# Vineyard Development: Principles, Problems and Perspectives

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**PLANTING A VINEYARD INVOLVES** an extensive commitment of time and money. Time and money, however, do not guarantee the desired result. Careful planning is the key, and without this essential component all other efforts may well prove, literally, fruitless. Planning backward from the desired result (high quality fruit and wine) is critical for success. This brings us to the beginning: planting on time is essential because vines must enter their first dormancy physiologically prepared for the winter season and in suitable condition to emerge stronger in the spring.

Whether new to the industry and suitably bankrolled or with years of experience, a planned planting program must consider expected early and late season weather vagaries and how these impact best laid plans. The most important deadline is the expected first harvest date.

Back in the late 1990s and early 2000s, the condition known as young vine decline (now referred to as Petri Disease) was the scourge of new plantings. Although it was widely acknowledged that defective plant material was an important factor, it was also clear that the forced early production of new vines played a role in vine decline. Use of inferior plant material, therefore, in combination with an aggressive time-to-harvest goal, may result in short-term vineyard failure.

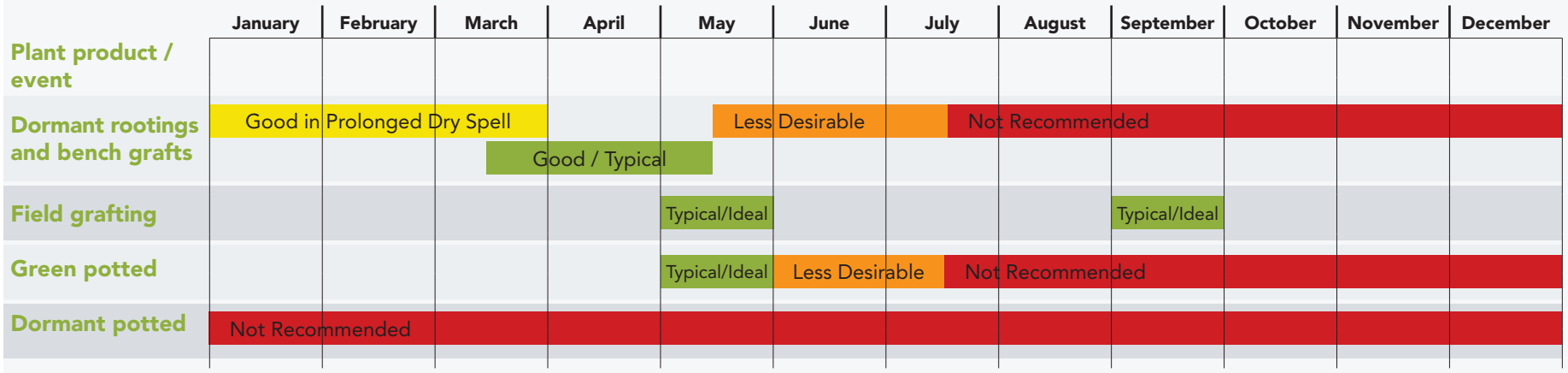
This article lays out some of the basic steps involved in the development and planting of a vineyard. Each step requires careful consideration and often the assistance of in-house talent or outsourced consulting groups to help realize maximum site potential. The article also includes a discussion of the pros and cons of some of the most popular rootstocks. Finally, it is always interesting and informative to share ideas with other growers, and some of those personal experiences and observations are presented here.

## Considerations for Vineyard Development

All things being equal, a new vineyard should be expected to sustain good yields for at least 25 years. Important steps to be considered, when replanting or developing a new vineyard, are presented here.

- Identify buyer for fruit (self or third party).
- In consultation with buyer, select location for vineyard development.
- Examine soil types and underlying formations to ensure they are suitable for vineyard development. Stay clear of serpentine and poorly drained soils.
  - Depending on variability, dig at least one 6-foot-deep backhoe pit per acre. Examine the physical and chemical attributes of soil at the surface and root zone. Note the presence of any hardpan.
  - Determine the total available water quotient (TAW) of the soil. This factor is a measure of the water-holding capacity of the soil and is essential for rootstock selection.
- Consult with the buyer to ensure that the desired clones and rootstocks are selected.
- Ensure that an adequate supply of water is available.
- Develop a ripping plan to remove any barriers to the desired root depth penetration.
- Develop a plan for essential amendments required to alter acidity or increase organic components. Gypsum, lime and compost are frequently selected additives in California.
- In light of the results of soil analysis, develop irrigation blocks, drainage design and trellis system design.
- Develop a spacing plan based on the required fruit quality and vine density.
- Order plant material. Use soil chemistry, physics and TAW, in combination with expected scion vigor, to select rootstock choices.
  - Dry-farming rootstocks include 110R, 1103P and St. George.
  - VR 039-16 for Xiphinema index-infected soils where fanleaf degeneration is a problem.
  - 1616C for heavy clay/cold wet soils and nematode resistance.
  - 44-53M for serpentine soils.
  - 420A and Riparia Gloire are frequently selected for high-density plantings and production of very high quality fruit.
  - 101-14 MG and 3309C for high quality sites but beware of susceptibility to nematodes and Phylloxera (101-14 MG) and virus agents (3309C).
  - If interested in working with in-demand rootstocks, such as 420A, 1616C or VR 039-16, place orders by September 1, 2012 for spring 2013 green vine delivery or spring 2014 dormant vine delivery. Requirement for favorite scion selections will also impact the timing because of potential scarcity.

TABLE 1. **Recommended planting and field grafting times**




## Critical Issues

Given that the year of first harvest has been established, the planting date is crucial to ensure that vines are ready for cropping without incurring unnecessary stress. TABLE 1 illustrates the recommended windows for planting green and dormant-potted vines and dormant benchgrafts and rootings, along with field-grafting opportunities for the rootings.

### VINE PRODUCT TYPE AND PLANTING TIME

As a general rule, dormant vines are preferable to green-potted vines. This is because it is far easier to inspect the quality of dormant plants (as roots and graft unions can be readily examined) and because dormant vines do not suffer transplant shock, commonly associated with late summer and heat spike planting of green vines. The grapevine's vigorous habit makes it less amenable to prolonged container storage. Hence, the planting of dormant-potted vines is not recommended. **Paul Sloan** of **Small Vines Viticulture**, Sebastopol, California, commented that, in his experience, vineyards planted to potted vines require the most replants.

Planting dormant vines should be considered a balance between growing season duration and the extent of pre-plant cold storage at the nursery. Strong dormant product should have good caliper and an extensive root system. The roots and trunk provide carbohydrates (energy reserves), which allow the vine to push at planting or withstand cold storage. Extended cold storage uses plant energy reserves that would be better directed to vine growth. Consequently, late planting is very deleterious to vine health.

Do not use product that has been stored for a season or stored and then replanted. Trunk vascular tissue discoloration and poor and uneven take are associated with extended vine storage and late planting. August-planted dormant vines (with or without the impact of other factors, such as hot weather, early frosts, etc.) generally show significantly inferior development in comparison to growth from new vines planted the following spring, i.e., late planting in year 1 produces an inferior vineyard to on-time planting of fresh stock in year 2. Vines should be planted early enough to benefit from a long growing season rather than suffer from a short one. The season should be sufficiently long for the vine to break dormancy, develop self-supporting root and shoot systems, and ultimately lay down frost-tolerant

### GROWER PERSPECTIVE:
### Snowden Vineyards

**Randy** and **Scott Snowden** of **Snowden Vineyards**, St. Helena, California, replanted Brother's Vineyard in spring 2011. Using 420A rootings and benchgrafted vines, they are working with an aggressive plan to see at least some harvested fruit by third leaf. This is the Snowden's fourth major planting in Napa Valley since 1961 when St. George was originally used. Dormant benchgrafts were planted in early May in cartons and topped at the wire in early August. Vine development in both rooting and grafted blocks was excellent.

The year 2011 is not turning out to be one of the better ones for yield and ripening in California, but the moderately warm spring and summer, combined with ample rainfall, have proven excellent for planting. The Snowdens planted more than 11,000 rootings and lost only one (to gophers). Planting mostly Cabernet Sauvignon this time around, Randy noted that back in the 1960s, his dad was one of the first to plant Cabernet Sauvignon in Napa Valley, using budwood from **Nathan Fay**'s legendary **Stag's Leap**.

Randy Snowden of Snowden Vineyards inspects CS/420A vines planted in early May 2011.

IMAGE 1. Virus test negative stressed Cabernet Sauvignon vines with significant J-rooting.

IMAGE 2. Root system of stressed Cabernet Sauvignon vine: note j-rooting and abnormal root architecture.

wood before the winter season. It is better to delay planting by a season rather than plant late.

Green-potted vines work best when the planting date—to the week—is established several months in advance so that the nursery can begin propagation on time. It takes roughly 14 weeks from grafting for a vine to be ready for planting. A green-potted vine should be ready for planting when it reaches this 14-week mark (which normally includes 1 to 2 weeks' acclimation to "vineyard" conditions at the nursery). At this point the root system should fill the container (and appear healthy), and there should be active shoot tip growth. Vines should have a substantial amount of shoot growth with good basal caliper.

With potted vines laying down about 1/2- to 1-inch of shoot per day, it is easy to see that root systems can soon become congested in the small pots preferred by most nurseries. Root binding is a common defect of potted vines, and the root system architecture developed in the nursery remains with the vine for life. In declining vineyards, it is not uncommon that the only observed defect is the presence of a compromised root system developed either from pot-bound vines or improperly planted and J-rooted dormant vines. (IMAGE 1 AND 2)

May is the ideal time for planting green vines in most regions of California. Delayed planting of finished product will result in defective root systems and the very real possibility of planting during a period of extreme weather (hot and/or windy). On-time planting will reduce transplant shock—a period of up to six weeks post-plant when green vines may languish and fail to initiate new growth. This can have a huge impact on vine development (IMAGE 3 AND 4) If planting late is unavoidable or coincides with a forecast heat spike, it is better to wait out the hot spell and maintain vines in pots under shade conditions.

IMAGE 3 Derek Cronk of Colinas Farming Company with strong stand of late June 2011 planted CS6/VR039-16 green potted vines.

IMAGE 4. Stalled mid July 2011 planting of CS169/VR039-16 green potted vines.

## ROOTINGS VS. DORMANT BENCHGRAFTS

Both dormant rootings and benchgrafts should be planted sooner rather than later. Weather permitting, very early plantings can be extremely successful as seen in the uniform stand and exceptional growth of 110R and St. George rootings farmed by **Caleb Mosley** and planted at **Araujo Estate**, Calistoga, California in January 2011, one of the warmest months in Northern California this year. (IMAGE 5)

The decision to use dormant rootings versus benchgrafts is much like the process leading to the use of potted vines: timing. It may be that a desired clone is unavailable from the nursery, which prompts the use of rootings or potted vines that allow clonal selection to be postponed for a season. Some growers prefer rootings (for personal preference or economics—lower up-front costs: rootings are about half the price of dormant benchgrafts) although there is so much variability in vineyard sites that there is no compelling evidence to suggest that one type of dormant product yields faster than another.

IMAGE 5. St. George rootings planted in January 2011 at Araujo Estate.

IMAGE 6. Crown gall development at chip bud site of field-grafted 420A rooting

## Working with Rootstocks

### 420A (VITIS BERLANDIERI X RIPARIA)

Some rootstocks deserve special consideration when choosing nursery product type. This is especially true of 420A. This rootstock is highly regarded by some who consider it the ultimate for wine quality (given that all other parameters are in place). One winemaker noted that he routinely received a 2-point higher score from Robert Parker for his 420A-derived wines over those grafted to 101-14 MG.

420A is considered a difficult rootstock to propagate. Pre-propagation cold storage of cuttings and cold storage of finished vines can severely reduce material viability (see TABLE 2). Because of the difficulty in root initiation (retarded by cold storage of cuttings), it is widely believed that 420A must be field-grafted for best results (actually this is untrue: using appropriate methods it is possible to routinely produce high quality benchgrafted 420A vines). Nevertheless, the majority of 420A vines start life as rootings. This is unfortunate as 420A is highly susceptible to crown gall, a "cancerous" tissue growth common in many plant species and induced by the bacterium Agrobacterium. Crown galls most frequently develop at a point of tissue damage. Dormant benchgrafts are less likely to develop galls, as all wounds should be properly healed at the time of vineyard planting.

Field-grafting, however, provides a perfect opportunity for gall development, both at the point of grafting and beneath, at the site of bleed wounding, which is usually near or at the level of the soil surface (IMAGE 6). Although bleeding is considered beneficial for the establishment of strong chip bud grafts, omission of this step has proved effective in limiting crown gall development in 420A without negatively affecting take (Paul Sloan, Small Vines Viticulture).

Crown gall is difficult to avoid as it is generally acknowledged that all **California Department of Food and Agriculture** (CDFA)-certified nursery stock is contaminated with Agrobacterium vitis. Examination of finishing vines during the growing season can permit selection of cleaner plants as can knowledge of nursery field-planting practice. It is far more desirable that nurseries use grapevine-virgin land every season for their field-finishing program. Regulations do not exclude non-certified stock from being planted in a field used previously. This is a recipe for crown gall development or contamination of apparently clean stock—not to mention transmission of other pests and diseases. Breaking off crown galls—especially important when they form at the graft union—followed by treatment with **GALLEX** (**AgBioChem, Inc.**, Los Molinos, California) can be effective in controlling their continued development. Unfortunately, no preventative and/or systemic treatments are in sight. This is, however, a major focus of one of Dr. **Tom Burr**'s research programs at **Cornell University**, Ithaca, New York.

In addition to susceptibility to crown gall, 420A is very intolerant of cold and wet soils at planting time. Low-lying, poorly-drained portions of a vineyard located on heavy clay soils in west Santa Rosa, California planted

TABLE 2. **Nursery harvest date and time in cold storage for dormant rootings and bench-grafted vines**

| Dormant vine harvest | PLANT DATE (months in cold storage) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN |
| Nov | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| Dec | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Jan | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Feb | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Mar | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

## GROWER PERSPECTIVE:
## Terlato Wine Group, Rios Farming Company and Coastal Vineyard Care Associates

According to **Manuel Rios** of **Rios Farming Company**, ground preparation, in particular drainage and rootstock selection, is critical. For Rios it is essential that site vigor and rootstock selection be in balance with trellis design. **Doug Fletcher** of **Chimney Rock Winery**, Napa, California and the **Terlato Wine Group**, Napa, works closely with Rios in Northern California and with **Erik Mallea** and **Jeff Newton** of **Coastal Vineyard Care Associates**, Santa Ynez, California, in the development of North and South Coast vineyards, including those at **Sanford Winery** and **Sanford and Benedict** in Lompoc, California.

Like Rios, Fletcher sees that up-front preparation is the key to success and vineyard longevity and noted that it is short-sighted to cut corners on something you only do every 25 to 30 years. According to Fletcher, soil chemistry, rootstock selection and pre-plant amendments are key, along with due diligence on nursery stock product quality and source materials. Fletcher agrees with this author that nematode pressure is a much more significant problem than widely credited. His greatest concerns in site development are canopy size, rootstock selection, soil type and total available water quotient, along with trellis design. Fletcher sees vineyard design as the interaction between soil, leaf area and trellis, rootstock characteristics and scion selection. He believes that the ability to generate uniform cane length and leaf area over a non-uniform vineyard site is evidence that trellis, spacing, soil, variety and rootstock are properly balanced.

Manuel Rios of Rios Farming Company inspects 2011 season 101-14MG rootings at Mee Lane in St. Helena.

Doug Fletcher of the Terlato Wine Group with mature vines at Chimney Rock Winery

with 420A rootings in May 2009—just before a heavy late season rain—failed. Although the vines were of uniformly very high quality, the roots of those planted in the cold wet soils failed to initiate new growth and rotted. It has been determined that 1616C, Vitis longii x riparia, is a good alternative for heavy clay, wet and cold soils, especially if nematode populations are problematic.

Careful selection of site and variety is extremely important for 420A, considered a late-ripening rootstock. **Manuel Rios** of **Rios Farming Company** (Rutherford, California) noted that, in Napa Valley, 420A can take too long to ripen fruit in cool years. Dropping fruit to one cluster per shoot and, in extreme circumstances, removing cluster wings has successfully promoted fruit ripening.

### 101-14 MG AND 3309C (VITIS RIPARIA X RUPESTRIS)

These two rootstocks, 101-14 MG and 3309C, are widely used in the production of high quality fruit in an array of soil and climatic conditions. Caution should be exercised, however, with the selection of 101-14 MG in situations where it is expected that vines will be routinely stressed, perhaps in difficult soils or in sites with limited irrigation capacity.

This rootstock's resistance to Phylloxera has been questioned lately as 101-14 MG vineyards have shown some decline in the presence of this root aphid. Because stressed vineyards are more susceptible to nematode population development, the simultaneous presence of these two pests can result in vine decline (IMAGE 7).

The 3309C rootstock is generally considered of lesser vigor than 101-14 MG with inferior nematode resistance and tolerance of wet soils. 3309C has been associated with graft union incompatibility, so selection of "virus test negative" rootstock and scion materials is critical. RSP-Syrah, a virus of unclear significance, is routinely found in 3309C CDFA-certified nursery increase blocks. Selection of RSP-Syrah virus-free 3309C and "clean" scion material is strongly advised if this rootstock is to be used.

### VR 039-16 (VITIS VINIFERA X ROTUNDIFOLIA)

VR 039-16 is the only rootstock choice for sites with Xiphinema index, the nematode vector of Fanleaf virus, the causative agent of Fanleaf Degeneration. This rootstock is used widely in the Rutherford area of Napa Valley where X. index and Fanleaf are widespread.

IMAGE 7. Phylloxera aphids on roots of a declining 4-year-old Cabernet Sauvignon/101-14MG vine

VR 039-16 is a vigorous rootstock that, like 420A, produces excessive callus during propagation. This callus may resemble crown gall, so it is very important to distinguish between callus and crown gall when vines are inspected at the nursery or at planting time. Because of its innate vigor, the timing for planting of green-potted, bench-grafted VR 039-16 vines is especially important. Experience has shown that a delay of only two weeks in planting can render otherwise healthy vines unusable because of root tissue collapse.

Planting time inspection of root systems is essential. VR 039-16 is considered difficult to propagate, and in general, nurseries only offer benchgrafted vines. A recent field grafting of year-old dormant VR 039-16 rootings was, however, very successful in Sonoma County's Alexander Valley. Some nurseries will propagate VR 039-16 rootings on request.

### 110R AND 1103P (VITIS BERLANDIERI X RUPESTRIS)

Because of their moderately high vigor and good drought tolerance, both 110R and 1103P are good choices for inferior soils or sites with limited water availability. The 110R rootstock is less tolerant of wet soils, and there have been observations of graft union incompatibility with a range of scions. The nature of this incompatibility is unknown; and as with all propagation materials, selection of the cleanest stock is strongly recommended.

### RIPARIA GLOIRE (VITIS RIPARIA) AND ST. GEORGE (VITIS RUPESTRIS)

Like 420A, Riparia Gloire is frequently selected for high quality plantings. It is a native American riverside species that tends to have a shorter season and low to moderate vigor. The rootstock is often used in high-density plantings and does poorly in overly wet and overly dry situations.

St. George has been an important rootstock in California and overseas since the early days of the U.S. wine industry. It is not as widely used now as it was in the early 1970s or even 10 years ago, but it offers exceptional drought tolerance in deep soils and is a good choice for dry-farming. This is a vigorous rootstock and is not a good choice for Merlot because of potential fruit set issues. (Merlot is prone to shatter.) Both St. George and Riparia Gloire have limited nematode resistance.

GROWER PERSPECTIVE:

## Small Vines Viticulture

**Paul Sloan** of **Small Vines Viticulture** in Sebastopol, California is no stranger to dealing with challenging situations. Working with a 60-year-old pasture in the hills west of Occidental, California, Sloan needed to accommodate his clients' European approach to vineyard development while at the same time preparing, laying out and planting during the spring of 2011. The site consisted of deep soils with great porosity, supporting native pasture roots to a depth of 5 feet.

Against the advice of their soils consultant, Sloan's clients wanted to maintain the natural structure and chemistry of the site and decided against ripping. Furthermore, rains delayed planting until late June. Apart from modest pre-plant irrigation, the vines were to be grown through the remainder of the season without additional water. The project is to be dry-farmed, so Sloan's clients wanted their vines to develop deep root systems from the start. As a balance to these constraints, Sloan planted high quality, uniform vines with no graft time deadline, meaning that they will most likely be maintained, as rootings, until spring 2013. In deference to the realities of farming in California, however, Sloan's clients have agreed to the installation of an irrigation system, only to be used to combat any harvest-time heat spikes that could severely impact yield.

Paul Sloan of Small Vines Viticulture with a new dry farmed planting of 420A rootings in Occidental, California

## Plant Time Issues: Preparing the Land, Planting the Vine

Whether planting dormant or green-potted vines, preparation of the planting hole and the vine are critical for vineyard longevity. Unfortunately, most vineyard operations are monotonous and repetitive, and none perhaps more so than planting. Key plant time issues for consideration are presented here.

- The root system is an important source of energy reserves required to initiate vine growth. Removing excessive root length may make planting easier but will also negatively impact vine development. However, a light trim of roots at planting time will encourage new root initiation. (IMAGE 8)
- Ensure that the root system architecture, as developed at the nursery, is maintained in the vineyard. Pay careful attention to positioning roots within the soil. Incorrect planting can lead to J-rooting and surface root travel.

IMAGE 8. Root initiation on spring 2011 planted 420A rootings at Dehlinger Winery in Sebastopol, California

- Remove all rocks that may impact existing or new root development. It is not unheard of for overzealous workers to bend not only the roots but also the trunk to fit the hole.
- Consider the addition of compost, fertilizers and mycorrhizal products to the planting hole. However, fertilizers should not touch root systems, and mycorrhizal products are of questionable efficacy—especially when used in concert with a fertigation program. Furthermore, to ensure that roots grow into the surrounding soils, it is inadvisable to create a planting hole that is overly welcoming.
- Pre-plant and irrigate, as necessary, to ensure that holes and backfill soil are of suitable moisture levels.
- Do not overly water or fertilize dormant or green vines. If planted in properly prepared and suitably fertile soils, dormant plantings can last the whole season without fertilizer. Green vines can benefit from application of a low impact fertilizer about four to six weeks after planting, but again, under correct conditions the vines can flourish with only limited or no fertilizer.

**Michael Sipiora** at **Quintessa**, St. Helena, California, prefers not to use fertilizer on young vines. He usually spreads 2 to 5 tons per acre of compost after ripping and adds either gypsum or lime as necessary. Post-planting, Quintessa applies 10 to 20 gallons per acre of estate-made compost tea. The compost tea appears to work well; Sipiora noted improved caliper on season-old rootings destined for field-grafting.

- Plant vines at the correct depth to ensure that rootings have enough above-surface trunk length for chip budding and that grafted vines do not root from the scion.
- Do not use wood chips from nursery-packed dormant vines as backfill for the planting hole—root rot can ensue.
- To protect emerging shoot growth and, depending on soil type (and availability), planting time and location, mound dormant vines with native soil and place cartons on green vines. Dormants can also be placed in cartons, and native soil or wood chips can be used inside the cartons. To avoid potential rot, do not let the spaghetti hose drip inside the carton if wood chips are used.

## Planting in the Eastern U.S.

**Mark Chien** of **Penn State Cooperative Extension**, Lancaster, Pennyslvania, noted that in the eastern U.S., few growers use compost in the planting process because soils are often overly-fertile, their goal being to slow vines down rather than encourage stronger growth. Most East Coast vines are well up to the fruit wire in the first year and will often carry a sizeable crop in the second. Nor do growers use mycorrhizal materials in planting holes for much the same reason, unless it is a replant situation or a soil that has been fumigated or replanted from orchard use. Roots are generally trimmed to 5 to 10 inches, depending on the grower and method of planting. The main exception is for laser planting when roots are trimmed to 3 to 4 inches. As a rule, green-potted vines are not used because most vineyards do not have irrigation and summer drought periods are not unusual.

According to Chien, some growers will follow up planting with a triple 16 blend just to give the new vines a bit of a boost out of the starting gate. Again, "growth is usually not a problem here," he commented, "I wish it were." Chien noted, "I'm not even sure what to say about irrigation. We have so little experience and information on it. We don't have ET and crop coefficient information for winegrapes in our climate. No one that I know is using C probes, gypsum blocks or tensiometers to measure soil moisture. A rare few are using stem water potential. Most of it is sheer guesswork based on visual symptoms and the weather forecast. It's an area of viticulture that we must improve to grow high quality grapes. Of course, it would help if we didn't get 70 inches of rain in a year like 2011."

- In-carton-planted vines do better with spaghetti hose in the carton and 15 inches away from the vine (**Derek Cronk**, **Colinas Faming Company**, Rutherford, California).
- Above all, pay careful attention to the finer details of the planting process. For good results it is essential that a vineyard supervisor be dedicated to monitoring operations.

## Conclusion

Planning and attention to detail are key to successful and drama-free vineyard development. Expect the weather to throw a wrench in the works and prepare a strategy should planting be necessarily delayed for a season. Even though there are no statistics that tabulate vineyard development short- and long-term failures, there are plenty of examples out there, along with the county farm advisors, professors, consultants and attorneys who usually get involved. Rushing to plant without taking care of the details up front could be the most costly decision you ever make. **WBM**