fertility decisions. While conventional fertilizers provide more flexibility with respect to application timing, cost, and nutrient composition, soil health should be a consideration for all vineyards. Ideally, careful additions and monitoring of organic matter, complemented with precise quantifiable additions of specific nutrients makes for the most sustainable approach to vineyard fertility management.

Measuring the Impact of Growing Grapes

Jim Kamas

In agriculture as with everything else in life, to every action, there is a reaction. Every pebble dropped into a pond creates a wave. The size of the wave depends on the size of the pebble. When we consider the consequences of our agricultural farming practices, we need to carefully examine the true effects of our choices and be wise stewards of our vineyards and the overall environment.

It is generally accepted that reducing the negative impacts of agriculture is in the best interest of the environment and the humans and animals that occupy it, and the majority of grape growers are searching for ways to strike a balance between reducing negative impacts and producing high quality fruit in a profitable way. How do we as environmentally conscious growers go about making decisions? A Sustainable Practices program, by its nature varies from farm to farm and should be viewed as a dynamic and even elastic concept. One means of accomplishing this may be to follow Organic growing principles or use only certified Organic pest control agents. It is important however to understand that pest control agents are not by way of being naturally occurring less toxic, persistent or have less impact on farm workers, consumers or the environment.

As an example, copper and sulfur, mainstays of organic fungal disease management programs have a strong impact on our environment. Copper is extremely toxic to some fish species and bees, has been shown to have a strong negative effect on soil microbes has toxicity to humans and can accumulate in the soil to the point where it is toxic to the very plants we are trying to grow. Sulfur readily volatilizes, has a substantially negative impact on bees and

Sustainable Agricultural Practices

many other beneficial insects and can also be phytotoxic to our crop. Unfortunately, even organic products can cause a substantial wave in our pond.

A number of years ago in an effort to measure the overall impact of chemical choices, Joe Kovach and Jim Tette, IPM specialists at Cornell, developed a concept called the Environmental Impact Quotient. This matrix of impact factors considers the effect of insecticides and fungicides on farm workers, consumers and ecological components and seeks to give growers a way to make the most sustainable choice when faced with multiple product options. Both organic and non-organic products are rated on numerous potential effects, then given a number considered to be a relative rating of overall impact. The numerical calculation to determine the EIQ of a product is:

EIQ={C[(DT*5)+(DT*P)]+[(C*((S+P)/2)*SY)+(L)]+[(F*R)+ (D*((S+P)/2)*3)+(Z*P*3)+(B*P*5)]}/3

Where: **DT = dermal toxicity,**
C = chronic toxicity,
SY = systemicity,
F = fish toxicity,
L = leaching potential,
R = surface loss potential,
D = bird toxicity,
S = soil half-life,
Z = bee toxicity,
B = beneficial arthropod toxicity,
P = plant surface half-life.

Farm worker risk is defined as the sum of applicator exposure (DT* 5) plus picker exposure (DT*P) times the long-term health effect or chronic toxicity (C). Chronic toxicity of a specific pesticide is calculated as the average of the ratings from various long-term laboratory tests conducted on small mammals. These tests are designed to determine potential reproductive effects (ability to produce offspring), teratogenic effects (deformities in unborn offspring), mutagenic effects (permanent changes in hereditary material such as genes and chromosomes), and oncogenic effects (tumor growth).

The consumer component is the sum of consumer exposure potential (C*((S+P)/2)*SY) plus the potential groundwater effects (L) . Groundwater effects are placed in the consumer component because they are more of a human health concern (drinking well contamination) than an issue for wildlife.

The ecological component of the model is composed of aquatic and terrestrial effects and is the sum of the effects of the chemicals on fish (F*R), birds (D*((S+P)/2)*3), bees (Z*P*3), and beneficial arthropods (B*P*5).

It is important to keep in mind that the EIQ has nothing to say regarding product efficacy. Therefor finding the product with the lowest EIQ is only half the job. Choosing a product with an extremely low EIQ is of little consequence if the product is not effective. In a sustainable production practice one should aim to choose products with the lowest EIQ that effectively deliver desired results.

Sustainable Agricultural Practices

Using these factors, EIQ numbers have been determined for many spray products. An example of those commonly used in grape growing is listed in the following table with organic products in green text.

Common Name	Trade Name	Action	Farm Worker	Consumer + Leaching	Ecology	Total EIQ
mancozeb	Dithane Manzate	Fungicide	20.25	8.13	48.79	25.72
copper sulfate	Copper	Fungicide/ Bactericide	24.3	13.15	148.25	61.90
hydrogen peroxide	OxiDate	Biological Fungicide	30.00	6.0	12.00	16.00
myclobutanil	Rally	Fungicide	8.10	12.15	51.79	24.01
puyrimethanil	Scala	Fungicide	9.00	6.00	23.00	12.67
metalaxal	Ridomil	Fungicide	8.10	12.15	36.95	19.07
sulfur	Sulfur	Fungicide	21.87	8.29	67.82	32.66
carbaryl	Sevin	Insecticide	15.0	5.50	47.70	22.73
ryania	Raynia	Insecticide	13.11	9.58	90.93	37.87

So, with a relative overall impact of specific products, the total impact of farming inputs can be calculated by multiplying the Product EIQ x Amount of Active Ingredient x Rate (Pounds Per Acre) x The Number of Applications to derive the EIQ Field Use Rating.

So, if we are calculating the potential effects of three different spray programs to manage powdery mildew in a vineyard here is how that would look

Program (A) utilizing only "conventional" materials

Rally, 40%WP, applied at .3#/acre, 4 applications per season

41.2 x 0.4 x 0.3 x 4 =

Total Field Use EIQ of 20

Program (B) utilizing only Certified Organic materials

Sulfur, 90% WP, applied at 6#/acre, 7 applications per season

45.5 x 0.9 x 6 x 7 =

Total Field Use EIQ of 1720

Program (C) combined conventional" and organic materials

Rally, 40%WP applied at .3#/acre, 2 applications **plus** Sulfur, 90% WP applied at 6#/acre 2 applications

41.2 x 0.4 x 0.3 x 2 = 9 +
45.5 x 0.9 x 6 x 2= 491=

Total Field Use EIQ of 500

Sustainable Agricultural Practices

Organic products certainly do not always have a larger impact than non-organic or "conventional" products, the point here is that there is no simple way to measure the impact of how we farm. Choosing only Certified Organic products is not a short cut to sustainable farming practice. Cornell University still maintains and regularly updates the EIQ website that can be found at: https://nysipm.cornell.edu/eiq.

The EIQ approach is not without criticism. Several scientific publications have offered critiques that do in fact have validity. As pointed out by Jonathan Dushoff in the Fall, 1994 edition of the American Entomologist, relative toxicity ratings assumed by the EIQ are not scaled to actual toxicity. An example Dushoff cited in this article relates to the impact of an insecticide application and its impact on birds. His example is as follows: *"One pesticide is toxic birds at 1 part per million (ppm) and is applied at 1 lb per acre, while another is not toxic to birds even at 1,000 ppm, but requires an application of 3 lbs per acre….According to EIQ, we should prefer the toxic pesticide, with an adjusted EIQ of 10.7, as opposed the nontoxic one with an adjusted EIQ of 20."* Now, this critic does not tell us if there are other environmental impacts associated with these products.

Other critical authors argue that the modeling techniques, the relative risk factors and the measure of environmental persistence used by the EIQ model are also flawed. A good review of these critiques can be found at https://peerj.com/articles/364/. No other usable models for predicting the environmental impact or overall sustainable nature of any agricultural product have been suggested that have been without criticism. The point is that risk is relative, must consider the impact on a vast, interconnected set of factors and most certainly not simplistic.

Natural and Organic Pesticide Options:
Justin Scheiner

Over the last decade, the terms sustainable and organic have become very trendy from a marketing prospective. As a response, a myriad of new ***"natural"*** or "***environmentally friendly***" products have become available. Some of these products purport healthier, more productive plants, others fight pests and disease, and some even claim to break the laws of physics. Keep in mind that there are no legal standards for the use of terms like **"natural" "environmentally friendly", "safe", "eco", "green", "bio",** etc. These are marketing terms, not different than **"best", "pure", "healthy"** etc.

Bear in mind, there is no law against selling a product that does not work.

As long as it is generally safe, lack of efficacy is not a barrier to marketing a product. So how do you know which products are worth trying, or are sustainably cost effective? The answer is that you have to do your homework before making a purchase. It can be especially difficult to find unbiased information on products that represent a new technology. Below we will briefly discuss some of the newer products and technologies on the market, highlighting what is known and what is unknown about their efficacy and how they work.

Hydrogen peroxide products: hydrogen peroxide is an oxidizing agent that has both antifungal and antibacterial properties. In addition to the antiseptic you get at the drug store to treat the scrape on your child's knee, hydrogen peroxide is available as an Organic Materials Review Institute (OMRI) certified vineyard fungicide. Agricultural use of hydrogen peroxide is not new. According to the USDA, the first pesticidal hydrogen peroxide products were registered in the U.S. in 1977 and now, there are over 150 labels registered. Obviously, hydrogen peroxide prod-

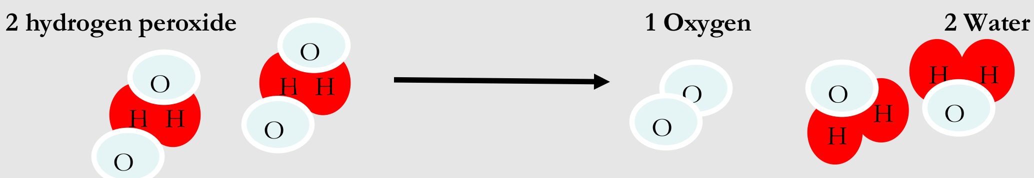
Sustainable Agricultural Practices

ucts would not have stood the test of time if they did not work. However, it's important to understand the limitations of these products to know how or if they may fit into your spray program.

As a strong oxidizer hydrogen peroxide kills cells on contact by stealing electrons and damaging their cell wall. That means good coverage is critical for effective use of hydrogen peroxide. It will only affect organisms with which it comes into direct contact. After it is sprayed, hydrogen peroxide rapidly decomposes into water and oxygen allowing for short restricted entry intervals. In fact, the Oxidate 2.0 label simply states "keep unprotected persons out of the treated area until sprays have dried".

Of the common fungal diseases that infect grapes in Texas, only powdery mildew grows almost entirely on the surface of the plant where it can be targeted by topical products like hydrogen peroxide. That enables a grower to

Warm temperatures and light speed up the rate of this reaction:



eradicate or kill visible powdery mildew colonies with surface active fungicides like sulfur or spray oil. However, other fungi like downy mildew, black rot, anthracnose, and so on, grow deeper into plant tissue making eradication of existing infections nearly impossible. While hydrogen peroxide will kill the spores of these fungal organisms and prevent spread, it does not persist to provide forward activity. That is why most hydrogen peroxide labels suggest short spray intervals of 3 to 5 days. However, under optimal weather conditions for fungal infection, black rot, downy mildew, and anthracnose require less than 12 hours for an infection to occur, and once the infection becomes visible it cannot be cured with an exception or two (e.g., mefanoxam and downy mildew).

In short, hydrogen peroxide is an efficacious vineyard fungicide, but it's important to recognize its limitations in order to properly integrate it into a spray program. And, it's important to note that many hydrogen peroxide products require the signal word "Danger" due to their high concentration. While it may be the same active ingredient as the hydrogen peroxide you get at the drug store, it is not the same strength. Extreme caution must still be taken when applying these products. Finally, the cost of these products should be weighed against the benefits to determine if a 5-day spray interval as some labels state fits into your economic model, or if occasional, more specific use is best for you.

Ozone is another strong oxidizer that's familiar to many winemakers as a sanitizing agent in the winery. Because ozone is not stable, it must be generated onsite. Most often it is generated and stored in cold water to increase stability as the half-life of ozone decreases with higher temperatures. For Example, the half-life of ozone in water at pH 7 is 30 minutes at 59°F and 12 minutes at 86°F.

Like hydrogen peroxide, ozone does not persist long after application. It oxidizes surface microorganisms such as bacteria and fungi, and fungal spores and has the same potential uses and limitations as hydrogen peroxide. Ozone is surface active only so coverage is critical, and it does not provide forward activity for disease control. One should strongly consider the cost of this type of treatment with the benefits and limitations in deciding if it will meet the economic component of a Sustainable spray program.

Sustainable Agricultural Practices

Biofungicides are pesticide formulations of living microorganisms that are typically found in the soil or on plants, or natural chemical products produced by them. Most of the products available are approved for use in organic production. But, how do they work? The modes of action of these products vary widely by active ingredient and range from competition (outcompete pathogen for nutrients and infection sites on plant tissue) to antibiosis (production of antibiotics or toxins) to parasitism, even induction of host plant resistance (systemic acquired resistance, SAR). Do they actually work? Many of the biofungicide products on the market have had some independent testing under field conditions and in short, the results vary by product. Overall, they do not generally perform as well as their conventional counterparts (if one exists), and it's again important to understand their limitations. For example, some biofungicides are actually fungi themselves and can be killed by conventional fungicide applications. So care must be taken when utilizing these products along with chemical fungicides be they conventional or Organic. Additionally because they are living organisms, the shelf life of these products tend to be shorter and may have special storage requirements, so you will want to carefully evaluate the details of any new product to determine if it's right for your program.

Compost tea as the name suggests is a liquid solution made by adding compost to water. There are many recipes for compost teas including some that call for additives such as molasses, yeast extract, kelp, algal powder, etc. and some that call for aeration. The concept behind compost tea is that you encourage growth of and subsequently extract the microbes that colonize the compost as well as any plant nutrients. The tea is then either poured around the base of the plant or sprayed directly on the foliage. The suggested benefits of compost tea are plant nutrition, disease and pest suppression, and enhanced soil health.

While there has been quite a bit scientific research in the area of compost teas, there is not a simple way to summarize their effectiveness other than saying that the results have been inconsistent across studies, compost tea recipes, and potential impacts that were tested. In other words, I would not suggest replacing your current fertility or pest management program with compost tea. However, if one wishes to use a compost tea there are a few considerations. First, during composting, most microbes will be killed by the heat and will need to repopulate before making a tea. This is especially important for manures in order to kill pathogens such as *E. coli* and *Salmonella*. While we assume that these pathogens would not survive alcoholic fermentation, the Compost Tea Task Force, part of the-National Organic Program, indicates that compost tea made with additives must be tested before it is applied on food crops, or a 90/120 day pre-harvest interval must be followed. A list of other best practices from the Compost Tea Task Force is available from:

ams.usda.gov/sites/default/files/media/NOP%20Final%20Rec%20Guidance%20use%20of%20Compost.pdf

The use of compost tea for suppression of fungal disease was examined in a joint study by Penn State and the Rodale institute in 2004. Their conclusions are as follows:

"The vineyard experiments include three treatments: a weekly, foliar application of compost tea beginning in mid-May, a pesticide control, and a no-spray control. In 2003, results here were the most dramatic out of the three crops, with compost tea suppressing powdery mildew (Uncinula necator) by approximately 50 percent on Chardonnay grapes. The tea also appeared to help control the spread of gray mold (Botrytis cineria), but this result was <u>not statistically significant</u>. Trials showed <u>no detectable effect</u>, finally, on black rot (Guignardia bidwellii) or Phomopsis (Phomopsis viticola), and use of compost tea actually seemed to encourage infection by downy mildew (Plasmopara viticola).

Sustainable Agricultural Practices

(Vineyard managers resorted to fungicides to control the latter diseases in late June and early July.)"

newfarm.rodaleinstitute.org/depts/NFfield_trials/0404/tea.shtml

Mycorrhizae and *Trichoderma* are both soil dwelling fungi that form beneficial associations with plants. Mycorrhizal fungi colonize the roots of plants such as grapes by penetrating the root epidermis and growing into the root system. This essentially extends the root system's reach into the soil by increasing its surface area. The host plant benefits from this relationship with an increased capacity to absorb nutrients and water and in return the mycorrhizal fungi feed on carbon produced by the host plant. This can be particularly beneficial in marginal soils.

Like mycorrhizae, *Trichoderma* are also commonly found in root ecosystems and can form an association with plant roots resulting in improved water and nutrient uptake. Additionally some *Trichoderma* strains are reported to stimulate or turn on the native defense systems of some host plants increasing their potential to fight off pathogens, and some even directly parasitize other fungal organisms. Several research studies have reported that specific *Trichoderma* strains applied to pruning wounds can reduce incidence of fungal trunk disease by colonizing the wound site and outcompeting fungal trunk disease pathogens through antibiosis.

There is clear evidence that mycorrhizae and *Trichoderma* play beneficial roles in plant health. Both groups of fungi comprise multiple species, many of which have been studied for several decades. In more recent years, preparations of these fungi have become available as inoculations for grapevines and other crops. Do they work? The ubiquitous nature of these microbes often makes them difficult to study under field conditions. However, research at the University of California Davis on mycorrhizae in vineyards suggests that mycorrhizae preparations are more practical in newly planted vineyards and more importantly in fumigated soil, although even grapevines planted in fumigated soil will become naturally colonized by mycorrhizae over time. Otherwise, field grown nursery stock already contain mycorrhizae in the roots and further development can be encouraged with cover cropping.

iv.ucdavis.edu/files/24422.pdf

Trichoderma products are available for the treatment of pruning wounds, but more field research is needed to determine how they can be most effectively incorporated into a trunk disease management program. Cultural practices such as timing of pruning, fungicides, and practices that encourage vine health will continue to be a very important for grapevine trunk disease management. For more information on managing grapevine trunk diseases, see the Texas A&M AgriLife Extension Fact Sheet Grapevine Trunk Diseases at

aggie-horticulture.tamu.edu/vitwine/files/2017/04/Grapevine-Trunk-disease.pdf

Summary

While there are many more vineyard products marketed as organic or sustainable not discussed here, it's safe to say that it's important to do a little homework before adopting any of them as part of your management plan. Certainly some products have proven efficacy and may fill a niche in your management program, but it's necessary to understand their limitations to determine if they will be cost effective. Recall that profitability is a key component of Sustainable production. All of our pest management and fertility tools have limitations so if proposed benefits of a product seem way too good to be true, well, then you know the rest.

Sustainable Agricultural Practices

Cover Crops for Vineyard Floor Management

Pierre Helwi

Cover crops are an important component of sustainable viticulture systems as they have a major and direct impact on the health of vines and the surrounding ecosystem. Growing a cover crop minimizes the use of chemicals which may negatively affect environment and reduce the physical impact of frequently running heavy equipment on vineyard soil. This article discusses the benefits and drawbacks of using cover crops in sustainable viticulture and includes guidelines for sound practices.

A cover crop can be defined as any vegetation grown in vineyard middles and occasionally under vines without being harvested. Cover crops may be planted annually fall and spring, or maintained perennially. The implemented technical aspects of this approach are delicate and must be well considered in order to benefit from the positive effects of the planted crop.

Benefits of cover crops

Improve soil structure: vegetation roots bind soil particles together, ameliorating soil structure and wa-ter infiltration. In additions, the mechanical action of cover crop roots loosen the soil up to 60 inches of depth, reduce its compaction and improve the pene-tration of water and air.

Improve mineral fertility: besides increasing soil nitrogen, the decomposition of the cover crop in-creases soil cation exchange capacity therefore the ability of a soil to hold and exchange nutrients allow-ing their restitution to the vine in an assailable form. Cover crops limit also mineral leaching by rain by storing them during the winter time. In addition, leg-umes contribute to enrich the soil with nitrogen by symbiotic fixation of the atmospheric form.

Improve soil biological activity and organic matter content: cover crops stimulate rapidly and in-tensely the biological activity of the soil during their growth and especially after decomposition. The quan-tities of formed humus (organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms) allow to main-tain the organic matter content of the soil.

Protect against erosion and run-off: cover crop protects the soil surface from raindrop impact that dislodges soil aggregates, enabling them to move with water run-off.

Limit weed germination and growth

Provide habitat for beneficial insects and preda-tors: some cover crops attract beneficial insects and arthropods which can contribute to control harmful insects and mites.

Suppress some populations of nematodes: an an-ti-nematode action is sometimes described for some cover crops. This action, due to compounds released during the decomposition of the plant, concerns only Root-knot and *Pratylenchus* nematodes responsible for direct damages.

Influence grapevine growth: the presence of vege-tative cover influences grapevine growth by compet-ing for water and nutrients or by providing additional nitrogen for vine development.

Provide firm footing for cultural operations and are aesthetically pleasing

Sustainable Agricultural Practices

The use of cover crops may also have some drawbacks. The presence of a cover crop may increase water use, frost hazard, and the competition with vines for soil moisture and nutrients. Pest problems may also results from the presence of cover crop mainly when it is not kept in a reasonable height, in addition to a possible increase in costs and management.

Which species can be used as cover crop?

Many types of plants can be used as cover crops. Legumes and grasses including cereals are the most extensively used, but there is increasing interest in brassicas (such as rape, mustard, and forage radish) and continued interest in others, such as buckwheat.

Families of cover crop are classified according to their ability to provide carbon ("slow" or "fast") and nitrogen (N). "Slow" carbon sources correspond to materials rich in cellulose and lignin such as cereals, "rapid" carbon sources are associated with grasses and brassicas with easily degradable sugars, and legumes are the N providers. In order to ensure that microorganisms can properly degrade the organic matter without depriving N, it is desirable to use a cover crop with a balanced formulation between slow carbon, fast carbon and N sources. Legume-grass mixtures complement each other in their soil-improving functions. This blend offers the benefit of both tap and fibrous root systems and supplies the vines with moderate N. Monocultures may be preferred where the species has a history of proven performance. Single-species plantings should usually be rotated to reduce the potential for build up of insects or pathogens. For each specific crop, ask the seed supplier about seedbed cultivation, as well as moisture and fertilizer requirements.

The table below adapted from Principles of Cover Cropping for Arid and Semi-arid Farming Systems, NM State University lists some of the species that can be used:

Winter annual

Name	Family	Characteristics	Seeding Rate (lb/ac)
Annual grasses (wheat, barley, oats, annual ryegrass, cereal rye, triticale)	Grass	Cold-tolerant, high lime tolerance, low drought and generally low salinity tolerance, moderate moisture use	Wheat, barley, oats, triticale: 60-120 Annual ryegrass: 15-30
Austrian winter pea	Legume	Moderately cold and drought tolerant, moisture efficient	60-80
Brassicas (mustards, turnips, forage radish)		Tap-rooted, moderate to high drought tolerance	Mustard: 5-12 Turnip: 4-7 Radish: 8-12
Hairy vetch	Legume	Cold tolerant, moderate tolerance to drought, and soil lime; low salinity tolerance	15-20

Winter annual cover crops are most often planted in vineyards because they grow during the dormant season and spring when rainfall is often most abundant, thereby aiding in erosion control and are not in competition with the vines for water and nutrients. They are sown in the fall and are mowed and disked in the spring, or killed with an

Sustainable Agricultural Practices

herbicide. Summer annual cover crops are usually planted in the spring and they are ready to mow or till in in about a month assuming adequate rainfall.

Summer annual

Name	Family	Characteristics	Seeding Rate (lb/ac)
Buckweat	Grass	Cold sensitive, moderate drought tolerance	50-60, drilled
Cowpea	Legume	Drought tolerant	50-100
Foxtail millet	Grass	Cold sensitive, drought tolerant	15-20
Lablab	Legume	Vining and spreading legume	50-60
Pearl millet	Grass	Cold sensitive, drought tolerant	15-20
Sesbania	Legume	Fast and vigorous growth	30-40
Sorghum-sundangrass	Grass	Cold sensitive, drought tolerant	15-40

Perennial

Name	Family	Characteristics	Seeding Rate (lb/ac)
Alfalfa	Legume	Cold tolerant, drought tolerant	15-18
Red clover	Legume	Cold tolerant, moderate tolerance to soil lime, low drought and salinity tolerance	20-28

Perennial cover crops are generally sown in the fall, but some can be planted in early spring. They usually do not require replanting for several years. Perennial species are most commonly used in vineyards planted on fertile sites where vines are seriously out of vegetative balance but are also utilized in less fertile sites in order to maintain soil structure in the aisles and provide firm footing for viticulture operations.

Sustainable Agricultural Practices

Legumes

Legumes provide N to the soil with the aid of symbiotic bacteria. A legume plant produces a tap root that does not penetrate well into compacted soil layers, so they are less useful for loosening soils and improving water penetration than cereals. A legume green manure cover crop can provide all of the N required under ideal circumstances after 2 seasons of careful management. The N contribution could be reduced by planting alternate row middles, combining legumes and cereals in the cover crop mixture, or reducing the width of the cover crop band. Legume cover crops should be used with caution in excessively vigorous vineyards and high rainfall areas of the state. Legume seed must be inoculated with the appropriate strain of N-fixing rhizobium bacteria prior to planting.

Grasses

Grasses do not fix N but may be useful as a trap crop to take up soil N and release it more slowly upon decomposition in the soil. Grasses have numerous small, fibrous and fine roots that are more likely to grow into compacted layers.

Cover Crop Planted at the Lubbock AgriLife Research Vineyard by Pierre Helwi

Wheat

Rye

Hairy Vetch

Cover crop management

Prior to seeding, the soil must be sufficiently cultivated to allow for good germination.. Many growers begin by shallow ripping using a shallow tiller. The soil is then moistened and disked twice (about a week apart), leveled, and seeded. Seeding will ideally be from mid-September to mid-October for most cover crops , when soils are warm and rainfall is likely. Seeding after mid-October in many areas of the state becomes risky due to cooling soil temperatures, slow germination, and early frost. No-till drilling method is highly recommended for seeding cover crops because, besides conserving soil texture, it offers a uniform seed placement and an excellent seed-to-soil contact, which leads to a high cover crop establishment rate. After seeding, the seedbed should be firmed to lightly pack the soil. Irrigation after seeding helps ensure successful germination and establishment.

Cover crops should be fertilized and soil amendments should be added on the basis of soil test results. Grasses and brassicas may require the addition of N for adequate growth. When planting legume-grass mixes, avoid or limit N fertilizers, which stimulate grasses to the point that the will shade out the legumes. Many growers use compost, which in most cases will adequately provide what the cover crops need.

The presence of the cover crop increases the risk of damage by spring frost. Often the cover crop is mowed in early spring for frost protection and then allowed to resume growth and go to seed. After the seed matures, the cover crop is mowed and left on the soil surface or incorporated into the soil using a shallow tiller.

Sustainable Agricultural Practices

The following factors should be considered when choosing whether or not to incorporate the cover crop:

- It may allow for rapid N release and availability for the current season.
- Maximum N release occurs about 3 weeks after incorporation, assuming that the soil remains moist.
- For perennial cover crops, several mowings might be required to keep the foliage from growing excessively tall.

Conclusion

Vineyard floor management is an important component of Sustainable winegrowing systems. If a cover crop is to be utilized, choices in cover cropping should be site-specific. Growers must consider their style of farming, yield and quality objectives, and any other criteria that they consider important.

Sustainability in the Winery

Andreea I. Botezatu

For the winemaker, sustainability represents the capacity to produce high quality wines while maintaining and protecting the environment as well as helping local businesses and surrounding communities to thrive.

How does that translate into practice? For wineries there are a number of criteria that come into play: building design and winemaking practices, water efficiency, energy efficiency, waste management, as well as neighbor, community and employee relations are some that we will look at in a little bit more detail.

Building design can play a major role in the sustainability of any operation. From questions regarding sun exposure (to make the most of it if you are in a northern, colder region or to shy away from it if you need cooling throughout the year), to utilizing most efficiently the local terrain, working with - rather than against - the natural landscape there are many steps that can be taken to ensure a good start to your sustainable winery. Utilizing local, natural, renewable or recovered materials and building with energy conservation in mind (gravity wineries) are also important paths to sustainability in the winery. Minimizing potential movement between buildings (winery to storage facility, storage facility to tasting and retail store, etc.) will save energy and money. Planning ahead for expansion is a good strategy as it will allow for (financially) painless and efficient growth.

Water efficiency – In Texas access to quality water is limited and costly. Wineries use vast amounts of water for tasks such as equipment and winery cleaning, technical tasks (pushing wine through lines for filtration, bottling line operations, etc), laboratory tasks (sample preparation, labware cleaning) and tasting room tasks (washing glasses). The goal of a sustainable winery is to maximize all water conservations methods at their disposal. The first step is to know how much water the winery is using. Keeping track of monthly and yearly water usage is essential, as well as regularly checking for any possible sources of water loss (leakage, pipe perforations, defective faucets, etc.). Some possible ways of decreasing water usage in the winery are installing low-flow aerators on faucets or using high-efficiency/low flow toilets. Maintaining water quality is also important. If the winery uses water filtration systems (reverse osmosis, ozone, ultra-violet radiation) these systems should be checked and maintained regularly. In terms of waste water management, wineries should have a wastewater management plan and should look into using alternative disposal methods for waste water, such as ponds, fountains, or use it for irrigation purposes. Monitoring the parameters of waste water is also an important step (dissolved oxygen, pH, suspended solids). Another

Sustainable Agricultural Practices

criterion is storm water management. Do wineries capture and use storm water? If storm water is drained, does it drain into a different capture system than waste water?

In the processing facility water usage should be monitored and rules such as using known quantities of water for tank or line washing as well as using high-pressure /low volumes nozzles can and should be implemented. Some useful questions to ask in terms of water usage for sanitation purposes would be: ”Is wastewater from tank cleaning and barrel washing collected and reused?”; “Is water used for cleaning and sanitizing tanks applied from either the top or bottom of the tank using a spray ball or rotating device that circulates the water in the tanks?”; “Is tank cleaning designed for tank size to help reduce water use?”; “Is barrel washing timed?”; “Is the temperature of water used in barrel washing monitored and adjusted according to the situation?”, etc. Some strategies to consider in the winery lab would be to have a set amount of water and rinse time for lab equipment, to trial new lab techniques that reduce water and to re-circulate condenser water.

Energy efficiency - the goal of a sustainable winery is to minimize the cost associated with energy use from a financial, ethical, and environmental perspectives. Energy efficiency is paramount and it is a critical first step in addressing energy use. While energy conservation is the ultimate goal, it can be achieved through efficient and judicious energy use. In the winery the biggest energy consumption is usually related to refrigeration. As such, sustainable options would be either using less refrigerated tanks, more insulated tanks or both. Having underground storage spaces with constant temperature throughout the year is a great option. Also, of extreme importance is installing properly sized HVAC systems. Energy efficient lighting, thermostats and automatic controls are all to be considered. Alternative, sustainable sources of energy are becoming more and more mainstream. Texas is blessed with sunny days almost year round, so the use of solar panels should be considered as an optimal choice. Red Caboose winery in Texas is one of the first to implement the use of photo-voltaic cells in their winery and they are producing so much electricity that not only do they cover their operational needs, but part of it is going back into the grid. . Another excellent option is the use of geo-thermal cooling for your building or parts of the building (tasting room, retail store, etc.).

Solid waste management- for wineries most of the solid waste consists of pomace, stems and lees. These can be brought back directly into the vineyard (or used on other crops) or alternately can be composted with animal manure. Some wineries sell their pomace to industrial alcohol producers. In terms of packaging, glass bottles are, from an environmental perspective, a sound choice. Glass bottles can be continuously recycled, which is beneficial

These are just a few guidelines for building and operating a sustainable winery. For more in depth information and to see what others are doing you can visit

sustainablewinegrowing.org/docs/2015_CSWA_Sustainability_Report.pdf

sustainablewinegrowing.org

sipcertified.org/wp-content/uploads/2016/10/SIP_Winery_Standards_2017-3.pdf

nzwine.com/en/sustainability/what-sustainability-means-to-us/

CSWA_Sustainable_Water_Management_Guide_for_Small_Wineries.pdf

Sustainable Agricultural Practices

in reducing winery waste. In California, for example, 64% of vintners separate recyclable glass and have designated recycling bins at their facilities.

Wineries are not islands in an empty space. They operate within communities and neighborhoods and, as such, they should contribute to their wellbeing and healthy sustainable development. From taking steps to minimize negative impacts on their neighbors (through, for example, noise pollution) to being open and ready to respond to community concerns and questions and even to work on enhancing their local communities through volunteering or providing contributions such as time, financial support or wine, there are many steps wineries can take on the road to sustainability. Maintaining a healthy environment is paramount for the well being of any community, as is keeping the natural landscape intact and adding to the economic vitality of the community by creating employment opportunities and developing quality products.

Offering a safe and stable environment for employees is also a part of the Sustainability paradigm. Keeping your employees informed about your Sustainability efforts as well as encouraging them to provide suggestions for improvement will help ensure the successful operation of your winery. Furthermore, the ability of vintners to compensate their employees fairly will increase the likelihood of attracting and retaining a dependable workforce.

Third Party Certification Models

While there is currently no 3rd party certification system for Sustainable Viticulture or Wine Production in place for Texas vineyards or wineries; this is a change that grower groups have the power to make. Across the country many grower groups working alone or in cooperation with their local Extension Programs have developed Sustainable Viticulture certification programs for their own growing regions.

To learn more about what other groups have done, please explore these web- pages representing just a few of the Sustainable Viticulture programs currently operating in the United States today.

Long Island Sustainable Winegrowing lisustainablewine.org/sustainability/

LIVE Sustainable Winegrowers livecertified.org/

California Sustainable Winegrower Alliance sustainablewinegrowing.org/

Certified Green Lodi Rules for Sustainable Winegrowing lodigrowers.com/wp-content/uploads/2014/01/LR-binder-COMPLETE-V14.pdf

Texas Winegrower is a production of the Texas A&M AgriLife Extension Viticulture Program.

Editor: Jacy L. Lewis Program Coordinator, and Laboratory Manager Texas A&M AgriLife Viticulture and Fruit Lab 830-990-4046

We welcome your questions or comments! Please address all comments or inquiries to:

grapelab@ag.tamu.edu

Find Us On The Web

https://www.facebook.com/TXViticulture/

We hope you have found this second special supplement to our regular newsletter both useful and informative. Our goal continues to be to provide timely information on topics of relevance to Texas winegrape growers. In service to the winegrape community we work to provide unbiased, science based information on important topics, and provide 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
Editor

Your Viticulture Extension Program Specialists

Fran Pontash

Representing the Gulf Coast and South Texas Winegrape Growers.

979-845-5341

fmpontasch@tamu.edu

Michael Cook

Representing the North Texas Winegrape Growers

940-349-2896

m.cook@tamu.edu

Pierre Helwi

Representing the Texas High Plains Winegrape Growers.

806-723-8447

pierre.helwi@ag.tamu.edu

Photos courtesy of Texas A&M Agrilife Extension

We are currently advertising for an Extension Program Specialist for the Texas Hill Country, but at this time the position remains unfilled. Until further notice, Hill Country Winegrape Growers may contact the Fredericksburg Viticulture and Fruit Laboratory and Jim Kamas at 830-990-4046 or j-kamas@tamu.edu

A member of the Texas A&M University System and its statewide Agriculture Program