

Establishing a Commercial Vineyard in Nebraska

**Paul E. Read, Professor of Horticulture/Viticulture and
Stephen Gamet, Research Technologist
University of Nebraska Viticulture Program
Department of Agronomy and Horticulture**

**Max McFarland, Mac's Creek Winery and Vineyard
Jim Ballard, James Arthur Vineyards
Seth McFarland, Mac's Creek Winery and Vineyard**

In recent years, there has been a tremendous increase in interest in grape production and winery development in Nebraska and the Midwest. This increased interest has led to a need for detailed information requisite to vineyard establishment. For a winery to be successful, it must have a ready source of consistently high-quality fruit that is available every year. Fortunately for Nebraska growers, there are many locations that offer resources of quality soil, water and abundant sunshine. Experience of growers and University research has demonstrated that there are many sites suitable for growing grapes of excellent quality that can be made into wines of exceptional quality.

Do your homework! Before embarking upon the potentially risky venture of growing grapes, garner as much information as you can. Read trade journals and research articles, attend grower workshops and conferences, visit other growers' vineyards and discuss their approaches and take advantage of their experience. Focus your research on Midwest regional resources, ask questions and study some more. Develop a business plan that will give you a road map of where you are going and how you will get there; where do you want to be in 5 years, in 10 years? Viticulture (the culture of grape growing) is unlike most other types of

agriculture, thus it is critical that you "do your homework".

SITE SELECTION: Selection of an appropriate site is essential to the success of the grape production enterprise. In the Midwest, three main factors are critical to selection of an acceptable vineyard site: cold temperatures, air movement and soil drainage. Low winter temperatures may directly damage the vines and buds or even kill the grape plants, while abrupt temperature drops in the fall or spring may also cause severe injury. Of special concern are temperature fluctuations in late winter/early spring that lead to early bud break and subsequent bud damage. Sites that



Vineyard in Hungary illustrating excellent potential air drainage.

facilitate air drainage and air movement will aid in diminishing the negative effects of frost and disease, respectively. Of equal importance is good soil drainage. The old adage that grapevines cannot stand "wet feet" is on target; that is, poor soil drainage reduces available air to the roots. This lack of air means that oxygen is not available to the root cells and may lead to root death.

CLIMATE: Climatic characteristics are generally broken down into macroclimate, *mesoclimate* and *microclimate*. Macroclimate is primarily dictated by geography, e.g. eastern Nebraska vs. western Nebraska. Minimum winter temperatures, length of growing season, growing degree days and rainfall amount and distribution are all macroclimatic factors. Microclimate is the climate in the immediate vicinity of the grapevine, its roots, stems and especially in the plant canopy. The microclimate in the canopy can be modified by vineyard practices such as training/trellising system, pruning practices, fertilizer applications, leaf removal and shoot positioning. Disease severity and fruit quality can be improved dramatically by practices that influence microclimate. Microclimate is mostly a result of mesoclimate factors, including topography and slope, elevation above surrounding land, soil type and aspect or direction of slope. Generally speaking, the best vineyard site is one with full sun exposure, good air drainage, good soil drainage, freedom from late spring frosts and harsh winter temperatures.

Winter temperature minima vary greatly from eastern Nebraska to western Nebraska and from south to north. For most grapes grown in the Midwest, temperatures should not fall below -20F (-28C) for an extended period of time or the plant may be killed. Cultivars ("varieties") vary greatly in their tolerance of cold winter temperatures. Therefore, cultivars should be carefully selected to match their cold-hardiness to the site selected. (For further notes on choosing cultivars, see NebFact "A Sampling of Wine Grape Cultivars Being Tested by the University of Nebraska Viticulture Program.")

Choosing a site that is likely to offer freedom from spring frosts is determined by the mesoclimate or vineyard site characteristics. Ideally, the site should be gently sloping and at a higher elevation than surrounding areas. Because cold air is heavier than warm air, cold air flows downhill to lower areas, thus reducing frost risk. In addition, air drainage during the growing season leads to rapid drying of foliage following rain or heavy dew. This in turn reduces conditions conducive to disease development. Steep slopes should be avoided because of potential soil erosion problems. Furthermore, obstructions such as wooded areas and windbreaks at the edges of the vineyard site should be avoided so that the cold air will not "pond" into frost pockets in the lower parts of the vineyard. Such areas may also harbor damaging wildlife such as birds, deer and other pest species.

Aspect of slope is also important in site selection. Although a south-facing slope is warmer, it causes early bud break in the spring which may lead to bud damage from late frosts. Early fruit maturation will often occur on southern slopes, which may lead to ripening during excessively hot periods resulting in undesirable fruit characteristics

for winemaking. Eastern slopes dry faster in the morning following dew or rain, thus, reducing disease problems. North slopes will have later bud break in the Spring, but will be colder in the winter. Winds may have potentially damaging impacts on western or southwestern exposures, depending on direction of the prevailing winds. Choice of slope may relate to cultivar selection, that is, cultivars exhibiting early bud break will benefit from north or eastern exposures.

SOILS: A wide range of soil types are satisfactory for growing grapes, with the exception of poorly drained soils (the "wet feet" problem mentioned earlier). Soils that will support root growth possess good aeration, moderate fertility, loose texture, good drainage (both internal and surface) and acceptable depth (preferably at least 40 inches, with no impeding layer). A well- drained sandy loam soil is ideal for grape root development.

Soil drainage is one of the most critical factors in site selection. Poorly drained soils cause poor root growth, resulting in slow vine growth, poor yields and reduced vine vigor, and ultimately a lack of longevity. Grape roots may penetrate to depths of 10 feet or more in well-drained soils, but may be restricted to two feet or less in poorly drained soils. If the poor drainage is the result of an impervious layer such as a hardpan, plow pan or similar, "ripping" (sub-soiling) the soil exactly where you will place the rows is recommended. It may also be helpful to rip at right angles to the row orientation. If the poor drainage problem is related to heavy soils with inadequate internal drainage, it may be advantageous to install drainage tile. Consult the Natural Resources Conservation Service or your County Extension Office for advice regarding solutions to moderate drainage problems. Extremely poorly drained soils will be prohibitively costly to correct and should be avoided.

Conduct a Soil Test. Grapes grow well over a relatively wide range of pH, organic matter and fertility levels. However, if the soil is extremely infertile or possesses very acid or alkaline characteristics it will be important to amend the soil to achieve a desirable range of values. Generally speaking, grapevines tolerate soil pH levels of 5.0 to 8.0, but the ideal is between pH 5.5 and 6.5. A few cultivars are more sensitive to high pH-induced nutrient deficiencies, e.g. iron, and should not be grown on soils of pH in excess of 7.0. For a list of high pH sensitive cultivars, consult "Winegrape Cultivars for Nebraska" and "Grapes for Juice, Jelly, Table and Other Uses". A good range for organic matter is from 1 to 3%. Very high organic matter may provide excess nitrogen, resulting in very vegetative, soft growth that is highly susceptible to winter injury and often may cause low fruit yields and quality.

Phosphorous is very immobile in the soil, so if phosphorous levels are low (below 40 pounds per acre), it is essential that phosphorous fertilization be applied prior to planting. It should be worked into the soil as deeply as possible because it will remain where it is placed. Although most Nebraska soils have relatively high amounts of potassium, if soil tests indicate levels of exchangeable potassium well below 200 pounds per acre, it is advisable to also apply potassium fertilizer before planting. Since potassium is more soluble than phosphorous, and thus more mobile, it can also be

added after planting. Occasionally magnesium, zinc and boron levels may be below optimum amounts, especially where field leveling was done, or other grade changes or modifications have taken place. In such cases, appropriate additions should be made. Exchangeable magnesium should be between 200 and 250, while amounts of actual zinc and boron should range from 8 to 10, and 1.5 to 2 pounds per acre, respectively. If levels of these elements are close to the recommended ranges, the grower may wish to defer application until after the first year of growth. Nutrient status of the vines should be monitored yearly by conducting foliar tissue tests. These tests will assist the grower in future years' fertilization practices.

Site Preparation and Vineyard Design Because grapevines are potentially very long-lived, it is important that site preparation and vineyard design be done very carefully and thoroughly. You will live a long time with your vineyard, including any mistakes. As noted above, pH adjustment and most fertilization should be done prior to planting. Correction of drainage problems and control of persistent perennial weeds must also be implemented before planting. Planning at least one year ahead of establishment of the planting should facilitate accomplishment of site preparation requirements. Plowing or rototilling the entire site, followed by fertilization, liming (if needed) and weed management practices can be done in the year before planting.



A cover crop can be seeded in late summer/early fall, then planting can take place the following spring. If planting in sod, such as an old pasture, it may be desirable to only plow the location of the rows to be planted. The sod left between the rows will reduce erosion and aid in use of equipment following a rain.

Planting. It is a good idea to survey the vineyard prior to development of a planting plan. Make a scale drawing or map of your planting plan – it will prove to be a valuable record as your vineyard develops. Grapevine rows are normally planted in a north-south orientation, with straight rows preferred where possible. Occasionally it may be necessary to plant rows on a contour or across a slope. However, curved rows will usually lead to problems with stability of the trellis. Differences in light interception between North/South and East/West row orientation lead to different ripening times. Spacing of plants varies with cultivars and equipment. A common spacing is ten feet between rows with plants eight feet apart in the row. Wider row spacing may be dictated by equipment available or trellis style. Greater spacing between plants in the row may be appropriate for cultivars of exceptional vigor (e.g.

‘Edelweiss’, ‘St. Vincent’, ‘Frontenac’) or on sites that stimulate strong vine growth. Wide row spacings intercept less sunlight with more hitting the ground and thus reduce yield per acre; narrow row spacings may impede equipment and reduce air flow through the vineyard, which will lead to greater disease problems. Close row and plant spacings will increase costs of establishment, since more plants and trellising will need to be purchased. For example, 8 x 10 foot spacing = 545 plants per acre, while 8 x 12 foot spacing = 454 plants per acre.

Preparation for Planting: Planting is best done in early spring after the average last date expected for a hard freeze to occur. Generally dormant bare-root plants are used, but rooted cuttings and green plants are sometimes employed. Certified, #1 size or better, virus free planting stock is most desirable. If planting stock has leafy growth, planting should be delayed until after the last frost date will occur. Because many cultivars are in great demand, orders for planting stock should be placed one year in advance of the desired planting date. This is especially true for newly available cultivars such as ‘Brianna’, ‘Prairie Star’, ‘LaCrescent’, Marquette’, and ‘Frontenac’ and Frontenac Gris.

When the shipment of plants arrives, bare-root dormant planting stock should be inspected immediately for damage or other problems such as mold. Then make sure that they are kept moist



and store in a cool place (less than 40° F, but above freezing) until ready to plant.

Prior to planting, soak the roots of dormant bare-root plants in water overnight or up to 24 hours. Prune off any broken or excessively long roots and dig a planting hole that will easily accommodate the root system. The roots should be spread out in the hole, covered with soil and firmed well around the roots. Some experts suggest setting the plant to a depth where the first shoot is at ground level, while others suggest planting deeper and/or mounding soil around the base of the plant – both seem to work well in Nebraska soils. It is recommended that the plants be watered following planting, even if the soil moisture seems adequate. This aids in settling the soil around the roots, eliminating air pockets and ensuring adequate moisture for the development of the new roots.



The young vine should be given support; often this is accomplished by placing a stout bamboo stake next to each vine and tying the vine to the stake as the vine grows. Alternatively, use of "grow tubes" may help the vine establish a single vertical shoot and protect the developing vine from herbicide and vertebrate pest damage. Ideally, the trellis should be established soon after planting to aid in supporting the developing trunk. Trellis system design is discussed in the NebFact, "Trellising Systems for Nebraska Vineyards".

Care of Young Vines. Weed control in the year of vineyard establishment is a must. Control of perennial weeds by use of an appropriate herbicide should be achieved in the year prior to planting. Approved pre-and post-emergence herbicides will help with annual weed control (see Nebraska Spray Guide for Grapes and Small Fruits for recommendations). Be sure to read and carefully follow all label directions for any pesticide used, including herbicides.

Young vines may benefit from application of nitrogen fertilizer after growth has commenced. A rate of 20 to 30 pounds of actual nitrogen per acre may be appropriate, depending on inherent soil fertility and organic matter. Placing the fertilizer in a circle of about 20 to 24 inches in radius should work well, or in bands along each side of the row at a similar distance from the plant. Care should be taken to avoid direct contact with the plant because nitrogen fertilizer has a great potential to "burn" the living tissue contacted. Split applications of nitrogen can be applied at monthly intervals, but in no case should they be applied after mid-July to avoid soft growth that will be vulnerable to winter damage.



A beautiful copy of 'Frontenac' grapes.