GW AGRICULTURE™
Putting Profit Back Into Farming Since 1993™
Improving Farms, Vineyards, Landscapes, Gardens and Orchards 2008

Vineyard Design and Development

Winegrape vines do best in natural environments, not in artificial environments.

In order to create the most natural environment, the objective is to integrate a vineyard within a site rather than impose an artificial conception of an idealized, sterile vineyard on the site. Don't fit a square peg in a round hole. Vines don't like it. People who look at or visit a vineyard won't like it either.

The best and healthiest vineyards, producing the highest yields and quality, are not pristine with perfectly manicured vines, where all the canes and leaves are perfectly trimmed, where bare dirt passes for floor management and nary a weed appears in the soil.

In these vineyards, devoid of plant life except vines, the sun is allowed to bake the soil, destroying the tilth and ruining the environment for the biota in the soil on which the vines are dependent for their very existence.

Vineyards with cover crops of indigenous and domesticated grasses, such as oats and rye, are just as unhealthy for the vines as bare dirt. Grasses compete with vines for soil nutrition. This is documented in *Cover Cropping in Vineyards* by the University of California. This phenomenon is commonly called "devigoration" In reality, the lack of nitrogen brought about the presence of a grass cover crop weakens the vines, making them susceptible to disease and insect damage, lowering the quality of the winegrapes and yield.

We have to be flexible and adaptable to each individual vineyard environment. We have to develop appropriate techniques for different vineyards. The goal should be to create an environment that is self-sustaining, producing high yields and quality with no insect or disease problems. Always work toward that goal.

Some of the best vineyards using the GW Agriculture system, planted with our exclusive cover crop mix and managed with our unusual pruning techniques, actually look kind of ratty and unkempt. We have vineyards on a fair variety of soils and climates. One outstanding vineyard is located on very heavy clay soil on Sonoma Mountain. Others are planted on sandy and silty loam and other soil types. All the best ones have mature perennial cover crops growing. They are perfect environments for winegrapes and all the life that supports them.

Not all of our vineyards have year-round perennial crop coverage. Some have cover crops only in the fall, winter and early spring. In these vineyards, usually with heavy clay soils, the floor is heavily cultivated for the summer months and the cover crop replanted over the winter. It takes a few years to develop a good perennial cover crop that is self sustaining.

Some soil conditions require extensive cultivation as preparation for hot, dry summers. For adobe and heavy clay soils, it is important to cultivate to reduce or eliminate the extensive cracking of the surface that can take place when the soil dries out in the summer. Cracked soil dries out faster due to the subsoil being exposed to air and heat, stressing the vines and increasing irrigation requirements, increasing costs and decreasing profit. This is a short-term solution that is solved long-term by a perennial cover crop with deep roots and extensive leaf development.

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Numerous studies available through the American Vineyard Foundation and other sources have shown that established cover crops require no more nor less irrigation to maintain than fields without cover crops, especially once well established.

Moreover, the benefit to the tilth, fertility, SEC, amount of organic matter and water holding capacity of the soil and the dramatic increase in predator insects (spiders), flying insects and other fauna, not to mention the increase in the complexity of flavors in the winegrapes, is remarkably high with a cover crop.

The notion that vineyard floor management requires the total removal of all plant and animal life simply does not hold up under examination and is, in my opinion, mostly a matter of convenience or is a cost saving measure for the grower rather than a technique that guarantees an increase in yield and quality.

We recognize that each vineyard is unique and while some techniques are appropriate for one vineyard, they may not be for another. That is what makes the GW Agriculture system so unique. You can use all the basics for success and still tailor it for your specific needs. It is better to have a cover crop half of the year than none at all.

What Is Natural Farming?

I have heard it said that farming is not natural, that planting food crops is an imposition on the land. I think this is nonsense. That thinking defies logic. Mankind has been given dominion over the Earth and all things on the Earth. In order for people to live, they have to eat. In order to eat, you have to raise food. You have to have a garden or a farm to do it. What could be more natural than growing food?

On the other hand, imposing an unnatural vineyard, a field of cotton or corn, an orchard or a garden, on the land in an unnatural way creates unintended and potentially deleterious consequences. You want to work with the Forces of Nature, not against them. You want to let the Natural Forces and the Natural Laws work for you, not against you. You want to work in harmony with these Forces and Laws.

The Natural Forces at work on the Earth constantly drive ecosystems toward homeostasis, or a steady state, which is a natural state of self-sustainability. When these Natural Forces are weakened in some way, this drive slows down or stops. When this happens, the environment eventually collapses.

There are only two ways in which an environment can be pushed to ultimate collapse. One, a catastrophic change in the weather (freezing, heat waves, high winds, fire, floods and so on), or the land (earthquakes, comets or volcanoes). The second is mismanagement by man.

Change can be extreme and fast, or slow and insidious.

Take, for example, the installation of an access road in a vineyard. This changes the environment under and around the roadway for the duration of the life of the vineyard, and beyond. The movement of heavy trucks, tractors and equipment, compacts the soil. Oil, engine exhaust, dust control chemicals and other pollutants accumulate. Water no longer percolates, instead, runs off away from the soil, reducing ground water reserves. Over the short run, not much grows in the roadway except occasional pioneer plants. Over the long run, an unused road once again becomes choked with vegetation, returning it to its natural state.

These Natural Forces are at work in your vineyard all the time. It behooves the careful and thoughtful grower to take advantage of them rather than fight them. It's far cheaper to operate this way too. This is one of the primary reasons why careful vineyard design is so crucial to its ultimate success.

Working with the Forces of Nature: The Golden Mean

Nature is relationships in space. Geometry defines relationships in space. Art creates relationships in space. Mathematics is one tool by which we attempt to understand how the natural world operates.

Thinking about space requires the ability to reason abstractly. All of Nature's interactions occur in a spatial field and there are structural constraints that allow for only a limited number of basic patterns.

They occur as a result of Nature's practicality since everything she does has a purpose.

Spirals, meanders, explosions, branchings, and crackings solve different spatial problems with the greatest efficiency. Using these, Nature works within the interaction of many complex forces where conditions are never simple. We find these recurring patterns, with infinite variation, at the microscopic and macrocosmic levels. They swerve from the absolutely perfect geometric model which, after all, is only an abstraction created by the human mind in order to parallel experience.

In creating forms in space, Nature does not indulge in sloppy craftsmanship. All details of design are fully worked out with a fusion of function, technique and material. She gives the same amount of attention to small and large, organic and inorganic forms alike, and no aspect of her design is unimportant. Her packing and partitioning of space are ultimately practical and efficient. Beauty is the by-product of her design as a result of the form and function being intimately related.

Whatever we may describe is obviously inadequate to the reality of Nature, for, as Jacob Bronowski has said, "The world is totally connected. Whatever explanation we invent at any moment is a partial connection, and its richness derives from the richness of such connections as we are able to make."

What does **proportion** mean? Viewing all things geometrically, we find that all parts of any whole are represented as proportions to each other part and to the whole itself.

A **ratio** is the comparison of numbers to each other which can be expressed in several ways. If, for example, we are comparing the number 2 to the number 3, we may write 2 to 3 or 2:3 or simply 2/3 Hence every fraction is a ratio in which the numerator is compared to the denominator.

A **proportion** is simply and equation in which two ratios are set equal to each other such as 2/3 = 4/6 or 2:3::4:6. This same equation may be expressed without the mathematical symbols by writing 2 is to 3 as 4 is to 6. When we write a/b = c/d, **a** and **d** are called **extremes** of the proportion and **b** an **c** are called the **means**. The names of the terms become much more meaningful when we write a:b::c:d. The extremes, then are the *outside* terms and the means are the *middle* terms. A **mean proportion** is one in which the means are equal such as 1:**3**::**3**:9.

One mean proportion which appears with amazing frequency in Nature and Mathematics, and has been used throughout the centuries by artists, is called the **Divine Proportion**. This proportion is derived from dividing a line segment into two segments with the special property that *the ratio of the whole segment to the longer part is the same as the ratio of the longer part to the shorter part*.

The ratio expressed by either side of the equation is called the **Golden Ratio** or the **Golden Mean**. The point which divides a line segment into two segments in the Golden Ratio is called the **Golden Section** and is unique with the exception of order; that is, the longer segment may be at either end of the original segment.

The **Golden Ratio** or **Golden Mean**, sometimes referred to a **Phi**, after the classical Greek sculptor Phidias who used it extensively in his work, is expressed as **Ø** where **Ø ≈ .618035** and is an irrational number, sometimes called a transcendental number. It is a unique, non repeating number like Pi ($\pi \approx 3.14159$).

Phi has a number of unique mathematical properties that are not relevant to this particular discussion but are interesting and should be briefly noted.

First, Phi is the only number that becomes its own reciprocal when decreased by one.

Second, if we consider the sequence whose terms are consecutive powers of Ø, i.e. Ø, $Ø^2$, $Ø^3$, . . . $Ø^n$, this, then, is a **geometric sequence** since each term is calculated by multiplying the preceding term by the same number, namely **Ø.**

Third, each term is also the sum of the two preceding terms. Therefore, it is at the same time a **summation sequence**, the simplest of which is the Fibonacci Sequence.

In other words, simply expressed, Phi, or Ø, can be expanded one way exponentially and in another way mathematically by addition as a summation of one number with the previous number.

Fibonacci (1170 - 1250), was a 13th century Italian mathematician who wrote books on geometry and trigonometry and popularized the use of Arabic numerals in Europe. He created the following sequence:

1,1,2,3,5,8,13,21,34,55,89,144 and so on. Each number is calculated by adding two previous numbers, such as 1+1=2, 2+1=3, 2+3=5, 3+5=8 and so on. The ratio of any consecutive pair of Fibonacci numbers is Ø, correct to at least five decimal places, and may be carried out *ad infinitum*.

For our purposes, the most important characteristic of **Ø** is that everything in Nature, whether an element, mineral compound, a plant or an animal, displays the **Golden Mean** proportions to one degree or another. Everything,

Mathematicians are often fond of saying that the entire Universe can be described as mathematical formulas. In this case, it is true.

For example, this sequence occurs naturally in the genealogy of the drone or male honey bee. He has a single parent, only a mother, whereas the female bee has both a mother and father. The male bee has 1 mother, 2 grandparents, 3 great grandparents, 5 great-great grandparents, 13 great-great-great-great grandparents and so on.

Take another example. If we observe the flowers, leaves and branches of the *Arcillea ptarmica* (sneezewort), we find several occurrences of Fibonacci numbers. As the flower stems branch out terminating into flowers, the number of branches increases in the approximate ratio of 1, 1, 2, 3, 5, 8 and 13 branches. Nature does not follow this pattern absolutely, but the tendency for these numbers to appear in natural branching patterns is too great to discount.

Numerous other examples are readily observable. The spirals in the face of a sunflower has, on average 55 long curves and 89 short curves. Pine cones, pineapples, and seed pods of many flowers also show these proportions.

The Nautilus sea creature, when cut in half, can be observed to spiral out in the same proportions. Natural spirals of all kinds are consistently geometric, the most prevalent being the logarithmic spiral found in the horns and teeth of animals, some spider webs, seed cases and stems of plants, the beaks of birds, the shells of sea creatures, the umbilical cord, the cochlea of the ear, the great bones in humans and the galaxies of the universe.

This is a spiral of growth that exemplifies Nature's laws of conservation. It fills space economically and regularly, affords strength with a minimum of materials, but has the exceptional property that while expanding it, alters its size but never its shape. The spiral provides a perfect solution to the problems of growth from a single point, growth by accretion, and growth under resistance, both factors which divert growth from a direct path.

Each complete turn of the logarithmic spiral, when measured against the previous complete turn within itself, expands in a proportion equal to the Golden Mean ratio of 1:1.618, repeating over and over.

The Hubble Telescope has shown that all the observable objects in the entire accessible Universe form and expand in these same proportions. Everything in Nature, and apparently everything in the Universe, to a greater or lesser extent, expresses its physicality in terms of the Golden Mean Ratio of .618 to 1. It is the natural pattern of all things.

All of greatest classical architecture from the Egyptian, Greek and Renaissance periods displayed these same proportions. The three great classical examples of this art are the Great Pyramid of Khufu

at Giza, Egypt, the Parthenon in Athens, Greece and the Italian master Michaelangelo's statue of David, now residing in Rome, Italy. Many consider these three the greatest examples of architectural and artistic marvels ever created. Beautiful. Strong. Everlasting.

Why? Because they express exactly those same proportions that Nature has spent billions of years proving. The Golden Mean Proportion is a fundamental law of science. Not to recognize it or take advantage of it puts us at a disadvantage.

Since this law can be so useful, and so prevalent, doesn't it make sense to design your vineyard using these same proportions? The layout of the vineyard, the placement of the access roads, the spacing of the vine and the design of the trellis are just some of the design features that can be greatly enhanced by using the Golden Mean Proportions as the basis for spatial relationships.

As a matter of convenience, a short-cut method is to think in terms of 1/3 to 2/3 as a ratio. The number .618 is very close to the 2/3 proportion. For those more inclined to be less tolerant of estimates, the easiest proportion to use is 1:1.618 or .618 to 1.

For example, with the GW Agriculture system, as a matter of practice, we do no midseason pruning. Thus, the canes on our vines sometimes exceed 25' in length. We usually use vertical trellising with catch wires to control the growth. (Our Field Sprays balance and control the growth of the vine canes making tipping and pruning unnecessary.) The height of the trellis stakes is 7.5' tall, with the horizontal guide wires set at about 34" to 35" above the ground. The height is determined by multiplying the ratio of 1 minus .618, or .382, times 90 inches (7.5'), the height of the stakes. When these vines grow out, they have plenty of room to grow to their optimum height. They look great too.

You can space your vines a 4' between the each plant in the rows and 7' between the rows to get these approximate proportions.

A useful characteristic of the Golden Mean Proportion is that the same balance can be achieved by using ratios based on the square of **Ø**, which would be 1:**Ø**, 1:**Ø²**, 1:**Ø³**, 1:**Ø⁴** and so on. Expressed mathematically, these re: 1:1.618, 1:381, 1:236, 1:146, etc. Any proportion can be utilized in the design of your vineyard.

So, if 4' spacing between the vines and 7' between the rows does not work for you, use a different proportion. Example: 8' between the rows, and close spacing of the vines at 36" to 37" apart. This is calculated by the formula 96 is to 1 as x is to **Ø²** (or .382) = 96 x .382 = 36.55". You have a multitude of variations available for any conceivable vineyard design.

History has shown that any structure designed and built using the Golden Mean Proportions is beautiful, strong and long lived. In the vineyard, the implementation of this simple technique will increase your yield, quality and disease resistance. It looks great too. The most common comments about vineyards designed this way are that it looks "natural" and is "peaceful", a real help to those working on your vines. The vineyard design fits because it is not imposed on the landscape. It becomes a part of the natural landscape since it reflects and in a sense, duplicates everything growing in Nature. It is a pattern that, like fractals, repeats itself over and over again.

Working with the Forces of Nature: Feng Shui in the Vineyard

Feng Shui (pronounced "fung shway") is a way of life which helps us to live in harmony with our environment. There are a number of Feng Shui principles that are applicable to vineyard design and development. The ones we find the most useful and easiest to implement concern the balance of energies, the Tao, the Five Elements and the movement of Chi, or the Life Force, in and around the vineyard.

There is considerably more to Feng Shui than these few principles and a more complete study might be in order but not for the purposes of this book.

The balance of the Yin and the Yang (pronounces "yawng", not "yang" with a long 'a') is important. These are the positive and negative forces, described as two magnetic poles, which are constantly interacting and creating movement. Together they create life. The new plantlet would be Yang while the fruit and seed of this plant would be Yin. Light colors and dark colors are opposites necessary to be present to appreciate one and the other. Monocotyledons and dicotyledons represent Yin and Yang. Tall plants and short plants. Biodiversity and biocomplexity. All can be expressed in terms of Yin and Yang.

For the best vineyard, create a balance of these forces.

The Tao (pronounced "dow") is, simply put, a matter of observing natural patterns and employing them in a vineyard. Modern science is moving away from the Newtonian linear view of life as a series of unconnected, isolated and unrelated objects to a more Taoist view that we are moving toward a less controlled view of the universe that is constantly changing and in which everything is greater than the sum of its parts. The new view is that the universe has order but it is based on chance and probability. The Chaos Theory, that unpredictably is predictable, and the identification of Fractals, or repeating patterns, has markedly changed modern science. It is, however, an 8,000 year old Taoist concept rediscovered.

The importance of applying the concept of biocomplexity as opposed to biodiversity in a vineyard cannot be overstated. This is the very best way of achieving balance and harmony in the Taoist realm.

The Five Elements are: wood, fire, earth, metal and water. All life goes through creative cycles and destructive cycles. Life, death and regeneration. Again, in a simplistic form, bring together these elements in a vineyard so that a natural balance and harmony can be created.

Chi, or the Life Force Energy, is that force which animates all things. In the Yoga tradition, there are Five Sheaths of Awareness or Consciousness. Minerals have one, plants two, insects and lower life forms have three, mammals have four and humans have five, the last being self-awareness or the ability to look in a mirror and say "That's me!".

Chi, or Prana, Ki, Mana, or the Breath of Life, as it is called by various religions, is present in all living things. It flows throughout the Earth. The ancient study of Geomancy in China recognized this movement and the patterns that Chi takes moving along a spider web of Ley Lines on the surface of the Earth. The movement of Chi can be impeded or it can be unimpeded. Sometimes one is desirable, sometimes the other.

It can be likened to the flow of air in a desert. Where the wind moves freely, little grows. Where it slows down, as on the leeward side of a hill or at an oasis, slowed down by palm trees and other vegetation, there is growth. Chi is like the wind. Slow Chi down, and the Life Force accumulates in that spot. Speed it up by removing obstructions and life diminishes.

The best vineyard design employs both features.

The movement of streams of air in vineyards and orchards has been well documented. Generally, cold air flows down hill and warm air flows up hill. By slowing it down slightly by designing in long, sweeping curves, following contour lines or juxtaposed to contours, Chi can be accumulated, but not too much at a time. Too much can cause an overabundance of growth, even death, which brings in fungi to regenerate that which has died.

The movement of air, like the movement of Chi, can cause damage if it moves too quickly. Cold air, rushing down a hill can cause tremendous damage to vines. Long sweeping curves solve this problem by controlling and guiding the movement of air, and Chi.

It only makes sense that if you want to achieve maximum yield, quality and health in your vines, that you take advantage of this simple fact of life.

We design long sweeping curves in our vineyards, or straight lines where we want the vines to stay dry, such as in low wet areas. We construct our vineyards to take advantage of the movement of the streams

of air to prevent mildew and other problems from occurring. We locate our roadways so that air flow is guided where we want it to go.

The important added advantage of using sweeping curves and following the contours of the land is that often, more vines can be planted in a limited space when compared to conventional straight line planting. Fewer turnarounds are required as well which saves time, money and end posts.

Where our vineyards are located on flat land, we can add curves from time to time, based on the movement of air. As Chi accumulates, plant growth is greater. We want lots of growth, but not too much. It's a balancing act but using reason and common sense, anyone can do it.

It takes years of study and experience to become a successful and competent Feng Shui practitioner. There are many books available on the subject and most larger communities have practitioners who can come out to your vineyard for a consultation. We encourage this for those who are interested in pursuing the principles of Feng Shui further.

For the purposes of this manual, the application of these few simple principles discussed above will greatly improve your chances of success.

Vine Placement

Vine spacing is a very important decision to make. Traditionally, vines are placed in row after parallel row, each plant directly in line with others so that if you were looking at your vineyard in an overhead view would, you would see a pattern of squares throughout.

There is a more effective way to plant your vines that more efficiently utilizes the soil resources.

Staggering the vines in a diamond or hexagonal pattern rather than in a square pattern gives the roots of the vines access to a greater area of soil while not competing with adjacent vines so directly. It looks better too. More natural.

End posts need not be staggered in this pattern. The vines at the end of the shorter rows can be pruned to fill the space so that no production is lost.

In theory, planting vines in diamond patterns sometimes allows more vines to be placed in a field. With access to more soil nutrition, you get better quality and yields.

Another consideration in vine placement, especially in growing field blends, is the appropriate location of several varietals within the vineyard itself.

Varietals have preferences as to location within a vineyard. Take advantage of the microclimates in the same way as you would selecting one varietal for an entire vineyard. Field blends allow the grape vines to become compatible with each other and by isolating some, allows them to develop their own flavors, integrated with the other vines, but distinct in their own right. Vines have different personalities which must be taken into consideration when planting. Some like to be alone, others do well planted mixed throughout.

For example, we recently mixed Cabernet Sauvignon. Merlot, Syrah, Petite Verdot and Malbec in one vineyard. The vineyard itself was on the southeast side of the Myacamus mountain range, near the floor of Napa Valley. In terms of its location, it was ideal for growing these grapes. Cabernet and Merlot are very compatible and can be interplanted freely throughout a vineyard. So, when they were purchased at a ratio of 1 Merlot for every 25 Cabernet vines, they were bundled as such and planted randomly throughout the vineyard.

Syrah prefers to be at the top of a hill. So, with two high spots in this vineyard, about a dozen Syrah vines were planted next to each other at these locations. Petite Verdot prefers cooler climes so they were planted together at a low, cool location. And the Malbec, which does best at higher elevations, were all planted together at a high, warm spot.

It is very important, even crucial to consider the personalities of grapes when planting. In this case, Syrah, Petite Verdot and Malbec could best reach their fullest expression by being planted contiguous with each other and not being mixed with other vines. That is their nature.

Some of the great Malbec vineyards in France are located high on steep hills. Here they develop those great flavors and that dark, tarry color that would be washed out if they were mixed with other varietals.

This is an important consideration that is often overlooked by modern viticulture. Let the vines develop the way they can best produce their individualized personality. Some work best alone. Others do not care.

By placing these same vines within the Cabernet/Merlot vineyard, they also get used to the other vines, causing, in the wine, both the wonderful flavors of these wines but in a way that is completely integrated with the main winegrape. This cannot be achieved by mixing varietals grown in separate locations.

This is not so crazy as it sounds. Pollen, blown by the wind and carried by insects from all the varietals of vines intermix with each other creating a genetic complexity that makes the winegrapes compatible with each other, long before they get crushed and mixed in a fermentation tank.

It is truly remarkable how many blended wines have distinct characteristics of the winegrapes in them. Distinct, yet not really blended. Using these techniques we have developed makes this happen.

On the other hand, the simple addition of our Fall Field Spray at a rate of only 4 ounces of each per 1,000 gallons of wine, at the fermentation or the barrel aging stages, will pretty well accomplish the same result. This is not as desirable as applying them in the field but it works.

Rhythms of the Seasons

We find that for new vineyards, the best way possible to plant vineyards is to start construction in the summer or early fall of the first year, roughly lay out the rows, plant a cover crop, apply compost and the field sprays and plant the vines as grafted rootstocks in compost filled holes in the spring. Of course, this is not always practical nor advisable. It is just an idealized approach.

It is our experience that by planting grafted rootstocks in compost filled holes, fourth year harvests can be possible in the third year. The application of treated compost and the field sprays mature the quality of the wine grapes markedly, producing in the third year a mature flavor and yield that you would normally find in the seventh or eighth year.

Seasonal timing is of great concern. It almost goes without saying that it is not advisable to plant vines in the hot, stressful summer months of July and August. Vines that are planted later in the year should be hilled to protect them from freezing or frost.

Many farmers have, for eons, relied on planting by the phases of the moon. If you are so inclined, plant fibrous rooted plants in the second and third lunar quarters, around the Full Moon, and plant fleshy rooted plants in the fourth and first quarters, around the New Moon. Grapevines are fibrous rooted crops.

Insect Attracting Plants

Rudolf Steiner emphasized the importance of flying animals of all kinds in and around farms. He said they "stir the ether". His observation can be likened to comparing a stagnant pond to a sweet smelling, healthy pond.

Folksinger Ramblin' Jack Elliot once sang, "Stagnate water's a stinkin' thang, slick on top and all turned green". The presence of fish, frogs and insects in a pond keep the water moving, fresh and full of life. In the same way, the movement of birds, bees, bats and butterflies keep the air and ether moving in a vineyard. When these animals are not present, disease and death sets into the vineyard. Then, you have to spend a fortune applying fungicides and replanting dead and dying vines every year.

You need to bring as many of these creatures to your vineyard as possible. You do that by creating

a complete habitat as close to Nature as possible. This will get you the best results. Factory farming techniques and faulty reasoning do just the opposite.

Think about planting insect attracting plants. It is a good idea.

Unless you specifically like the looks of a flower garden as an insectary, a centrally located garden planted with insect attracting species is not preferable to locating these same plants in and around the vineyard. By placing these insect attracting plants around the vineyard, in mini-gardens within the vineyard or mixed in with your cover crop, you are increasing the likelihood that these insects will come in contact with your vines.

One objection often raised concerning bees and butterflies in vineyards is that grape flowers are complete in themselves and do not need insects to pollinate and fertilize the flowers to grow grapes. But if that is true, why do bees and other insects move from grape vine to grape vine? Nature is efficient. She does nothing by chance. Pollinators such as bees and butterflies, flitting from grape flower to grape flower, spread the genes of a wider variety of grapes to your vines, adding to the complexity and rightness of the wine made from these grapes. That's one of the best reasons in the world for inviting them into your vineyard.

Plan to plant species that bloom at the same time your vines bloom. This requires that you plant a wide variety of species since vines never bloom at the same time each year. We use up to 24 different species in our cover crop mix, plants that bloom from January through June, and beyond. These flowers are guaranteed to attract your helpful buddies.

Planting Your Vines

Our goal with a newly planted field is to get the highest, high quality yields in the quickest way possible. To accomplish this, we have found the very best way to start vines in any field is to use an auger to dig a hole approximately 10" to 12" in diameter, about 30" deep.

Deep rich soils on flat planes require fewer vines per acre with wider spacing. Light and rocky soils and vineyards placed on inclines require closer spacing and more vines per acre. In our system, fewer vines per acre doesn't translate into asking more of vines than they can deliver, as some believe. Fewer vines per acre don't necessarily translate into higher quality.

Dig holes and fill them with fairly raw compost.

Over the years, as the vines grow, spread compost throughout the vineyard further and further away from the vines as the field ages. In other words, place compost under the vine plants (as opposed to in the rows) in young plants, widening the application as the vines grow older over the first three years until compost can be applied generally throughout the vineyard by a manure spreader.

This is an especially useful technique on thin or poor soils. We have planted vines in old dirt access roads using this technique with almost 100% of the vines surviving.

Starting Up

Walk the land. Get to know it well. Do not rely on someone else's opinion. Check it out for yourself. What you think, you grow.

Purchase a contour map from the U.S. Geological Survey, state, county or consulting engineers. Examine aerial pictures. See how the vineyard fits in with other vineyards in the area. Talk to the other growers. Get to know their practices and beliefs. If you are a dyed in the wool organic practitioner, any sprays they make could have a dramatic impact on your vineyard and the flora and fauna that you bring to it.

Work with your neighbors and tell them what you are doing and why. Let them get to know you. Don't preach. Be practical. Lead by example. It's more effective.

Before you begin anything, remove poisonous plants such as poison oak and turkey mullein from around and within the prospective vineyard.

Install your deer fence before you plant your vines, not after.

Locate the access roads along the horizontal contours of the land.

Locate bird houses, owl houses and bat houses throughout the perimeter of your vineyard. It is a good idea to set your bee hives after the vineyard has been planted. It is safer for the bees and you want your honey bees to get used to working in your vineyard. Bee honey is an excellent source of food for you and your family and are indicators of the presence of pesticides around your vineyard. Rudolf Steiner particularly recommended that adults, especially older persons, eat a teaspoon of honey a day. The pattern of the hive matrix of cells used for storing honey and laying eggs is imprinted on the honey which, in turn, is passed on to people, fortifying and strengthening the matrix of their bone cells, creating stronger bones in older persons.

For the healthiest bees, place your beehives on sturdy raised platforms at least 3' high, facing south, with protection from the prevailing winds and on the north side.

Why a platform? Bees live in the air and the warmth. They make homes in trees, up off the ground. They do not like to live on cold or wet ground. Give your bees and environment where they can thrive and they will repay you a hundredfold.

You want to enclose the platform on three sides only. Make a solid floor with drainage for rain. Use lattice rather than solid wood on the sides so as not to reflect and amplify the sunlight and heat on the hives. This will sufficiently slow down the wind without creating a buffeting effect over the top of the barrier that solid fences create. On the north side, behind the hives, the barrier fence should be made with a solid bottom, approximately 2/3 or the same height as the hives, then a lattice on the top 1/3. This will keep the hive warmer in cold weather and will break up any high, cold winds that may blow on to the hive.

Do not use pressure treated wood to make the platforms as the preservatives in the wood will weaken the hive. Use a naturally decay resistant wood such as redwood, black locust or Osage orange for the support posts. Do not paint or otherwise treat with preservatives the platform wood. Let it age naturally. This is healthier for your bees. A cleverly designed platform need not be ugly and painting it won't improve it. You want it to look as natural as possible. Painting the hives is another matter entirely. Just remember that the lighter the color, the less likely the bee hive is to heat up too much.

If it is impossible or impractical to place honey bee hives in your vineyard, orchard bee houses are an acceptable substitute. These houses come predrilled with appropriately sized holes that orchard bees use to lay eggs that overwinter in the boxes. To gauge the size of the orchard bee hotel you need, figure that you will require one hole for every 10 to 20 vines in your vineyard. These should be permanently located as indicated in the instructions that come with the kit throughout the perimeter of your vineyard, away from any contact with sprays of any kind.

Remember, you are creating a natural habitat but one that is easy to manage at the same time.

Whether we like it or not, indigenous plants of all kinds will grow in your vineyard. Instead of fighting them, work with these forces and start a cover crop of compatible plants of your choosing. Everything that grows in and around the vineyard influences to a greater or lesser extent the flavors and the personality of your winegrapes. You have the ability, and with our program, the knowledge, to influence this the way you want to do it and the way you want the winegrapes to taste.

Wine made from a vineyard without a cover crop and companion plants in it and around it, compared to a vineyard which has them, is monochromatic in taste, flavors and aromas. It lacks complexity and terroir. It doesn't age as well and the wine never reaches the potential of the varietal without an excessive amount of engineering by the winemaker, even the addition of artificial flavors as we have seen in many

wines today. This "wine fix" is completely unnecessary.

An additional benefit is that planting a cover crop which becomes homogenous throughout the vineyard over time, makes the flavors in the winegrapes in that vineyard more uniform throughout.

Don't allow the cover crop to overtake the small vines. The first two years, it is especially important to remove the thick growth from around the vines in order for them to get enough light to grow fast. After two or three years, when the vines reach the lateral wires, this is less of a consideration.

We've seen many situations where the grower neglected paying attention to this crucial detail, only to lose a years growth from their vines. Grow tubes are useful in the management of these young vines as they encourage rapid vertical growth and it makes it easier to use a string trimmer around the young vines without damaging them.

The importance of excellent nursery stock can't be understated. Rooted canes or grafted rootstocks in pots can both be planted using our techniques with equal success. However, we have seen rootstocks grow so rapidly the first year that the diameter of the main trunk reaches more than one inch the first year. This causes some difficulty in budding the vines as the diameter of the rootstock trunk is greater than the tighter curve of the bud. In this case, "T" budding is preferable rather than field or chip budding. This is a small price to pay. Rootstocks planted in pure compost can feed and markedly speed up the growth of the graft, in some cases, creating a third year yield in the second year of growth.

Implementing the plan

The use of poisons, pesticides, herbicides, chemical fertilizers and inappropriate plowing and cultivation on a regular basis works to against these Forces of Nature, weakening them, thus slowly destroying your soil and weakening your crop as the result.

This phenomenon has been thoroughly studied and shown over and over to be true. The application of herbicides, for example, destroys the root system of unwanted plants. These very root systems are surrounded by bacteria, viruses, fungi, worms and other soil biota that are dependent on the root systems for life. By killing the root system of an unwanted weed, you are indirectly killing the biota in the soil.

For example, most fungi are beneficial and serve the purpose of rendering minerals and dead organic matter available to plants by changing the chemistry in the material so that it is more compatible with plants and can be more easily taken up by other root systems. Destroy the fungi and you starve your vines. Starving your vines creates stress. Stress creates an environment for the growth of disease and damaging insects, Nature's way of culling out the weaklings.

Here are the steps we recommend you follow when installing a vineyard. This list assumes that you have completed all applications and permits required, that they have been granted and that the vineyard complies with all other appropriate regulations of the various governmental agencies overseeing vineyards as required.

1. Select the location of your vineyard.
2. Select and preorder the appropriate varietal or varietals for your location. Determine the approximate number of vines and be sure to preorder more than needed.
3. Determine and map the contours of your vineyard. Make a drawing and plan with list of items to be completed.
4. Lay out the vineyard boundaries and install access roads following the contours and landmarks on your property with careful consideration for the flow of air throughout the vineyard.
5. Apply the field sprays to the vineyard and around it.
6. Cultivate with chisel plow one to two feet deep, or deeper if appropriate. Remove rocks and other obstructions. Disk and smooth soil.

7. Locate and install bird, owl and bat houses, bee hive deck and insect attracting plants (the latter in the fall or early spring).
8. Locate and install companion and barrier plants around the outside of the vineyard (in the fall or early spring).
9. Remove any unwanted and poisonous vegetation. Selectively trim or remove unwanted brush and trees (those not protected by law).
10. Locate and set aside area for making and storing compost.
11. Install deer fencing and gates.
12. Select the vine spacing and lay out the vineyard rows and on the ground.
13. Count the actual number of vines needed for the vineyard and accept delivery of the vines. Store in the shade. Keep moist.
14. Install electric, irrigation and drainage lines, sump pumps and drainage ditches.
15. If started in the Fall, select and plant the appropriate cover crop. For vineyards started in the spring or summer, wait until Fall to plant the cover crop.
16. Locate but do not plant the varietals in their correct places within the vineyard.
17. Install trellis posts and end poles.
18. Bring in compost and treat with homeopathic compost spray.
19. Dig 1 foot diameter by 30" deep holes for vines with an auger, place compost in the holes. In vineyards that are being rehabilitated or restored, dig 1' deep holes on either side of the vines and fill with fresh compost, cover with the dirt removed to dig the hole to prevent the compost from drying out. For sufficiently infertile soils, dig four holes around the base of the vine and fill with compost, cover with soil.
20. Plant the vines in the compost filled holes.
21. Install grow tubes and vine support stakes.
22. Install trellis wires as appropriate.
23. Install drip lines and emitters.
24. Apply field sprays once again.
25. Regularly monitor the growth of the cover crop and remove or pull back growth from the vines to give them plenty of sunlight. Mow the cover crop about 6" high in the early spring after the mustard has flowered but before they produce seeds. Mow again in late spring, creating a mulch throughout the vineyard and trim around vines. If appropriate, after the mulch has dried for a few days, disk in the mulch. Continue to irrigate the vines so that they are not stressed.
26. Proceed as you normally would to train the vines to the appropriate mode of trellising. Monitor vines in grow tubes for slugs and snails if wet conditions exist, for overheating if hot conditions exist. Spray the vines with our #2 Field Spray if slug damage occurs.