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ATTRA
Appropriate Technology Transfer for Rural Areas

ORGANIC GRAPE PRODUCTION

HORTICULTURE PRODUCTION GUIDE

ATTRA is the national sustainable agriculture information center funded by the USDA's Rural Business -- Cooperative Service.

Abstract: *Organic grape production provides a more predictable economic return in the irrigated parts of the arid West. Though not impossible, organic grape production in the East is complicated by a climate that fosters insect and disease problems and by consumer preferences for grape cultivars (both dessert and wine grapes) difficult to grow in the East. Organic management options for diseases and insects are presented. Cultivar choices are discussed in terms of disease resistance. Marketing ideas for eastern labrusca-type grapes and organic wines are briefly presented.*

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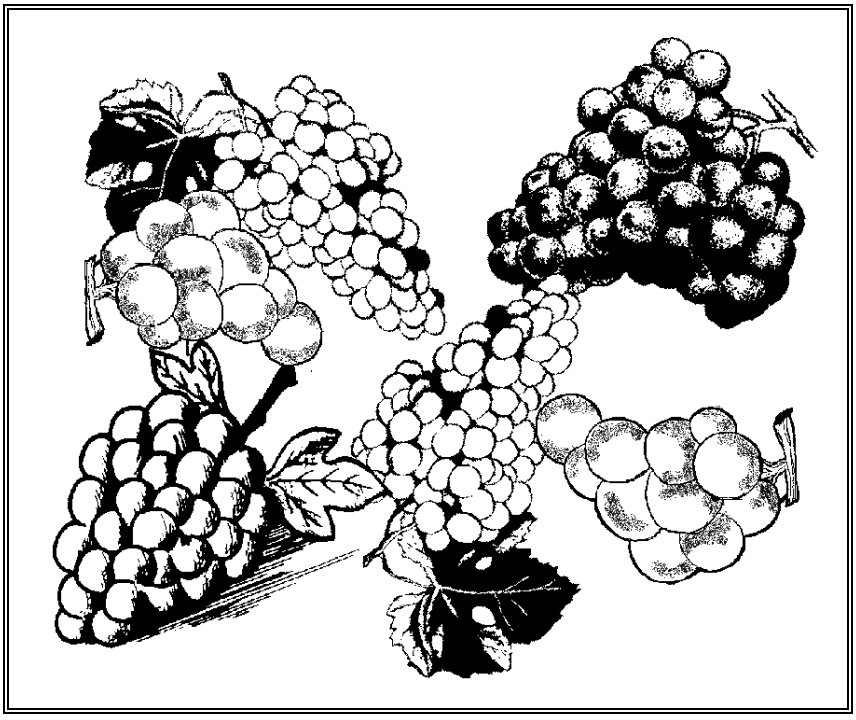
October 1999



Introduction

In some parts of the country, grapes are among the fruits easiest to grow organically. Diseases can be managed with a combination of cultural strategies (including specific pruning and training techniques, cultivar selection, and proper siting of the vineyard) and organically acceptable, mineral-based fungicides such as sulfur and Bordeaux mix. Biological, cultural, and pheromonal controls can be relied upon to control most mite and insect problems. Cover crops, mulching, and/or mechanical cultivation can control weeds, and fertility needs can be met with a variety of organically acceptable materials and strategies.

Contents:

The many large-scale organic wine and table grape vineyards in California are testimony to the relative ease of organic grape culture in that part of the country. Even though other regions are not as amenable to organic production of grapes as is the arid West, with careful attention to pest control (especially disease control) and the proper cultivar for the climate, grapes can be grown organically almost anywhere in the United States. There are now two commercial-scale organic vineyards/wineries in the Northeast, and Cornell University has published a first-of-its-kind report, *Organic Grape and Wine Production Symposium* (see **Publications** section for full citation and ordering information).

There are certain considerations and practices in grape production that will be the same for organic growers and conventional growers. For instance, site selection, pruning and training, and planting techniques are similar for both conventional and organic grape culture. This cultural information is available through the Cooperative Extension Service and common gardening or viticultural texts, magazines, and bulletins (see the **References** and **Publications** sections for specific literature citations). Accordingly, this publication focuses primarily on organic controls for pests and diseases. For information on organic weed control and fertility management refer to ATTRA's *Overview of Organic Fruit Production*.

Geographical Considerations

As with other fruit crops, the generally drier conditions in the western half of the United States are more conducive to organic grape production than in the East. In fact, there are several very large-scale organic vineyards in California and Arizona, including some managed by well-known vintners such as Gallo and Fetzer. Mites, leafhoppers, and leafrollers are likely to be the most troublesome arthropod pests in the West, and all of these are indirect pests; i.e., they do not directly attack the fruit.

In general, indirect pests can be tolerated in higher numbers than direct pests, allowing more time for naturally-occurring or purchased biocontrol agents to exert an acceptable level of control. Botrytis bunch rot can be a serious disease problem in the West, but it can be controlled through cultural techniques and/or sprays of organically acceptable fungicides.

The major problems for eastern organic grape growers are the grape berry moth and several fungal diseases. The berry moth is a direct pest of the fruit and, if left unchecked, can render whole clusters unmarketable. A pheromone-based mating-disruption system for the berry moth provides organic growers with an effective non-pesticide option for berry moth control (see the **Insect and Mite Pests** section, p. 5). Other indirect insect and mite pests can be troublesome in the East as in the West, but it is the severe disease pressure that provides the major challenge for eastern growers. If the eastern grower is producing for the fresh market, he or she should have a disease control plan. Several diseases can be devastating, but black rot is probably the most important of these to control. It only takes a few black rotted grapes to render a cluster unsaleable on the fresh market. On the other hand, grapes produced primarily for juice, wine, or other processed products will have a slightly higher tolerance for damage to the clusters.

Northern growers should choose cultivars with proven cold hardiness for their particular climatic zone. The European wine grape (*Vitis vinifera*) is not well adapted outside of USDA climate zones 8 and warmer; zone 7 can be marginal. In zones 5–7,American types (mostly *V. labrusca*) or some of the American-European hybrids (usually called "French hybrids") are the best choices. There are some American types that are cold hardy in zones 3 and 4. As with other types of cultural information, cultivar recommendations for a particular region are best obtained through the county or state Cooperative Extension Service.

Extreme disease pressure makes organic culture of bunch grapes very difficult in the Deep South. However, many cultivars of the indigenous muscadine grape, *V. rotundifolia*, are readily grown without pesticides of any sort. And while they do not have the same wide market acceptance as bunch-type grapes, they may be sold on local markets or processed into jams, preserves, juice, wine, etc.

Diseases

Ideally, the best solution for disease problems on grapes is to plant resistant varieties (see Appendix I: Disease Resistance Rating Chart for Grape Cultivars). Unfortunately, the market often prefers those varieties that are especially susceptible to indigenous diseases. This is the case with the *V. vinifera* cultivars (the high-quality European wine grapes). In general, they are highly susceptible to all the American grape diseases and pests including downy mildew, black rot, Phomopsis leaf spot,

powdery mildew, and phylloxera. If the grower decides to plant *V. vinifera* cultivars, he/she will often be culturing a susceptible plant under environmental conditions that invite disease development. Therefore, profitable production of a marketable product without the use of fungicides will be very difficult. However, as already indicated, California's dry, Mediterranean climate is quite amenable to the culture of the European wine grape, and organically acceptable fungicides are adequate for controlling most disease problems there.

American grape varieties (*V. labrusca* and others) differ in their susceptibility to various diseases. Concord, for example is quite resistant to anthracnose but susceptible to black rot. Ives is relatively resistant to black rot but highly susceptible to downy mildew. Edelweiss (*V. labrusca*) and Cynthiana (*V. aestivalis*; also known as Norton) are two American cultivars which appear to have significant resistance to most of the major grape diseases. Muscadine grapes (*V. rotundifolia*), suited only to the South, are very resistant to most bunch grape diseases and pests. See the enclosures for more information on varietal resistance.

Where varietal resistance, sanitation, and other cultural controls are not adequate, the organic grower will have to rely on the organically acceptable mineral fungicides, such as the various sulfur and copper formulations. Organic growers are allowed to use such products since they are mined materials; however, sulfur and sulfur-containing fungicides can be disruptive to beneficial insects and arthropods (spiders, mites, et al.) present in the vineyard.

Another problem associated with the use of sulfur is tissue injury (phytotoxicity). This damage can occur when sulfur is used while temperatures are over 85° F. (about 30° C.). Some cultivars, especially those of *V. labrusca* origin such as the Concord, are highly susceptible to sulfur injury even at lower temperatures (see the chart, p. 12). In regions where rainfall is plentiful during the growing season, wettable powder or flowable formulations are preferred for their retentive qualities (1). Flowable suspensions are less damaging to predatory mite populations and should be used when possible.

For more information on organic production methods for specific crops, please contact ATTRA. ATTRA has prepared the following publications:

- **Organic and Low-Spray Apple Production**
- **Organic and Low-Spray Peach Production**
- **Organic Blueberry Culture**
- **Organic Culture of Blackberries and Raspberries**
- **Overview of Organic Fruit Production**
- **Organic Strawberry Production**

Bordeaux mix (copper sulfate mixed with hydrated lime) is less likely to be phytotoxic than sulfur due to the "safening" influence of the lime. Damage can still occur on sensitive cultivars, especially in high temperatures.

The following discussion of grape diseases focuses primarily on organic controls. For details of symptomology, life cycles, epidemiology, and more, refer to the publications listed in the **References** and **Publications** sections of this publication.

Powdery mildew

The fungus that causes powdery mildew, *Uncinula nector*, overwinters inside dormant buds of the grapevine, or on the surface of the vine. Its control in commercial vineyards is generally based on the use of fungicides. Sulfur is effective against powdery mildew, but, as mentioned above, care must be taken to avoid damage to sulfur-sensitive cultivars. Cultural practices may reduce the severity of powdery mildew. Planting in sites with good air circulation and sun exposure, and orienting rows to take advantage of these factors are helpful (1). The use of training systems that

promote good air circulation should be incorporated.

Some formulations of sodium and potassium bicarbonate have also proven successful in controlling powdery mildew on grapes. See ATTRA's *Use of Baking Soda as a Fungicide* (request by phone or find it on our website: www.attra.org/attra-pub/baksoda.html).

Also, a new biofungicide, AQ10, which contains the fungal parasitic agent *Ampelomyces quisqualis*, is labeled for control of powdery mildew on grapes. Formulated as a water-dispersible granule, it germinates and parasitizes powdery mildew mycelia under high humidity conditions, which may limit its value somewhat. Contact the manufacturer, Ecogen (2), for more details.

Vitis species differ greatly in susceptibility to powdery mildew. *V. vinifera* cultivars are highly susceptible, whereas American species are much less so. The French hybrids developed by crossing *V. vinifera* with American species have varying levels of resistance.

Black rot

The disease organism that causes black rot is the fungus *Guignardia bidwellii*. The fungus overwinters in mummified berries on the soil, or in old clusters still on the vines. Fungal spores (ascospores) are spread by air currents and blowing rain, both in the early spring and throughout the growing season. Although this disease may be the most important disease facing Eastern growers, it is virtually unknown in the West.

Proper sanitation is important in controlling black rot. Removing overwintering mummified berries from the vines, and disking mummies into the soil are beneficial practices that reduce the amount of primary inoculum present in the spring (1). Black rot control for bunch grapes is very difficult in the East due to high humidity and foliage density problems. For organic growers, liquid copper formulations, or copper-sulfur compounds such as Bordeaux mix, can be used for prevention of black rot, as well as suppression of powdery mildew, downy mildew, and Phomopsis leaf spot.

Because the copper and sulfur compounds cannot remedy an established infection, they must be used as protectants. That is, these compounds need to be present on the plant surfaces before an infection period is anticipated. In the case of black rot, growers with a history of the disease will want to begin spraying when the first vegetative shoots are 3–6 inches long. This is roughly when the pathogen begins releasing spores which may infect leaf or flower tissues. Protection should be maintained until the berries begin their final ripening stage (at about 5% sugar) (1). Depending on the cultivar, inoculum level, and weather conditions, it is possible that this could entail sprays every 7–14 days from bud break until early August. For example, in the wet growing season of 1991, organically grown Seyval wine grapes (rot-susceptible, French-hybrid) required 17 fungicide applications for disease control (3).

However, because spores require free water and a certain temperature range for germination and infection, this rigorous a schedule will probably not be warranted every year. Also, proper sanitation and good early season control will help to reduce the inoculum levels of the pathogen.

With relatively resistant cultivars and good early season coverage, some Eastern viticulturists have been able to control black rot with as few as 2–4 sprays of Bordeaux mix (the first when new shoots are 2–4 inches long, and the remainder at 2-week intervals). There are few bunch grape cultivars with high levels of resistance, but some relatively resistant cultivars include Chambourcin, Cynthiana (aka Norton), Edelweiss, Elvira, Esprit, Foch, Ives, Cascade, Missouri Reisling, and Alwood. The non-bunching muscadine grape is very resistant to most races of *G. bidwellii*, but there are races of this fungus which are pathogenic to muscadines in some areas of the South (1).

Phomopsis

Phomopsis cane and leaf spot is caused by the fungus *Phomopsis viticola*. It overwinters in the bark of the canes and can be especially severe in

the early spring when rain occurs for several consecutive days. Inoculum levels build over time, with disease problems increasing in severity with each successive cool, wet spring. Few cultivars are resistant to Phomopsis, though there are varying degrees of susceptibility.

Control of Phomopsis for the organic grower consists of a combination of appropriate sanitation measures and the use of liquid copper fungicides. Growers should avoid introduction of the problem into the vineyard by using only pathogen-free propagation material when planting or re-planting. Once the disease has appeared, the grower should remove as much infected wood as possible from the vines during pruning. Debris should be shredded, disked, or plowed into the soil (1).

Downy mildew

Another disease to which *V. vinifera* varieties are highly susceptible is downy mildew, caused by the fungus *Plasmopara viticola*. Downy mildew usually overwinters as spores in fallen leaves, but may survive in buds as mycelium in regions with mild winters. Downy mildew is favored by all factors that increase the moisture content of soil, air, and host plants. Therefore, rain is the principal factor promoting epidemics. The most serious epidemics of downy mildew occur when a wet winter is followed by a wet spring and a warm summer with intermittent rainstorms every 8–15 days (1).

Preventative management practices for downy mildew consist of draining soils, reducing the sources of overwintering innoculum, and pruning out the ends of infected shoots. However, because none of these measures is sufficient for cultivars highly susceptible to downy mildew, fungicidal control may be necessary. As mentioned above, organic growers can use liquid copper, or Bordeaux mix for control of this disease. Several resistant cultivars are listed in Appendix I.

Botrytis

Botrytis bunch rot of grapes (causal organism: *Botrytis cinerea*) can be a problem throughout the U.S., but can be especially troublesome in wet or humid areas. Botrytis is more of a problem on varieties with tight clusters, which harbor more moisture than looser-clustered varieties. California research indicates that the incidence of botrytis bunch rot can be greatly reduced by removing leaves around a ripening cluster, thereby improving sunlight and air penetration into the cluster (4). Reducing fertilization, thereby reducing lush vine growth, can also be helpful in controlling botrytis.

Bordeaux mix or sulfur-containing fungicides are ineffective against botrytis. However, the beneficial fungus *Trichoderma harzianum* is effective against botrytis and registered in the U.S. for that use. It is available as Trichodex™ (call 212-661-9800 for closest distributor).

Insect and mite pests

Grape berry moth

The grape berry moth, *Endopiza viteana*, does extensive damage directly to grape berries. This pest is generally distributed east of the Rocky Mountains, varying in severity from one region to another. The only biological control agent that has been found to be of appreciable value is the egg parasite *Trichogramma minutum*. When feasible, cultural practices aid greatly in reducing the overwintering population. Success of these practices depends on plowing or cultivating to bury the cocoons containing overwintering pupae.

A popular method is to throw the soil from the row centers into a low ridge under the grape trellis with a grape hoe, disk, or plow. This should be done 30 to 45 days before harvest. The row centers should be almost level and seeded to a winter cover crop. In the spring, at least 15 days before grape bloom, the ridge soil containing the cocoons in its surface is pulled from under the trellis into the row centers with a mechanical grape hoe. Any islands of soil left around the posts and grapevines may have to be raked by hand into the row centers. The row centers are then disked and cultipacked to bury the cocoons. Rain or irrigation after this operation will help to seal in the cocoons. This

practice has reduced berry moth populations to a point where shortened spray schedules can be used in commercial vineyards (4).

Grape berry moth sex pheromone-impregnated twist-ties that not only hold up the vines but confuse male berry moths seeking mates are available commercially from Pacific Biocontrol (800-999-8805). This mating disruption system should qualify as organically acceptable under most, if not all, organic certification programs.

Leafhoppers

Grape leafhoppers, *Erythroneura spp*., can also be a serious problem throughout the United States, but West Coast vineyards are probably more consistently troubled by these pests.

Research in California indicates that biological control of the leafhoppers can be achieved if the tiny parasitoid wasps (*Anagrus epos*) which attack the leafhoppers are allowed to build up their populations on another leafhopper species, which feeds on blackberry plants and French prune trees (5). Maintaining plantings of prune trees near vineyards significantly increases the chance of biocontrol by the wasp. There are other potential biocontrol agents for grape leafhoppers being researched (6).

Clean cultivation in and around the vineyard can help to reduce leafhopper populations because the adults overwinter in shelters afforded by weeds in these areas. Two pesticides that can be used by organic growers for leafhopper control are insecticidal soaps and the botanical insecticide sabadilla. Soap sprays are only effective if they cover the leafhopper; i.e., there is no residual effect from soap left on a plant surface.

Mites

Various mite species cause problems on grapes throughout the United States. Proper irrigation, dust reduction along roadways and other cultural practices can help somewhat in reducing spider mite problems.

Sulfur can be used against these pests, but sulfur can be disruptive to beneficial mites and other natural enemies of the pest mites. Soap sprays can also be effective against mites, but thorough spray coverage is essential, since the mites reside and feed primarily on the underside of the leaf surface.

The beneficial predatory mite *Metaseiulus occidentalis* has been shown to be effective in controlling spider mites in California. These beneficial mites can be purchased from several insectaries in California and elsewhere. Maintaining a ground cover on the vineyard floor is considered to be advantageous to predatory mites and various beneficial insects. For appropriate cover crops for a specific region, contact the local or state Cooperative Extension Service.

Grape phylloxera

The grape phylloxera (*Daktulosphaira vitifoliae*) has two forms–an aerial, leaf-galling form and a subterranean root-feeding form. Historically, the root form has been the more economically important of the two.

Phylloxera is most injurious to *V. vinifera* roots, but foliar feeding on all grape species can be severe enough to cause defoliation, although this is rare. Roots of *V. rupestris* and other American species are tolerant or relatively resistant, compared to *V. vinifera*, which has led to the grafting of *V. vinifera* onto *V. rupestris* roots for phylloxera control. There are no known controls for already infested roots; however, grafting onto American species practically eliminates phylloxera injury.

Caterpillars

Several lepidopterous species attack grapes, including the orange tortrix, the omnivorous leafroller, and the grape leaf skeletonizer. The naturally occurring bacterium *Bacillus thuringiensis* is effective against these lepidopterans. Trade names include Dipel™, Thuricide™, and Javelin™.

Marketing and Economics

A vineyard using a simple single-wire trellis costs around $4,000 per acre to establish, and that does not include land or machinery (7). Maintenance of the planting may cost up to $2,000/acre/year (mostly labor for pruning and picking), and it takes around four years for a new vineyard to begin significant production (7). Because of these high establishment and maintenance costs and the long-term nature of a vineyard, it is strongly advised that the potential organic grape grower have a realistic marketing plan before planting on a commercial scale. Local or state Cooperative Extension Service offices may be able to supply publications or other help in this regard.

As mentioned in the introduction, organic grape production in California is an accomplished and profitable reality. For instance, Stephen Pavich grows grapes organically on over 1400 acres for nationwide conventional and organic markets and is able to do so at costs roughly equivalent to conventional production costs (8). Furthermore, because of his climate, Pavich is able to grow the seedless *V. vinifera* types currently most popular in the marketplace. Vinifera types also keep longer (1–4 months at 32° F.) than labrusca types (2–4 weeks).

Because of these advantages and a competitive market, it may be difficult for growers other than established California or Arizona growers to successfully compete in a wholesale organic market dominated by such large producers. Wholesale buyers of organic grapes, East and West, can be found through the annual *National Directory of Organic Wholesalers* available from the California Action Network (CAN) (9).

A five-year study by Cornell University in New York indicated that growing costs were 69-91% higher for organic vs. conventional growers (3). In fact, two of the three cultivars (Seyval, Elvira, and Concord) lost money in the organic system. Only Elvira provided a modest positive return of $35/acre (compared to about $375/acre for conventionally grown Elvira). The authors of this study point to high weed control costs as a major factor in the economics of the organic plots.

Marketing labrusca type grapes

Another problem for the organic grower outside of California is the choice of cultivars adapted to the grower's region and relatively resistant to diseases. The problem is that many cultivars which are both disease resistant and adapted to a particular region are likely to be seeded labrusca types. Most of the seedless types developed for the East are not particularly disease resistant. Mars (seedless) appears to be one of the most resistant, yet it can suffer greatly from black rot in a wet year.

Moreover, most of the seedless varieties (Canadice, Interlaken, Himrod, Lakemont, et al.) are subject to major crop losses in many parts of the East due to winter or early spring freeze damage to fruit buds. The cultivar Reliance is an exception to this last rule, but, again, it is susceptible to most of the major grape diseases.

Many consumers prefer the full, fruity flavor of these American grapes. Many older consumers grew up thinking that grapes were "supposed" to taste the way American grapes taste. Even children know how grapes are "supposed" to taste due to their exposure to grape jelly (usually made from Concords) and grape-flavored candy and bubblegum. It might behoove the marketer to offer a berry or two as free samples to potential customers at farmers' markets or roadside stands.

Offering recipes and suggestions for a particular cultivar's best use (wine, preserves, fresh eating, etc.) could also be helpful. Because many of the labrusca types have tough, sour but "slipping" skins, it might even be helpful to show customers how to eat these slip-skin types (the pulp can be squeezed into the mouth and the skin discarded).

Broker Mel Nass of Venture Vineyards, Inc. (10) has made a successful business of marketing seeded and seedless labrusca types in Eastern markets. Mr. Nass emphasizes the "real" grape flavor of labrusca types in seasonal radio and television ad campaigns in selected Eastern markets. Although Venture Vineyards purchases grapes throughout the Eastern U.S., part of the campaign has in the past also included appeals to

state or regional loyalties (e.g., "Buy the taste of New England. Buy Concord grapes.").

Organic wine

The organic wine market appears to be growing. However, while wine giants such as Gallo produce organic wine, many of these companies choose to market little of their product as "organic" (11). Nevertheless, there are some American and several European wine companies which do market their wines as organic or as made from organically grown grapes. Entrepreneurs hoping to find an unexplored niche market in organic wines will probably be disappointed. On the other hand, California winemakers are finding that they can grow organic grapes economically and produce high-quality wines.

Given the weaker economics of organic grape and wine production in the East, it would seem even more important that eastern growers receive a premium for their products. However, a survey conducted as part of the Cornell study cited previously (3) prompted the researchers to conclude that there was no price premium in the marketplace in 1990 for wine labeled organic. At least one experienced organic vintner, Walter Pedersen of Four Chimneys Winery and Vineyard in Himrod, New York, believed that in 1995 this was already changing and predicted increasing demand and prices for organic wines (12).

Summary

In arid Western climates, commercial-scale organic production of table and wine grapes is an accomplished fact. In the East, the commercial success of organic grape production is complicated by disease and insect pressure and the types of cultivars adapted to Eastern climates. Organically acceptable fungicides and insect controls as well as disease-resistant cultivars make small-scale organic production of grapes possible in the East, but commercial success may depend on novel marketing techniques (try ATTRA publications *Resources for Organic Marketing* and *Direct Marketing*).

References:

1. Pearson, R.C., and A.C. Goheen (ed.) 1988. Compendium of Grape Diseases. American Pathological Society Press, St. Paul, MN. 93 p.

2. Ecogen, Inc.
2005 Cabot Blvd., West
Langhorne, PA 19074
Tel: (215) 757-1590
Fax: (215) 752-2461

3. White, G. B. 1995. The economics of growing grapes organically. p. 78. In: R.M. Pool (ed.) Organic Grape and Wine Symposium. Cornell University, Geneva, NY.

4. Bettiga, L. et al. 1989. Integrated control of botrytis bunch rot of grape. California Agriculture. March-April. p. 9–11.

5. Davidson, Ralph H., and William F. Lyon. 1987. Insect Pests of Farm, Garden, and Orchard. 8th ed. John Wiley and Sons. p. 481.

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8. National Research Council. 1989. Alternative Agriculture. National Academy Press, Washington, DC. p. 351.

9. Wilson, Mike. 1999. Profits from the vine. PrairieFarmer. September. p. 74-76.

10. CAN
PO Box 464
Davis, CA 95617
916-756-8518

11. Mel Nass
Venture Vineyards, Inc.
8830 Upper Lake Rd.
Lodi, NY 14860
607-582-6774

12. Fisher, L.M. 1992. Organic wines enter the mainstream. In Business. Vol. 14, No. 1. p. 22–24.

13. Pedersen, Walter. 1995. Marketing organic wines in New York. p. 87. In: R.M. Pool (ed.) Organic Grape and Wine Symposium. Cornell University, Geneva, NY.

Appendix I:

Disease Resistance Rating Chart for Grape Cultivars

Publications:

American Journal of Enology and Viticulture.
American Society of Enologists
P.O. Box 411, Davis, CA 95616.
530-753-3142
http://www.ajev.com
Refereed, scientific journal for wine research. Call or email for cost.

Cornell University Media Services Resource Center
7-8 Cornell Business & Technology Park
Ithaca, NY 14850
607-255-2080
The Cornell Cooperative Extension Service produces an excellent series of fact sheets and other bulletins relevant to Eastern grape production. Ask for their publications catalog. Many other state Extension services also offer publications on grape production. Check your county or state office.

Flaherty, D.L. et al. 1992. Grape Pest Management. Univ. Calif. Pub. 3343, Second Edition. ANR Publications, University of California, Oakland, CA. 400 p.
A handbook for California only. Excellent color plates.
$70 plus $7.00 shipping and handling from:
UC Regents
ANR Publications
6701 San Pablo Ave.
Oakland, CA 94608
800-994-8849

Hegwood, C.P. et al. 1983. Establishment and Maintenance of Muscadine Vineyards. MAFES Bulletin 913. Mississippi State University, Mississippi State, MS. 20 p.
A short but comprehensive treatise on commercial production of muscadines. Valuable discussion of the horticultural traits of cultivars. Cooperative Extension in other Southern states also produce materials on muscadines.
Free from:
Office of Agriculture Communications
Box 9625
Mississippi State, MS 39762
662-325-7774

Jackish, P. 1985. Modern Winemaking. Cornell Univ. Press, Ithaca, NY. 289 p.
$35 plus $3.50 shipping and handling from:
Cornell Univ. Press Services
POB 6525
Ithaca, NY 14851
800-666-2211

Minnesota Grape Growers Assoc. 1990. Growing Grapes in Minnesota. MGGA, White Bear Lake, MN.
Excellent guide for viticulturists in coldclimates.
$7.50 ppd. From:
MGGA
35680 Hwy. 61 Blvd.
Lake City, MN 55041
651-345-3531
http://www.mngrapes.com

Pearson, R.C., and A.C. Goheen (ed.) 1988. Compendium of Grape Diseases. American Phytopathological Society Press, St. Paul, MN. 93 p.
Incredibly comprehensive treatise on this subject. Color plates of symptoms. Highly recommended for the serious grower.
$37 plus $5.00 shipping and handling from:
APS Press
St. Paul, MN 55121-2097
800-328-7560

Pool, Robert (ed.). 1995. Organic Grape and Wine Production Symposium. NYSAES Special Report, Number 69. NYAES Communications Services, Cornell University, Geneva NY.
The best (practically the only) guide to-date on growing organic grapes in the East. On the web in Acrobat in its entirety:
http://www.nysaes.cornell.edu/hort/faculty/pool/organicvitwkshp/tabofcontents.html
Order as "SpR 69, Shaulis III," $13 ppd., from:
Bulletins, Communications Services
New York State Agricultural Experiment Station
Geneva, New York 14456

Vineyard and Winery Management
Box 329
Watkins Glen, NY 14891
607-535-7133
Trade journal for the Northeast wine industry.
$29/6 issues/year.

Researchers, Practitioners, and Organizations:

American Wine Society
3006 Latta Rd.
Rochester, NY 14612
http://vitis-ir.com/AWS/

Amateur and professional viticulturists and wine makers. Promotes home production. Sponsors wine competitions.

Kate Burroughs
Harmony Farm Supply
PO Box 460
Graton, CA 95444
707-823-9125
http://www.harmonyfarm.com/
Consultant for organic production. Also supplier for natural pest control products.

California Table Grape Commission
PO Box 5498
Fresno, CA 93755
http://www.tablegrape.com/
Grape growers united to promote California table grapes. Conducts research on production. Quarterly grower report.

Cooperative Extension Service and Land-Grant University System
Every state has a land-grant university and an associated Extension Service. Research and extension services relevant to viticulture are offered in many states. To contact the county CES, see Yellow Pages under "Government, County."

Minnesota Grape Growers Association
Box 10605
White Bear Lake, MN 55110
http://www.MNgrapes.com/
Source of information for growing grapes in very cold climates. Newsletter and annual "Yearbook."

New York Wine/Grape Foundation
350 Elm St.
Penn Yan, NY 14527
http://www.uncorkny.com/
Grower/processor/retailer group which promotes sales and use of New York grapes and grape products. Also provides marketing information assistance.

North American Fruit Explorers
Rt. 1, Box 94
Chapin, IL 62628
http://www.nafex.org/
Amateur and professional fruit afficionados share information in a quarterly journal, Pomona*, and in national and regional meetings.*

State Fruit Experiment Station
Southwest Missouri State University
Mountain Grove, MO 65711-9252
http://mtngrv.smsu.edu/dept.htm
A state-supported institution independent of the Cooperative Extension Service and the land-grant system. A leader in the midwest for wine and viticulture research.

Munson Memorial Vineyard
Grayson County Community College
6101 Grayson Dr.
Denison, TX 75020
903-465-6030
http://www.grayson.edu/grayson/division/artsci/viticult/muncen.htm
The Munson Memorial Vineyard is a repository for the cultivars developed at the turn of the century by the prolific grape breeder and botanist, T. V. Munson. Munson crossed native and European species for disease resistance and for adaptability to various soils and climates. The Vineyard provides only information and cuttings--no plants.

Plants:

Boordy Vineyard
Box 38
Riverwood, MD 21139
Wide range of labrusca, vinifera, and French hybrid grapes.

Fairacre Nursery
Rt. 1, Box 1068
Prosser, WA 99350
Wholesale only. Specializes in viniferas.

Concord Nursery Co., Inc.
Mileblock Rd.
North Collins, NY 14111-9770
Wide range of labrusca, vinifera, and French hybrid grapes.

Ison's Nursery and Vineyards
Rt. 1, Box 191
Brooks, GA 30205
Specializes in muscadines.

Owens Vineyard & Nursery
Georgia Hwy. 85
Gay, GA 30218
Specializes in muscadines.

Lon Rombough
PO Box 365
Aurora, OR 97002
http://www.hevanet.com/lonrom/
Private grape breeder. NAFEX [see above] consultant for grapes. Huge collection of grape cultivars; sells cuttings. Enclose SASE with inquiries.

Sonoma Grapevines, Inc.
1919 Dennis Lane
Santa Rosa, CA 95401
Specializes in viniferas.

Southmeadow Fruit Gardens
Box SM
Lakeside, MI 49116
Specializes in "antique" cultivars, including some Munson selections.

Dave Wilson Nursery
19701 Lake Rd.
Hickman, CA 95323
Wholesale only. Specializes in viniferas.

Vineyard Supplies:

A. M. Leonard Inc.
PO Box 816
Piqua, OH 45356
800-543-8955
Wide range of horticultural tools.

Amberg's Nursery, Inc.
3164 Whitney Rd.
Stanley, NY 14561
716-526-5405
Wirevise connectors, tying materials, more.

Green Hoe Co.
West Main Rd.
Portland, NY 14769
716-792-9433
Hydraulic grape hoes, end-post anchors, more.

Harmony Farm Supply
PO Box 460
Graton, CA 95444
707-823-9125
http://www.harmonyfarm.com/
Irrigation supplies, organic fertilizers, ecological pest controls.

Pacific Biocontrol
719 Secon St.
Davis, CA 95616
800-999-8805
Pheromone disruption system for grape berry moth.

Peaceful Valley Farm Supply
PO Box 2209
Grass Valley, CA 95945
916-272-4769
Organic pest controls and fertilizers.

The electronic version of **Organic Grape Production** is located at:
http://www.attra.org/attra-pub/Grape.html

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Appendix I

Disease Resistance Rating Chart for Grape Cultivars

Compiled by Guy Ames & Ric Lancaster October 1999

	Black Rot	Downy Mildew	Powdery Mildew	Botrytis Rot	Anthracnose	Sulfur Sensitive
Cultivar:						
Abouriou			**MR**			
Alicante Bouschet			**MR**			
Alicante Ganzin			**HR**			
Alwood	**R**	**S**			**S**	
America		**MR**				
Angur Kalan			**HR**			
Aramon			**MR**			
Athens		**HS**				
Aspiran			**HS**			
Aubun			**HR**			
Babeasca Neagra			**HR**			
Bacchus			**HS**			
Baco Noir	**HS**	**MS**	**MS**	**MR**	**SS**	**No**
Barbera			**MR**			
Baroque			**HR**			
Bath		**MR**				
Belcan			**MR**			
Black Corinth			**HS**			
Bouteillan			**HS**			
Brighton	**HS**	**MS**				
Buffalo	**MS**	**MR**	**MR**	**MR**		
Cabernet Sauvignon			**MS**			**No**
Campbell		**HS**				
Campbells Early	**MS**	**HS**				
Canadice	**HS**	**HS**	**MS**	**MS**		**No**
Cardinal			**HS**			
Carignane			**HS**			
Cascade	**MR**	**MR**	**MS**	**MR**		
Castor			**HR**			
Catawba	**HS**	**HS**	**MS**	**SS**	**MS**	**No**
Cayuga White	**HS**	**MS**	**MS**	**SS**	**HS**	**No**
Caywood		**MR**				
Challenger	**HS**	**HS**	**MS**		**HS**	**No**
Chambourcin	**SS**	**SS**	**HS**		**SS**	
Champanel		**MR**	**MR**			
Chancellor	**MS**	**HS**	**HS**	**SS**	**MS**	**Yes**
Chardonnay	**HS**	**HS**	**HS**	**HS**		**No**
Chardonnay[NY]	**MS**	**HS**	**HS**	**HS**		**No**
Chelois	**SS**	**SS**	**MS**	**SS**	**SS**	**No**
Chelois	**MS**	**MR**	**MS**	**HS**	**MR**	
Chenin Blanc			**MS**			
Clairette			**HS**			

Claverie			HS			
	Black Rot	**Downy Mildew**	**Powdery Mildew**	**Botrytis Rot**	**Anthracnose**	**Sulfur Sensitive**
Clinton		**MR**	**HR**			
Concord	**HS**	**MS**	**MS**	**SS**	**SS**	**Yes**
Cottage		**R**				
Cynthiana/Norton	**MR**		**SS**	**SS**	**SS**	**Yes**
DeChaunac	**MS**	**MS**	**MS**	**MS**	**MS**	**No**
Delaware	**HS**	**HS***	**MS**	**MS**	**MS**	**No**
Diamond	**HS**	**MS**	**HS**			
Durif (*Petite Sarah*)			**MR**			
Dutches	**MS**	**MS**	**MS**	**MS**	**MR**	
Elviria	**MR**	**MR**	**MS**	**MS**		
Emperor			**HS**			
Erie		**S**				
Flame Tokay			**HS**			
Foch	**MS**	**SS**	**MS**	**MS**	**MS**	**Yes**
Fredonia	**MS**	**HS**	**MS**	**MR**		
French Colombard			**MR**			
Gewurztraminer			**MS**			
Glenora	**HS**	**HS**	**HS**		**HS**	
Goeth						
Golden Muscat	**HS**	**MS**	**HS**			
Greek Perfume		**S**				
Grenache		**MR**	**MR**			
Grignolino			**MR**			
Himrod	**HS**	**HS**	**HS**	**SS**	**HS**	
Island Belle		**S**				
Isabella		**MR**				
Italia		**S**				
Ives	**MR**	**HS**	**MR**	**MR**		
Janjal Khara			**HR**			
Kendaia						
Kerner			**MS**			
Lady Patricia		**R**				
Lakemont		**S**				
Leon Millot	**HS**	**MS**	**HS**		**SS**	
Lomanto		**MR**				
Long John		**MR**				
Loretto		**R**				
Lutie		**R**				
McCampbell		**MR**				
Maccabeu			**HR**			
Malbec			**MR**			
Manito		**S**				
Marechal Foch	**MS**	**SS**	**MS**	**SS**	**MS**	**Yes**
Mars		**S**	**HR**			
Marsanne			**MR**			
Mataro			**MR**			
Mauzac			**HR**			
Merlot			**HS**			
Meunier			**HR**			

Mid-South		R				
	Black Rot	**Downy Mildew**	**Powdery Mildew**	**Botrytis Rot**	**Anthracnose**	**Sulfur Sensitive**
Missouri Riesling	**SS**	**HS**	**HS**	**MS**		
Moored		**S**				
Muscadel			**HS**			
Muscat Alexandra			**HS**			
Niabell			**HR**			
Niagara	**HS**	**MS**	**MS**	**SS**		**No**
Oberlin 595		**R**				
Ontario		**MR**				
Optima			**HS**			
Orion			**MR**			
Patricia		**R**				
Pearl		**S**				
Perlette			**HS**			
Petite Bouschet			**MS**			
Phoenix			**HR**			
Pinot Blanc			**HR**			
Pinot Noir			**HS**			
Pollux			**MR**			
Portland						
Rekasetali			**HR**			
Reliance	**HS**	**S**	**SS**		**HS**	
Riesling (gray)			**HR**			
Riesling (white)			**MR**			
Riesling			**MS**			
Riesling[NY]	**HS**	**HS**	**HS**	**HS**		**No**
Rubired			**HR**			
Rish Baba			**HS**			
Rosette	**MR**	**MR**	**HS**	**MR**		
Rougeon	**MR**	**HS**	**HS**	**MR**		
Royalty			**MR**			
Rubired			**HR**			
Saturn		**S**				
Schuyler		**S**				
Semillon			**MR**			
Seneca		**S**				
Seyval Blanc	**HS**	**SS**	**HS**	**MS**	**SS**	**No**
Silva			**HR**			
Sirius			**MR**			
Sovereign Coronation		**S**				
Steuben	**HS**	**HS**	**S**	**MR**		
Suelter		**R**				
Sylvaner			**MS**			
Tampa			**HR**			
Terret Noir			**HR**			
Thompson Seedless			**HS**			
Tinto Cao			**HR**			
Ugni Blanc			**MS**			
Urbana	**MS**	**HS**				
Valdiguier			**HR**			

Vanessa Seedless		MR				
	Black Rot	**Downy Mildew**	**Powdery Mildew**	**Botrytis Rot**	**Anthracnose**	**Sulfur Sensitive**
Venus	**HS**	**HS**	**HS**		**MS**	
Verdelet	**MS**	**MR**	**MS**			
Vernaccia			**MR**			
Vidal			**HR**			
Vidal Blanc	**MS**	**SS**	**HS**	**SS**	**HS**	**No**
Vignoles	**HS**	**MS**	**MS**	**HS**	**HS✣**	**No**
Villard Blanc	**HS**	**SS**	**HS**	**SS**	**HS**	
Vinered	**HS**	**HS**	**MS**	**SS**	**HS**	
Westfield		**S**				
White Riesling	**HS**	**HS**	**HS**	**HS**		
Worden	**MS**	**HS**				
Yates		**S**				
Zinfandel			**MR**			

HR=Highly Resistant **MR=**Moderately Resistant **SR=**Slightly Resistant **R=**Resistant **SS=**Slightly Susceptible **S=**Susceptible **MS=**Moderately Susceptible **HS=**Highly Susceptible

✣=Fruit of Vignoles is highly susceptible to anthracnose while foliage and shoots are only slightly susceptible

***=**Fruits not susceptible

References: (The information for this chart was taken from the following sources. Please consider that the disease reaction of a particular cultivar depends on several factors, especially the climate in which it is grown.)

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4) Roy, Robert R. and David W. Ramming. 1990. Varietal resistance of grape to the powdery mildew fungus, *Uncinul necator*. Fruit Varieties Journal. July. p. 149-155.