Characterizing Wine Grape Production and Producers in Pennsylvania: Results of a Recent Survey

Barbara L. Goulart and
Kathleen Demchak

ADDITIONAL INDEX WORDS. *Vitis vinifera*, *Vitis labrusca*, French-American hybrid grapes, small business, wineries, grape management

SUMMARY. While the Pennsylvania wine industry was established early in the history of the European settlement in the state, the current industry was spawned relatively recently by virtue of the Pennsylvania Winery Act in 1968. The industry is widely distributed, with wineries and wine grape production throughout the state, however the primary center of production is in southeastern Pennsylvania, where climatic conditions allow for the production of some of the hardier European wine grapes. A second, much smaller cluster of production is along Lake Erie, within the zone of more temperate weather induced by the lake. A third region is scattered throughout the harsher environments of the rest of the state. These regions are characterized not only by climatic differences, but by differences in producer demographics, clientele, pest complexes, cultivar preferences and obstacles to production. The industry is built primarily on French-American hybrid production, however European grapes are being produced, are in demand, and as such, are commanding relatively high prices.

The wine industry in Pennsylvania is centuries old, with wine being produced from grapes as early as the 1600s (He-

drick, 1908). However, the modern wine industry in Pennsylvania was established in 1968, when the Pennsylvania grape industry sponsored legislation which permitted the establishment of small farm wineries (Pennsylvania Liquor Code, 1968). While this industry has developed and grown since that time, surprisingly little is known about its composition, including information on acreages planted, cultivars produced, prices received, regions of production, and grower demographics. In response to this dearth of information, a survey instrument and mailing list was developed. The survey was fielded to 113 growers in the spring of 1995.

The objectives of the survey were to characterize the industry, distribute this information to the industry for its use, and to use the information to better address the educational and research needs of the wine grape industry in Pennsylvania. The information presented in the remainder of this paper is the result of 38 completed surveys, representing a 34% response rate, which is fairly typical for this type of survey (Dillman, 1978).

LOCATION AND CHARACTERIZATION OF GRAPE GROWING SITES. The largest portion of the wine grape producing respondents were located in the southeastern portion of the state, however a cluster of respondents were also located in northwestern Pennsylvania, where juice grape growers often plant some wine grapes to supplement their income (Fig. 1). There were a surprisingly large number of wine grape growers scattered throughout the rest of the state, which will be referred to as the "other" region throughout this paper.

Farms in the northwestern part of the state were considerably larger (just over an average of 30 acres (12 ha) than those in the southeast or other parts of the state, which averaged ≈ 10 acres (4.1 ha). The greatest majority of respondents from the southeast and other region of Pennsylvania used the grapes grown for their own wineries. Remaining grapes which were produced in those regions were sold to other Pennsylvania wineries. This was in contrast to the wine grape producers in northwestern Pennsylvania, who sold $\approx 50\%$ of their grapes to other states' wineries. Given the close proximity of this part of the industry to Ohio and New York, this was not surprising. However, the grapes which go out of the state represent an unused resource for Pennsylvania wineries, particularly in light of the fact that the limited winery act of Pennsylvania requires that all of the fruit in the wines be grown in Pennsylvania (Pennsylvania Liquor Code, 1968).

CLIMATIC PARAMETERS. Predictably, growers in the southeast had the largest number of frost-free days, as well as a wider perceived variation in soil pH (Table 1). The low number of frost-free days cited by one grower (13) may not be a mistake, since many low lying areas on the lake can have very unpredictable frosts. Twenty-nine percent of the southeastern and 22% of the other region producers collected weather data, with

Fig. 1. Geographic distribution of respondents to wine grape survey in Pennsylvania. one respondent. Diagonally hatched area = southeast region; vertically hatched area = northwest region; unfilled area = other region.

Department of Horticulture, Pennsylvania State University, University Park, PA 16801.

The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

Table 1. Climatic and terrain parameters, as reported by wine grape growers in Pennsylvania, by region.^z

Climatic parameter	Northwest	Southeast	Other
Minimum temperature °F (°C)	-10 to -20 (-23 to -29)	15 to -20 (-9 to -29)	-15 to -26 (-26 to -32)
Maximum temperature °F (°C)	100 (38)	90 to 105 (32 to 41)	80 to 105 (27 to 41)
Number of frost-free days	13-180	150-240	120-160
Soil pH	5-6.5	5.5-7.4	5.5-6.8
Terrain	Mostly flat, slightly rolling	Flat-steep hillsides	Mostly rolling to steep hills
Percent of respondents collecting weather data ^y	0	29	29

^zNorthwest, southeast, and other regions delineated in Fig. 1.^yMost collect temperature data only.

none of the northwestern respondents collecting such data. Time and cost constraints were the primary reasons for not collecting weather data.

Grower characterization

AGE. Only one respondent was under 30 years of age. Growers in the northwest were the youngest group with

50% between the ages of 30 and 40 years. This trend was the opposite in the southeastern part of the state, with 60% of the growers 50 years or older.

EDUCATION. Winegrape growers were a well-educated group with all completing at least high school. Those in the southeast received the most years of formal education. Areas of

post-high school education varied widely among regions. Those in the northwest received the majority of their degrees in agriculture or business. Those in the southeast and other area received the vast majority of their education in nonagriculture areas, including business, math, chemistry, physics, the arts or social sciences.

Table 2. Grape acreage in production and planted in Pennsylvania, 1995, by region.^z

Cultivar	Acres in production			Additional acres planted ^y		
	Northwest	Southeast	Other	Northwest	Southeast	Other
Vinifera, red						
Cabernet Franc	0.0	4.1	2.5	0.0	4.5	2.8
Cabernet Sauvignon	0.0	10.4	2.0	0.0	3.8	2.0
Merlot	0.0	2.0	0.0	---	---	---
Pinot Noir	0.0	3.2	2.0	0.0	2.0	1.0
Vinifera, white						
Chardonnay	0.0	14.4	4.3	0.0	10.8	4.0
Gewurztraminer	0.0	0.9	0.0	0.0	0.0	0.1
Pinot Gris	0.0	4.3	0.0	0.0	8.3	0.0
Riesling	0.0	2.0	2.0	0.0	0.0	1.1
Sauvignon blanc	0.0	0.2	0.0	---	---	---
French-American hybrid, red						
Chambourcin	2.0	19.0	6.3	3.0	4.3	7.6
Chancellor	0.8	4.0	0.8	0.0	2.0	0.1
Chelois	0.0	0.2	1.3	---	---	---
De Chaunac	0.0	3.5	0.3	0.0	0.2	0.0
Foch	1.0	4.3	2.3	0.0	0.1	2.1
Villard	0.0	2.2	0.0	0.0	0.2	0.0
French-American hybrid, white						
Aurore	0.0	0.0	0.3	---	---	---
Cayuga	0.0	3.0	0.3	0.0	2.0	0.1
Chardonnell	0.0	1.6	0.5	0.0	0.3	1.1
Rayon D'or	0.0	1.2	0.0	---	---	---
Seyval blanc	5.0	14.5	9.5	0.0	0.8	1.1
Vidal blanc	10.8	25.0	3.9	0.0	2.5	0.0
Vignoles	0.0	13.3	0.2	0.0	0.1	0.0
American						
Catawba	40.5	0.6	0.0	0.0	2.1	0.0
Concord	163.0	1.3	0.8	0.0	0.1	0.0
Delaware	0.0	0.4	1.0	---	---	---
Niagara	0.0	0.0	0.1	---	---	---
Norton/Cynthiana	0.0	0.0	0.1	---	---	---

^zSoutheast, northwest, and other regions delineated in Fig. 1.^y1 acre = 0.4047 ha.

COMPUTER USE AND LITERACY. Half of the growers in the northwest owned computers, while in the southeast and other region, 4 out of 5 growers owned computers. IBM-compatibles outnumbered Macintosh computers by nearly a 3 to 1 margin consistently across the state. All growers in the other region said they would be interested in computer software to help make management decisions, while 70% of growers in the southeast were interested. Less than 30% of growers in the northwest were interested in computer software for management decisions.

The growers in the northwest were younger, had fewer years of formal education, and less interest in using computer software than growers from other areas. These growers were also more likely to have post-high school training in agricultural disciplines,

which may make them feel less in need of additional training.

Grape types, cultivars, yields, and prices received

French-American hybrids (*Vitis vinifera* L. × *Vitis* sp.) clearly represent the largest portion of the wine grape industry, with about 200 acres (80 ha) of American grapes (*V. labrusca* L.) being processed for wine (Table 2). The largest acreage of European (*V. vinifera*) grapes was in the southeast, with French-American hybrids produced in all regions of the state. 'Chardonnay' occupies the most vinifera acreage, with 'Cabernet Sauvignon', 'Cabernet Franc', 'Pinot Noir', 'Pinot Gris', and 'Riesling' also occupying relatively large areas. 'Vidal', 'Seyval', 'Chambourcin', and 'Vignoles' were the most common

French-American hybrid cultivars.

It should be noted that 1993 was a year in which higher than average yields were realized, while 1994 was the season which followed the coldest winter of the century, and the lower yields in that year were a reflection of that very harsh winter (Table 2).

Yields for French-American hybrid grapes ranged from <1 to 3 tons/acre (2.2 to 6.7 t·ha⁻¹) with yields relatively unaffected by the very cold winter of 1994 (Table 3). 'Cayuga White', 'Seyval Blanc', and 'Vidal Blanc' were the highest and most consistent yielding white cultivars, while 'Foch', 'Dechaunac', and 'Chancellor' occupied this niche for the red hybrids. The other region typically reported lower yields than either the southeast or the northwest. This was probably a reflection of less desirable meso climates at those locations, since

Table 3. Wine grape yields and prices received in Pennsylvania, 1993–94, by region.²

Cultivar	Yield (tons/acre) ^y			Prices received (\$/ton) ^x		
	Northwest	Southeast	Other	Northwest	Southeast	Other
Vinifera, red						
Cabernet Franc	–/–	2.4/1.4	–/–	–/–	1700/1650	–/–
Cabernet Sauvignon	–/–	2.4/1.2	–/–	–/–	1600/1700	–/–
Merlot	–/–	2.0/2.0	–/–	–/–	–/1800	–/–
Pinot Noir	–/–	2.2/0.8	–/–	–/–	1600/1800	–/–
Vinifera, white						
Chardonnay	–/–	1.9/1.4	1.2/–	–/–	1600/1600	1900/1900
Gewurztraminer	–/–	2.0/1.5	–/–	–/–	1700/1800	–/–
Pinot Gris	–/–	2.2/0.3	–/–	–/–	1200/1200	–/–
Riesling	–/–	2.2/1.0	–/–	–/–	1250/1200	–/–
Sauvignon blanc	–/–	2.5/2.5	–/–	–/–	1200/–	–/–
French-American hybrid, red						
Baco	–/–	–/–	–/–	–/–	–/–	400/400
Chambourcin	–/–	3.3/3.0	–/3.0	–/0	915/896	–/–
Chancellor	3.0/2.7	4.3/4.0	–/–	500/550	550/550	400/400
Chelois	–/–	–/–	1.2/1.2	–/–	–/–	450/450
De Chaunac	–/–	5.8/6.2	–/–	–/–	550/650	400/400
Foch	3.0/4.2	5.7/4.6	1.0/1.0	370/400	1000/775	450/450
Villard	–/–	5.5/–	–/–	–/–	–/–	–/–
French-American hybrid, white						
Aurore	–/–	–/–	1.0/1.3	–/–	–/–	450/450
Cayuga	–/–	6.2/6.2	–/–	–/–	–/–	400/400
Chardonnay	–/–	3.0/3.0	1.5/–	–/–	700/700	–/–
Seyval blanc	4.8/4.5	4.5/5.0	2.2/2.4	385/400	853/796	1010/1010
Vidal blanc	4.2/4.3	4.0/3.5	2.2/2.1	398/409	620/613	450/450
Vignoles	–/–	2.2/2.5	1.5/1.5	–/–	717/775	–/–
American						
Catawba	5.6/6.8	–/0.7	–/–	204/203	1000/1000	–/–
Concord	5.0/9.1	–/3.9	–/2.0	190/183	725/625	450/450
Niagara	8.0/120	6.5/7.8	–/–	240/220	638/450	425/425
Norton/Cynthiana	–/–	–/–	1.5/1.5	–/–	–/–	–/–

²Southeast, northwest, and other regions delineated in Fig. 1. Data presented in columns is from 1993–94.

^y1 ton/acre = 2.24 t·ha⁻¹.

^x\$100.00/ton = \$110.23/t.

Table 4. Requirements of wineries, by cultivar, when purchasing Pennsylvania grapes for wine making.

Cultivar	pH	Total acidity (parts/100)	Soluble solids (%)	Canopy thickness ^z	Maximum yield ^y (tons/acre)	Purchasers (no.)
Cabernet Franc	3.3	0.85	23	3	3	1
Cabernet Sauvignon	3.1–3.45	0.85–0.9	20–23	1.5–3	2–3	3
Carmine	3.3	0.85	23	3	3	1
Catawba	2.9–3.1	0.9–1.5	16–21	---	---	3
Cayuga	3.1	0.9	20	4	---	1
Chambourcin	3.1–3.3	0.8–1.2	19–22	3	2.2–3.5	7
Chancellor	3.25	1.1	20	---	---	1
Chardonnay	3.1–3.35	0.8–0.95	21–22	1.5–2	3–3.5	4
Concord	3.1–3.2	0.9–1.1	18–22	---	4–5	3
DeChaunac	3.2–3.25	0.8	21	---	---	2
Delaware	3.2	1.0	21	---	---	1
Foch	3.3	1.0	19	3	4	1
Gewurztraminer	3.4	0.8	21	---	---	1
Niagara	3.1	0.8–0.9	20–22	---	4	3
Pinot Noir	3.3	0.85	22	3	3	1
Riesling	3.15–3.2	0.95–1.2	19–21	1.5–2	3	3
Seyval	3.1–3.25	0.8–1.0	19–21	2	4–5	6
Steuben	3.2–3.25	0.8–0.9	20	3	4–6	2
Vidal	3.1–3.25	0.8–1.0	20–21	2	2–5	6
Vignoles	3.1	1.2	21.5	2	3	1

^zCanopy thickness is the approximate number of leaves that cover the fruit.

^y1 ton/acre = 2.24 t·ha⁻¹.

the southeast and the northwest have more temperate climates. Prices for French-American hybrids varied according to cultivar, but were, in general between \$500 and \$1200/ton (\$551 and 1323/t) (Table 3). There was little difference in price between 1993 and 1994, probably because the French-American hybrid prices were not in particularly short supply, since yields were not dramatically decreased by the colder winter of 1994.

Yields for vinifera in 1993 were reported between 1.5 and 2.5 tons/acre (3.4 and 5.6 t·ha⁻¹), with prices between \$1200 and \$1700/ton (\$1323 and 1874/t) (Table 3). In 1994, vinifera yields plummeted to between 0.25 and 2.5 tons/acre (0.56 and 5.6 t·ha⁻¹), depending on vineyard location and grape cultivar. Relatively high prices, between \$1200 and \$1700/ton were received for vinifera grapes in both years. Growers in the southeastern portion of the state consistently reported receiving higher prices for all wine grapes, including American grapes (Table 3).

Management information and practices

PEST COMPLEXES. Growers in the southeastern and northwestern regions

predictably battled different pest complexes, with morning glory (*Convolvulus arvensis* L.) and grape berry moth (*Endopiza viteana* Clemens) the primary weed and insect problems in the northwest. Growers in the southeast, in contrast, reported greatest problems with canada thistle (*Cirsium arvense* L.) and japanese beetle (*Popillia japonica* Newman). All growers reported greatest disease problems as powdery mildew [*Ucininula necator* (Schw.) Burr] and black rot (Guignardia bidwellii Ellis), while growers in the northwest also cited downy mildew (*Plasmopara viticola* Berk. & Curt.) as a primary problem.

METHOD OF HARVEST VARIED WIDELY AMONG REGIONS. Most growers in the southeast (90%) and all growers in the other area harvested by hand, while most growers in the northwest harvested by machine or a combination of by machine and hand. This may be due to the fact that northwest growers also grow grapes for juice, so that machine harvesting equipment and expertise is readily available.

Among those hand harvesting, the main sources of labor were family, friends, and day labor. Growers who hand harvested in the other region relied equally on those three categories. Growers in the northwest relied

mostly on day labor and friends, and growers in the southeast relied the most heavily on day labor, less on friends, and very little on family. Infrequently listed labor sources were the Boy Scouts, and regular staff.

Winery requirements for buying grapes

Nine wineries reported buying grapes. Their requirements for grapes purchased are listed in Table 4. 'Chambourcin', 'Seyval Blanc', and 'Vidal' were the most frequently purchased. Other cultivars bought fairly frequently (by at least one-third of wineries) were 'Cabernet Sauvignon', 'Catawba', 'Chardonnay', 'Concord', 'Niagara', and 'Riesling'. 'Chambourcin', 'Chardonnay', and 'Vidal' were most commonly listed as the most desirable cultivars. It is interesting to note that 'Seyval Blanc', though tied for second as the most frequently purchased cultivar, was never chosen as one of the most desirable cultivars. Other cultivars listed as most desirable were 'Cabernet Sauvignon', 'DeChaunac', 'Riesling', and 'Steuben'.

Challenges and successes

PROBLEMS IN PRODUCTION OF VINIFERA. Not surprisingly, the greatest problem with vinifera production in all re-

gions of the state was cold injury (Table 5). Yields that were too low were also a problem statewide. Northwestern growers had difficulty with powdery mildew. Southeastern growers often reported having a problem with crown gall (*Agrobacterium tumefaciens* E.F. Smith & Townsend). Growers in the other area of the state, in addition to cold injury, had problems with black rot, powdery and downy mildew and pruning and training.

MOST EXPENSIVE ASPECT OF PRODUCTION. A large proportion of growers noted that spraying or chemicals was the most expensive aspect of their operation. This was especially true of growers in the other region of the state, with 56% reporting this as one of their largest expenses. Labor was another common expense, especially among growers in the northwest, with 42% citing it as a their largest expense. This actually may have been the most expensive aspect, since a large portion of the expense involved with pruning and harvest (two other areas cited) is labor. Equipment was a large expense for growers in the northwest and southeast. Only three growers statewide considered either planting or trellis to be the most expensive aspect of their operation.

HIGHEST PROFIT MADE. Profits were most often made from wine sales, though this was almost exclusively a southeastern phenomena, reported by 38% of southeastern growers, 14% of northwestern growers and no growers from the other region (data now shown). The second most common response was "what profit?", as reported by 22% of growers from the other region and 14% of growers from the southeast. American grapes and wines were listed third most often,

though this was mentioned as a profitable area only among growers in the other region (11%) and the southeast (5%), perhaps because they were in greater supply relative to demand in the northwest. Other responses were processing sales (only by growers in the northwest), direct sales of juice or grapes to individuals, and high quality vinifera.

MOST SERIOUS MISTAKES IN WINE GRAPE PRODUCTION. Twenty-five different responses were received covering every facet of production. Growers in the northwest reported few mistakes relative to those from the rest of the state. Cited most often as the biggest mistake was the selection of the wrong cultivar or type of grape, though only in the southeast and other regions. Lack of disease control or improper timing of sprays was second, and the wrong trellis or training system was third, both almost exclusively in the southeast and other regions. Problems with nutrition and weeds and lack of planning plagued mostly the southeastern growers. Fortunately, there were a few growers who reported that they wished they had planted sooner, or planted more. Other problems were the using wrong spacing (both vines too close together or too far apart), having the wrong site (mostly in the other region, and mostly due to insufficient air drainage) and incorrect pruning. Some of the other mistakes noted included planting vinifera too shallow or not hilling, having yields that were too high (see remarks on the most successful practices, next section), hiring untrained help, cropping too soon, and planting.

MOST SUCCESSFUL PRACTICES IN WINE GRAPE PRODUCTION. Again there were a wide variety of responses, with 18 dif-

ferent practices cited as being successful. The practice most commonly reported as a success was choosing the right cultivars. However, there was little consistency among growers as to what these were. A number of growers felt that they had a good trellising or training system, especially in the other region. Growers in all regions felt that controlling yields was a successful practice, and those in the northwest and other region viewed using either narrow row widths or close in-row spacing as successful. Good pest and disease control programs and sufficiently planning were also cited as successful aspects of their operations.

Many practices that were employed and listed as most successful were mentioned as the biggest mistakes by other growers. These practices clearly represent the most critical decisions in the vineyard, and many are long term commitments, once the decision is made. The most critical practices listed were cultivar selection and trellis and training systems. These were mentioned by nearly half of all respondents, and are both long term decisions that are difficult to change once committed to. Nearly one-third of the respondents cited spray programs when listing their biggest mistakes or most successful practices. Decisions regarding pesticide application can also have long term consequences, though in general, mistakes with these decisions can more easily be remedied than poor decisions in cultivar selection or trellising system.

The results of this survey support observations that the wine grape industry of Pennsylvania has a very diverse set of clientele and climate to address. The industry is currently small relative to that in New York or other states, but has the potential to be a viable part of the agricultural and tourist industries of Pennsylvania.

Table 5. Pennsylvania wine growers reporting specific problems with European grape (*Vitis vinifera*) production.

Problem	Respondents reporting problem (%)		
	Northwest	Southeast	Other
Cold injury	100	82.4	83.3
Yields too low	50.0	47.1	33.3
Crown gall	0	47.1	33.3
Powdery mildew	100	29.4	50.0
Black rot	0	23.8	66.7
Nutrition	0	29.4	33.3
Downy mildew	50.0	17.6	50.0
Botrytis	50.0	29.4	16.7
Japanese beetle	0	17.6	33.3
Pruning-training	0	11.8	50.0

Literature cited

- Hedrick, U.P. 1908. The grapes of New York. State of New York Department of Agriculture. 15th Annu. Rpt. vol. 3. part II. J.E. Lyon, Albany, N.Y.
- Pennsylvania Liquor Code. 1968. Title 40. Section 505.2: Limited Wineries. Pennsylvania Liquor Control Board Regulations, Harrisburg.
- Dillman, D.A. 1978. Mail and telephone surveys: The total design method. Wiley, New York.