GROWING COLD-TENDER GRAPE VARIETIES IN NEW YORK

by Nelson Shaulis, John Einset, and A. Boyd Mack

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CONTENTS

Definitions ................................................................. 4
New York Cold Problem .................................................. 6
Severity of Cold in New York Viticulture ......................... 6
Selecting Grape Varieties ............................................... 8
Selecting Areas and Sites ............................................... 8
Better Vine Management Techniques ............................... 9
Results of the Geneva Vine Variety and Vine Management Trial 11
Conclusions ............................................................... 15
Literature Cited .......................................................... 15
GROWING COLD-TENDER GRAPE VARIETIES IN NEW YORK

by Nelson Shaulis¹, John Einset², and A. Boyd Pack³

Choosing the right grape variety for New York conditions is most important in order for the grower and the industry to be successful. In making this choice, the grower must evaluate both the fruit and the vine.

For example, in New York, susceptibility of grape vines to cold injury is the characteristic that most frequently determines where a variety should be planted and how well it will perform.

The purpose of this bulletin is to: (1) classify according to cold hardiness some grape varieties grown in New York, (2) present some temperature data to aid in selecting vineyard areas and sites to help reduce the chance of cold injury, and (3) describe some vine management techniques for cold-tender varieties that will help reduce the seriousness of winter injury.

This bulletin is not intended to evaluate grape varieties, areas or sites, or management techniques, but, rather, it emphasizes the importance of the relationship of all these factors under New York conditions, particularly when growing the more cold-tender varieties.

DEFINITIONS

Four terms are used frequently in this publication and should be thoroughly understood by the reader. The first is cold injury, which is the killing by cold of some portion of the vine. Second is the seriousness of cold injury, which is the amount of decrease in fruit production or fruit quality resulting from cold injury. The third term, cold hardiness, is the survival capability of a specified tissue of a vine following a specified exposure to a low temperature. This term is frequently used in a more general way as in Table 1, to compare whole vines or vine varieties over many exposures to cold. The fourth term, cold tenderness, is, of course, the opposite of cold hardiness.

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Table 1.—Relative Cold Hardiness of Grape Varieties as Grown in New York.

<table>
<thead>
<tr>
<th>Most Hardy</th>
<th>Hardy</th>
<th>Medium Hardy</th>
<th>Low in Hardiness</th>
<th>Not Hardy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Alpha</td>
<td>Clinton</td>
<td>Elvira</td>
<td>Iona</td>
<td>Steuben</td>
</tr>
<tr>
<td>Beta</td>
<td></td>
<td>Concord</td>
<td>Niagara</td>
<td>Portland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fredonia</td>
<td>Delaware</td>
<td>Baco 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worden</td>
<td>Van Buren</td>
<td>S10878</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seibel 1000</td>
<td>Buffalo</td>
<td>S5279</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Catawba</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Foch</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S13053</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S5898</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agawam</td>
<td></td>
</tr>
</tbody>
</table>
NEW YORK COLD PROBLEM

Because of New York climatic conditions, all grape varieties grown in the state can be injured by cold. It is for this reason that New York viticulture is localized in a few districts where there is a longer growing season with less likelihood of late spring freezes or early fall freezes and where higher winter minimum temperatures prevail. The problem of cold is usually that of the lowest temperature for part of a day, not that of average temperatures. In the spring and in the fall, the extent of cold injury to the vines may be rather uniform. On the other hand, winter cold injury to the vines, even of the same variety in the same row, does differ in both extent and seriousness. Consequently, the Geneva Station is studying methods for reducing cold injury and its seriousness.

SEVERITY OF COLD IN NEW YORK VITICULTURE

From 1933 to 1952, there were 7 years (1934, 1935, 1936, 1941, 1943, 1945, and 1949) in which more than 16 per cent of the grape buds were reported (1) (2) as killed by freezing. During 2 of these 7 years (1934 and 1945) more than 40 per cent of the buds were killed. In the 1933–34 freeze, about 9 per cent of the bearing and 6 per cent of the non-bearing grape vines in New York were killed (1). Gladwin (8) reported that following a temperature of \(-24^\circ F\). in the winter of 1933–34 in variety plots at Fredonia, New York, 37 per cent of the trunks and 70 per cent of the buds of Niagara were killed; there was an 82 per cent kill of buds of Delaware, and 12 per cent of Concord buds were killed. This is an example of how severe cold injury can be even with the hardier varieties at extremely low temperatures.

Although most official weather stations are not located to represent vineyard areas, their records, nevertheless, are useful. Weather data from some stations in the grape producing areas of New York are listed in Table 2. The areas are listed in order of increasing frequencies of lowest temperatures below \(-5^\circ F\)., and the stations within an area are similarly ranked. The Long Island, Lewiston, and Westfield stations show particularly mild temperatures in the winter. It is the authors' experience that in these three areas, superior sites exist for growing cold-tender varieties of grapes in New York.

Temperature data in Table 2 become more meaningful when compared with temperatures of other grape areas and when related to cold injury. According to Nuttonson (10), the minimum temperatures recorded over a 50-year period at the northern German grape stations of Geisenheim and Bernkastel were \(-9^\circ F\). and \(-4^\circ F\). respectively. Konlechner and Poch (9) reported a 40 per cent killing of primary buds of White Riesling at a temperature of \(-11^\circ F\). at Klosterneuberg, Austria, in the winter of 1939–40. In New York, \(-8^\circ F\). temperatures in December killed 50 per cent of the primary buds of bearing White Riesling
Table 2.—Lowest Shelter Temperatures (°F) at Stations in New York Vineyard Areas.

<table>
<thead>
<tr>
<th>Area</th>
<th>Station</th>
<th>Lowest temperatures of 1951–May 1968</th>
<th>No. of days with lowest temperature at or below −5, −10, and −15°F in 1951–May 1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Island</td>
<td>Bridgehampton</td>
<td>35</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Riverhead</td>
<td>37</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Patchogue</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Niagara</td>
<td>Lewiston</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Lockport (2NE)</td>
<td>28</td>
<td>19</td>
</tr>
<tr>
<td>Lake Erie</td>
<td>Westfield</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Fredonia</td>
<td>32</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Buffalo</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Finger Lakes</td>
<td>Penn Yan</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Canandaigua</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Geneva</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>Hudson Valley</td>
<td>Glenham</td>
<td>29</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Poughkeepsic (FAA Airport)</td>
<td>26</td>
<td>21</td>
</tr>
</tbody>
</table>
vines, while nonbearing vines of the same variety were not injured by that temperature nor by a \(-16^\circ F\) temperature later in the same winter.

Cold injury has been, on occasion, a serious problem in New York vineyards, and it is also a fact that minimum temperatures in New York vineyard areas are generally lower than the minimum of some stations of the northern grape area of Europe.

There are many examples of success of reducing the extent of cold injury and its seriousness in New York. However, the problem is generally increasing because of more extensive plantings of cold-tender varieties; because some plantings are on sites too cold for the variety; and because less than full use of available vine management techniques, particularly crop control, has been made.

**SELECTING GRAPE VARIETIES**

The classification of some grape varieties according to their winter cold hardiness is given in Table 1. This is a tentative guide for the winter conditions encountered in New York vineyard areas. Only with selected vines and defined conditions can one decide the question of the relative cold hardiness of those vines at those conditions. In vineyards, many variables exist, and only estimates can be made of cold hardiness. Material in Table 1 is an estimate of winter cold hardiness based on reports (4) (5) (7) and unpublished records mainly from this Station. It can be used as a general guide to compare vines of similar age and vine maturity at a similar exposure to cold.

**SELECTING AREAS AND SITES**

Some temperature data for New York vineyards areas are presented in Table 2.

By using the data in Tables 1 and 2 and by careful selection of vineyard sites, it is possible to arrive at a better than average combination of variety and site which can reduce the amount of cold injury. Selecting vineyard sites within an area has been described by Dethier and Shaulis (6). As mentioned previously, cold temperature (in autumn, winter, and spring) is the major factor accounting for the localization of commercial grape culture in New York in a few areas. Even in these areas, the yield of fruit of the cold-hardy variety, Concord, may sometimes be reduced by cold injury depending upon the vineyard site. When growing varieties less cold-hardy than Concord, area and site selection become even more critical. For example, in the vineyards of Cornell University's New York State Agricultural Experiment Station at Geneva, there are two warm sites where White Riesling is grown rather successfully. There are also colder sites at the same Station where it is impossible to grow this variety although Delaware and Concord succeed at all Station sites. At Fredonia, New York, the variety Romulus fails because of winter cold injury, yet Concord and Delaware
thrive under those particular conditions. Cold injury that is serious occurs to Seibel 5279 when grown in the Lake Erie area on sites where there is minor injury by cold to Concord or Delaware.

**BETTER VINE MANAGEMENT TECHNIQUES**

In a vineyard, the extent of winter cold injury will vary considerably in a population of Concord, Romulus, or White Riesling vines. Excessive fruit load, excessive vine size, and shoot growth which continues into autumn are frequently associated with more extensive cold injury. Each of these three factors tends to delay the maturity of the vine as well as the fruit, and each can be controlled by vine management. Proper vine management can also help reduce the seriousness of cold injury which may sometimes occur.

For example, double trunk training is one technique that can reduce the seriousness of cold injury. At the Vineyard Laboratory in Fredonia, New York, the trunks of some Concord vines planted in 1956 have had such extensive cold injury over several years that about 70 per cent of them had to be removed. However, because each vine had two trunks (Figure 1B and Figure 1C), and the two trunks of a vine usually are not injured equally, only the trunk with less injury was retained. The result was only a slight reduction in bud number or crop. Injury of similar extent on single trunk vines either of Concord, or of more cold-tender varieties, prevented cropping in one or more seasons following injury. It is recommended that one or two suckers be retained on each vine each year in order to afford a replacement trunk when necessary and to increase vine capacity according to Winkler (11).

A second technique used in reducing the seriousness of cold injury is to delay pruning, or at least the final pruning, until the extent of injury to cane, bud, or trunk can be estimated. With vines which are likely to be winter cold-injured, the best choice of canes to retain can be made at the start of shoot growth in early spring. At a preliminary pruning in late winter, twice the number of buds per vine (and canes per vine) is retained as will be finally kept for fruiting. If the bud burst indicates there is no injury to primary buds, the bud number can then be cut in half. If, however, half of the buds have been killed, all the buds can be retained, and a nearly normal crop will result when there is not serious injury to the retained trunk(s) (Figure 1B).

Assuring adequate vine capacity so that a reasonable yield can be obtained without over-cropping is a third vine management technique helpful in reducing the seriousness of cold injury. Since many of the cold-tender varieties are either *V. vinifera* or closely related to that species, and are susceptible to root damage by the phylloxera insect, it is recommended that a phylloxera-resistant rootstock be used for varieties of *V. vinifera* and for varieties as susceptible as Ives, Foch, and Delaware. This is not only a desirable but, in many instances, an
essential means of attaining an adequate size of the vine. In trials conducted by the Geneva Station, the various rootstocks did not differ in affecting the winter cold hardiness of the vines.

Using resistant stocks for cold-tender varieties is complicated by two requirements. Firstly, the graft union must be several inches above the soil level to prevent scion rooting. Secondly, during the winter the base of the scion must be covered to prevent its being killed back to the rootstock. These requirements can be met by establishing in late summer a ridge of soil about 4 inches above the graft union and removing this ridge in the spring.

A fourth management technique is to retain many suckers following cold injury to the trunk. The growth of vigorous suckers indicates less (if any) injury to the roots than to the above-soil or above-snow portions

Figure 1.—Trunks of vines and cold injury. Photographs taken on July 1, 1967. Injuries are those from a winter minimum of –8°F. (A) Both trunks were killed and suckers afford opportunity for renewal. (B) One trunk was killed; arrow indicates where it was removed. Other trunk carried the full crop and suckers were retained for trunk replacement.

(C) Both trunks are sound; suckers were retained for trunk replacement if needed. (D) Multiple trunks on cold-tender variety.
of the vine (3). With or without the use of resistant rootstocks, a large
vine whose single trunk is severely injured or killed to the surface of
the soil will generally produce suckers which are numerous and vigor-
ous (Figure 1A). Many of these should be retained to provide enough
leaf surface to maintain a mature vine. In the following year, those
suckers become canes on which fruit can be produced, and in the
following year, several can be selected as replacement trunks.

Since there is, within a variety, a dependable association between
grape maturity, vine maturity, and resistance to winter injury, vine
management that promotes earlier or more complete maturity of the
fruit is a fifth technique to increase cold hardiness of grape vines. This
is true whether the variety is as cold-hardy as Concord or as cold-tender
as Dutchess. Thus, the maintenance of healthy foliage by spraying
and the adequate exposure of the foliage to sunlight by training and
trellising are management techniques leading to earlier maturity of
the fruit and vine which consequently increases cold hardiness.

A sixth technique is to thin flower clusters on lightly pruned vines.
In order to have the large leaf area which is produced when a light
severity of pruning is used, and yet to prevent over-cropping, flower
cluster thinning to one cluster per shoot is effective in maturing the
crop and the vine.

A seventh management technique is to reduce shoot vigor, especially
in late summer, by limiting nitrogen fertilization and ceasing cultiva-
tion early enough when necessary to permit weeds or cover crop to
compete with the vines. These practices tend to mature shoots and
reduce the extent of cold injury.

For tender varieties, in the State of Washington, some commercial
growers have bent the entire vine towards the soil, and then covered
it with soil to protect it from winter cold. On good sites within the
warmest areas of New York, cold-tender varieties, at least through class
9 as listed in Table 1, can be grown without such a covering.

Just as the justification for any technique of management in the
vineyard is based on the demand for the grapes, so the more expert
and expensive handling necessary for cold-tender varieties depends on
the special value of the grapes of those varieties. There is long-term
use of certain of these management practices in Canada and in New
York. Brights Wines Limited, Gold Seal Vineyards, Inc., and Dr.
Konstantin Frank have made commercial use of some of these practices
in their culture of cold-tender varieties.

RESULTS OF THE GENEVA VINE VARIETY
AND VINE MANAGEMENT TRIAL

In order to conduct vine disease research, the Plant Pathology De-
partment of the New York State Agricultural Experiment Station
made a planting of White Riesling, Delaware, and Concord grapes in
1959 at Geneva. Because of the wide range in bud hardiness, as shown in Table 4 for 1961–62, this Loomis Farm site was chosen as meeting precise specifications discussed by Dethier and Shaulis (6). For the same reason, vine management techniques described in Table 4 and outlined previously in this text were used to prevent or reduce the seriousness of cold injury. Table 3 presents data for all of the White Riesling vines grafted to the three named rootstocks, for all of the Delaware grafted to C.3309, and for all of the Concord vines.

Some of the White Riesling grafted vines were from the Gold Seal Vineyards, Inc., Hammondsport, New York. These were a part of that company’s efforts, then led by Dr. Konstantin Frank, in the culture of *V. vinifera* varieties in New York.

The survival of White Riesling vines on resistant stocks and with multiple trunks was excellent, even though there was killing of some
Table 3.—The 1962–1967 Growth and Yield of White Riesling, Delaware, and Concord at the New York State Agr. Expt. Sta. (Loomis Farm), Geneva, N. Y.

<table>
<thead>
<tr>
<th>Lowest Temp., °F</th>
<th>Vineyard Temperature</th>
<th>Geneva (official)</th>
<th>Vine Capacity (lbs. cane prunings)</th>
<th>Fruit Yield lbs./vine</th>
<th>Cluster No./vine</th>
<th>Sol. Solids %</th>
<th>Sampling Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>−4</td>
<td>−4</td>
<td>1.3</td>
<td>2.1</td>
<td>1.9</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>1961</td>
<td>−20</td>
<td>−20</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>1962</td>
<td>−10</td>
<td>−14</td>
<td>1.3</td>
<td>2.1</td>
<td>1.9</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>1963</td>
<td>−7</td>
<td>−11</td>
<td>2.2</td>
<td>2.4</td>
<td>2.0</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>1964</td>
<td>0</td>
<td>−3</td>
<td>2.8</td>
<td>2.6</td>
<td>1.8</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>1965</td>
<td>−9</td>
<td>−12</td>
<td>2.4</td>
<td>3.4</td>
<td>1.7</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>1966</td>
<td>−4</td>
<td>−6</td>
<td>3.2</td>
<td>4.0</td>
<td>1.7</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>1967</td>
<td>−6</td>
<td>−8</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 4.—Concord, Delaware, and White Riesling Plot Description and Management Techniques at the New York State Agr. Expt. Sta. (Loomis Farm), Geneva, N. Y.

<table>
<thead>
<tr>
<th>Item</th>
<th>White Riesling</th>
<th>Delaware</th>
<th>Concord</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of planting</td>
<td>1959</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacing (row × vine)</td>
<td>8½ × 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replicates</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rootstock</td>
<td>3309, 5BB, and 5C</td>
<td>3309</td>
<td>own</td>
</tr>
<tr>
<td>Trunks per vine</td>
<td>2 to 4 (Fig. 1D)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pruning time &amp; severity(^1)</td>
<td>March: 40 + 40</td>
<td>March:</td>
<td>March:</td>
</tr>
<tr>
<td></td>
<td>Bud break: 20 + 20</td>
<td>20 + 10</td>
<td>20 + 20</td>
</tr>
<tr>
<td>Flower cluster thinning</td>
<td>to one cluster per shoot</td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>

| Cold Injury                               |                |          |         |
| % of buds (1961–1962)                     | 60             | 10       | 20      |
| Vine mortality (1960–1967)                | 1              | 0        | 0       |

\(^1\)March pruning severity was on basis of nodes; May, or bud break, pruning severity was on basis of nodes with fruiting shoots.

Trunks of some vines. The use of double or multiple trunks was essential. Delayed final pruning was also essential for White Riesling because there was a variable, but important, amount of cold injury to buds in most of the years. It was also found that the use of phylloxera resistant stocks was essential for White Riesling and highly desirable for Delaware. In 1966, the fruit yields of own-rooted White Riesling and own-rooted Delaware were 0.7 and 14.0 pounds per vine respectively. There were no grafted Concord vines in this planting.

Flower cluster thinning of White Riesling increased cluster size and fruit maturity. The mean yield of these 42 vines was 4.3 tons per acre per year during the 5-year period. Yields were uniform. However, even with flower cluster thinning, the variability in maturity of clusters on any large vine suggested that a larger crop could be carried only at the risk of greater injury to the vine when very low temperatures occurred.

The vine size of about 2½ pounds of cane prunings was considered near optimum for an 8-foot vine spacing. There was more winter cold injury of buds of White Riesling on the larger vines. Because the lowest temperatures of replicates 3 and 4 was about 2 degrees colder that those of replicates 1 and 2, there was more winter cold injury to buds of White Riesling in those replicates. Concord and Delaware were not similarly affected. Thus, the special selection of site was necessary for satisfactory survival of the more cold-tender variety.

Yields of White Riesling were reduced through the use of flower
cluster thinning as a special management technique, but this was considered necessary to reduce the amount of cold injury. The practice is justified by the amount of high quality fruit. Also, the cost of vine management for White Riesling was greater in order to reduce the seriousness of cold injury. Again, the resulting high quality of the fruit is justification for this higher cost.

CONCLUSIONS

The problem of cold in New York viticulture is a major one for all varieties, but especially for those that are more cold-tender.

The means of preventing or reducing the amount of some cold injuries for a particular variety are in the selection of area and site, the use of management techniques such as avoiding over-cropping, maintenance of moderate vine size, and prevention of autumn growth of shoots. The need for more careful management techniques increases as a grower chooses varieties more susceptible to cold injury.

Use of double trunks and delayed pruning are effective means of reducing the seriousness of cold injury. Because area and site selection and vine management combine to affect the extent and seriousness of cold injury, the culture of a variety, within broad limits, will depend upon the demand for the fruit and the skill of the vineyardist.

The conclusions drawn from the data on the response of White Riesling to site and vine management are considered to be applicable to other varieties of similar cold tenderness in New York's major vineyard areas. Use of information on varieties, area minimum temperatures, and management techniques can help to combine area and site with vine management to make the culture of even cold-tender varieties more successful in New York State.

LITERATURE CITED