

THE GRAPE INDUSTRY IN SOUTHWEST MICHIGAN:

A GEOGRAPHIC STUDY

Thesis for the Degree of M. A.

MICHIGAN STATE UNIVERSITY

Barbara Westinghouse

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A handwritten signature in cursive script, which appears to read "J. Morrison", is written over a horizontal line.

Major professor

Date September 5, 1961

ABSTRACT

THE GRAPE INDUSTRY IN SOUTHWEST MICHIGAN: A GEOGRAPHIC STUDY

By

Barbara Westinghouse

This thesis is a discussion of the grape industry of the Southwest Michigan Vineyard Region from the viewpoint of economic geography. Michigan usually ranks third in national grape production. Some 95 per cent of its crop comes from vineyards in four southwestern counties -- Van Buren, Berrien, Kalamazoo, and Cass -- where two areas of greater vine concentration can be distinguished. One centers on the villages of Paw Paw and Lawton; the other around the twin cities of St. Joseph and Benton Harbor. Vineyards in the former area are much more concentrated, three townships having approximately 82 per cent of the vines in Van Buren County, while the three leading townships in the latter area have only 34 per cent of Berrien County's vines.

The most important physical factor explaining the focusing of viticulture in the Region is the favorable climate, largely the result of the "lake influence" from Lake Michigan. This tends to retard vegetation growth in the spring until likelihood of frost is past and to delay frost in autumn until the grapes are harvested. In spite of more advantageous conditions here than elsewhere in Michigan, however, spring frosts are the single most important cause

of crop damage.

Because the vines have a better chance of escaping frost injury if set on slopes sufficient to provide adequate air drainage, roughly 42 per cent of those in the Region are on moraines, 23 per cent on outwash plains, and 19 per cent on till plains. In the St. Joseph-Benton Harbor area where the "lake influence" is greatest, only 71 per cent of the vines are on these three features, but in the Paw Paw-Lawton area, some twenty-five miles east, 97 per cent are on such sites, thereby compensating for the diminished effects of the "lake influence".

Most of the Regions' vineyard acreage is concentrated on Plainfield sand (28 per cent) and Fox sandy loam (11 per cent) associated with outwash plains, and on Coloma loamy sand (27 per cent) and Bellefontaine sandy loam (10 per cent) found on moraines. These soils generally have adequate water and air drainage. The greater effect of "lake influence" in the St. Joseph-Benton Harbor area is again illustrated by the fact that only about 67 per cent of the vineyard acreage there is planted on these four most favorable soils, in contrast to 88 per cent thereon in the Paw Paw-Lawton area.

Approximately 90 per cent of the plantings in southwest Michigan are of the Concord grape. Most of the rest are Delawares and Niagaras. Average vineyard size is about ten acres. Approximately 44 man labor hours per acre are

expended for pre-harvest activities and 16 hours on harvesting. Roughly three times more labor (33 hours) is spent on pruning and tying as on any other pre-harvest task. Almost no labor is hired from outside the Region, even for harvesting.

Two notable historic changes have characterized the marketing of Michigan grapes. One has been the turn for transportation used from boat to rail in the late nineteenth century, and then to motor truck after 1920. The other has been the shift from selling most of the crop as fresh fruit previous to 1940, to where almost 90 per cent is now sent to local juice plants and wineries.

The Welch Grape Juice Co., owned by the National Grape Co-operative Association, Inc., the leading vineyard co-operative of several in the Region, operates the largest processing plant. It is located in the Paw Paw-Lorton area, as are also the next three biggest establishments. Grapes marketed fresh are more largely from the St. Joseph-Benton Harbor area and are mostly disposed of through the Benton Harbor Fruit Market.

For some years prior to 1951, cheap California wines and wines made in Michigan from grapes and juice imported from California offered damaging competition to wines pressed from Michigan grapes. The resultant low prices received by Michigan growers caused them to seek aid from the State Legislature. This body, as a consequence, periodically amended Act No. 8, Public Acts of 1933 (Extra Session), so as to

levy a tax on all wines sold in Michigan other than those made in Michigan from Michigan grapes for which a minimum of \$85.00 per ton had been paid to the growers.

In recent years there has been an upward trend in Michigan grape production, which is likely to continue, because of high and stable prices received as a result of both legislative aid and an increase in population and thus demand. Probably the concentration of an ever larger proportion of Michigan's total vineyard acreage in the Region will occur as demand increases. Sites with satisfactory conditions for viticulture are several times as extensive as those now used.

THE GRAPE INDUSTRY IN SOUTHWEST MICHIGAN:
A GEOGRAPHIC STUDY

By

Barbara Westinghouse

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East Lansing, Michigan
September, 1961

Barbara Westinghouse

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Chapter I

INTRODUCTION

Michigan's Importance In Grape Production

During most years since 1920, Michigan has placed third among the states in the total production of grapes. It is usually surpassed only by California and New York.¹ Preliminary data for the national grape harvest of 1959 indicate that California produced 2,950,000 tons, or 91.3 per cent; New York, 84,000 tons, or 2.6 per cent; Michigan, 57,000 tons, or 1.8 per cent; Washington, 57,000 tons, or 1.8 per cent; Pennsylvania, 29,000 tons, or 0.9 per cent; and Ohio, 16,000 tons, or 0.5 per cent (Appendix Table 1).

Although grape production in the states other than California is relatively small, it gains significance because the grapes grown are of a different kind. In California the varieties raised are of Vitis vinifera, the European type grape which supposedly originated in southwestern Asia and was spread into Europe in very early times. Attempts to grow the European grapes in the United States failed other than in California and parts of adjacent southwestern states

¹During the last twenty years, grape production in Washington state has gradually increased, so that recently it has sometimes exceeded that of Michigan. If the trend continues, Washington will soon completely replace Michigan as the third most important grape producing state.

where the climatic conditions are similar to those around the Mediterranean Sea and in southwestern Asia.

Elsewhere in the United States, varieties of the American type grape are cultivated. These have been derived from the native wild grapes which the early white settlers found growing in profusion throughout eastern North America. Vitis labrusca, the fox grape, indigenous to the area from the Allegheny Mountains to the Atlantic Ocean and from New England to Georgia, was predominant among the wild vines and its domesticated varieties have been more extensively cultivated than those of any other American species. Vitis labrusca varieties, particularly the Concord, Delaware, and Niagara, exclusively comprise the commercially cultivated grapes in Michigan.¹

Of the 1959 production of American type grapes, or those other than the Vitis vinifera grown in California and adjacent states, New York harvested approximately 29.9 per cent; Michigan, 20.3 per cent; Washington, 20.3 per cent; Pennsylvania, 10.3 per cent; and Ohio, 5.7 per cent. Michigan, thus, not only commonly ranks third among the states in total grape production, but is usually second only to New York in the harvest of non-European varieties (Fig. 1). Michigan's importance has developed mainly during the present century. Before that, New York, Ohio, Pennsylvania, and Missouri,

¹A short description of the appearance, characteristics, and main uses of these varieties is given later. See pages 43-44.

Fig. 1

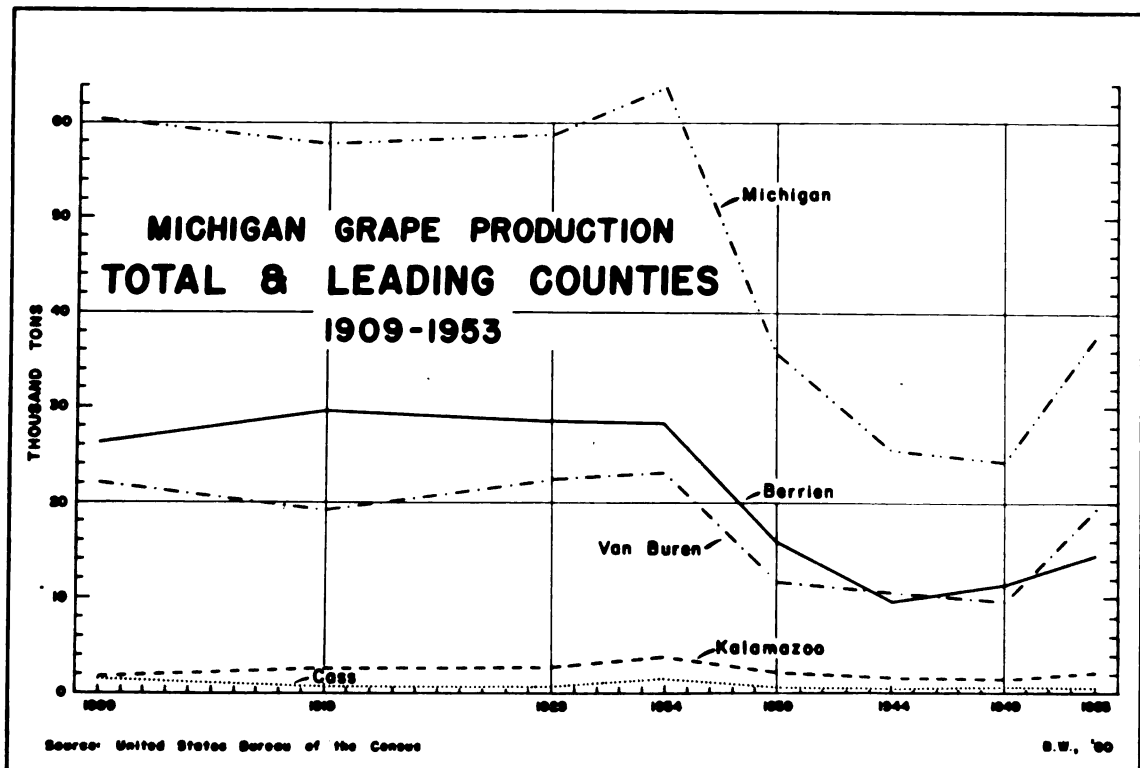
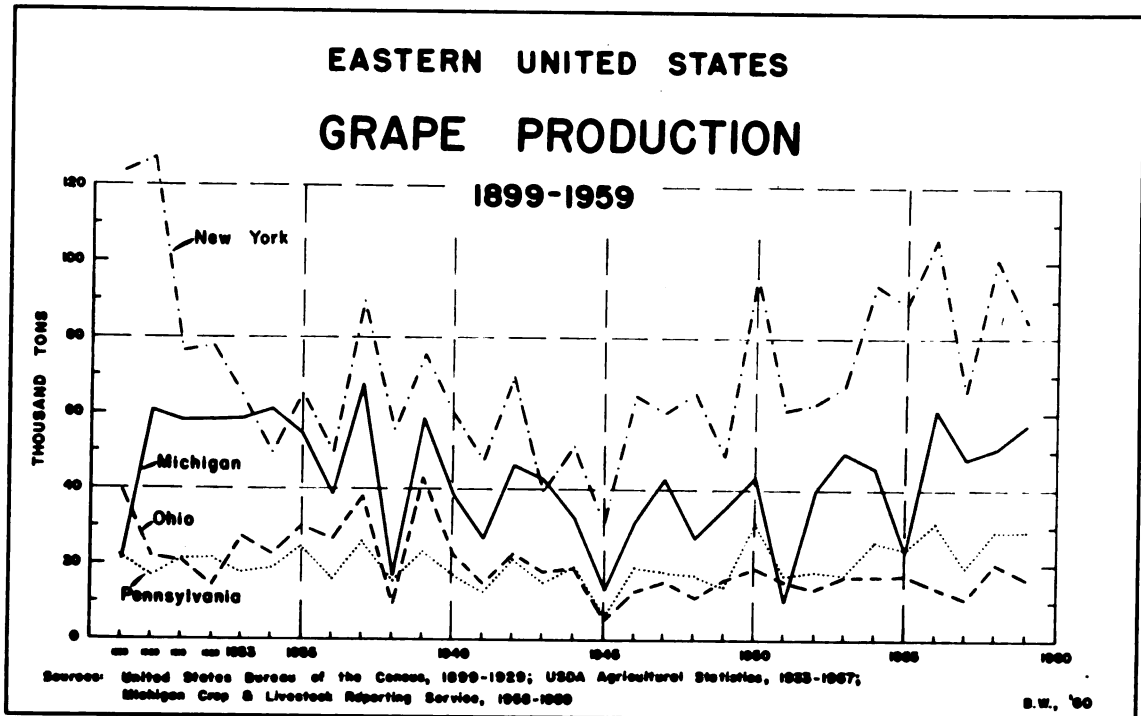


Fig. 2

among the states east of the Rocky Mountains, all had a larger production than did Michigan.

Location of Michigan Vineyards

During the present century also, Michigan viticulture has become concentrated to an increasing degree in the southwestern part of the state. In 1953, the last year for which statistics for individual counties were available, four counties in southwest Michigan produced 35,850 tons of grapes, or 96.3 per cent of the total state production of 37,236 tons. These counties, their respective yield and percentage of the 1953 Michigan harvest were: Van Buren, 19,042 tons, 51.1 per cent; Berrien, 14,340 tons, 38.5 per cent; Kalamazoo, 2,105 tons, 5.7 per cent; and Cass, 363 tons, 1.0 per cent (Fig. 2; Appendix Table 2).¹ The location of the four counties and of their townships, villages, and cities which are most associated with viticulture is shown on the map, Figure 3.

In 1909 these same counties harvested 52,272 tons of grapes, or only 86.6 per cent of the Michigan crop. Tonnage and percentage breakdowns were: Berrien, 26,511 tons, 50.7 per cent; Van Buren, 18,500 tons, 35.4 per cent; Kalamazoo, 2,800 tons, 5.4 per cent; and Cass, 461 tons, .9 per cent.

¹ Allegan, the only other county of significance in 1953, with a production of 483 tons of grapes, or 1.3 per cent of the Michigan total, is also in southwest Michigan, but was not included in the study because its greatest concentration of grapevines is in the middle of the county and is separated from the vineyard areas in the other four counties named.

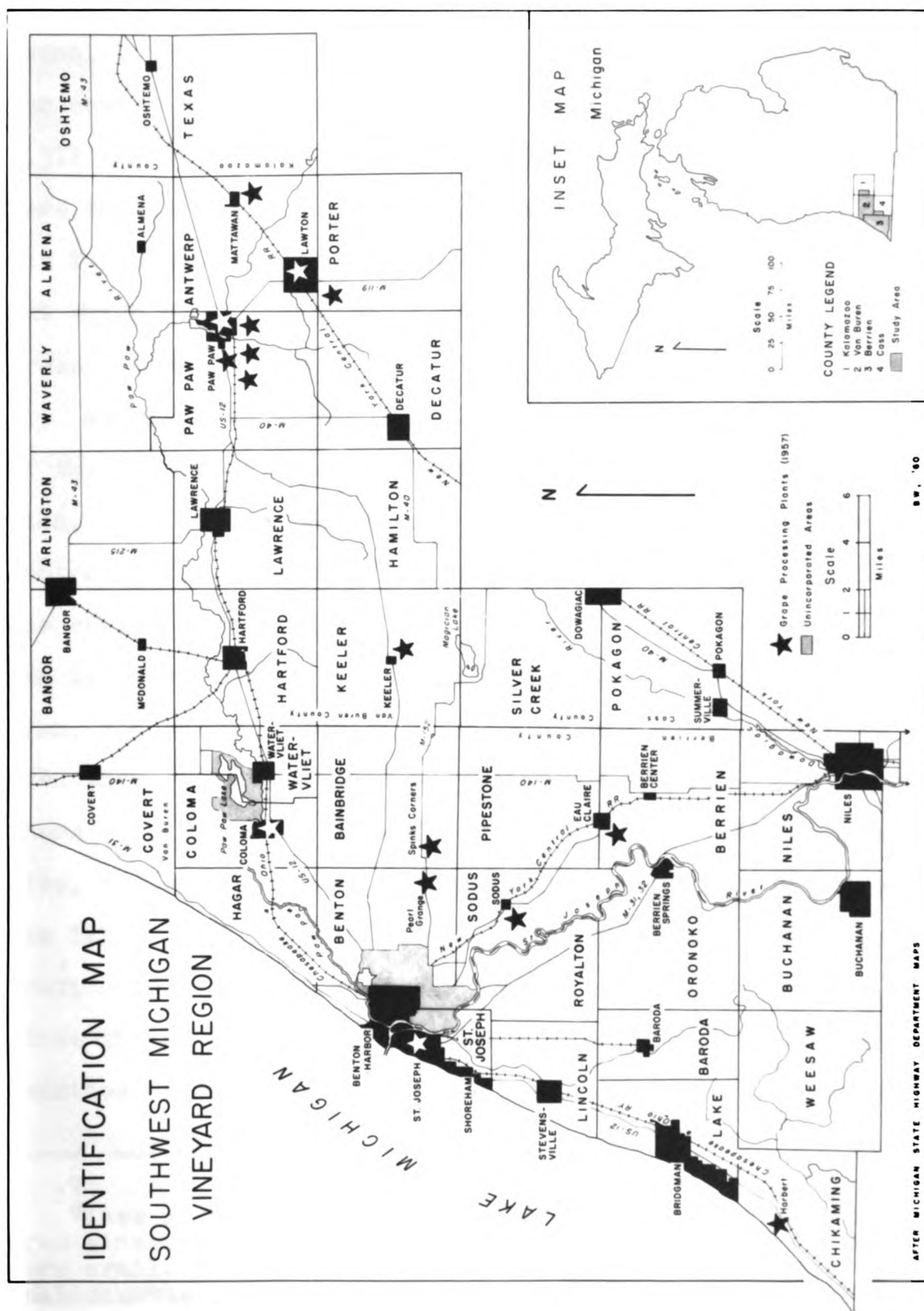


Fig. 3. Identification Map, Southwest Michigan Vineyard Region.

43.9 per cent; Van Buren, 22,203 tons, 36.8 per cent; Kalamazoo, 1,947 tons, 3.2 per cent and Cass, 1,600 tons, 2.7 per cent. Kent County and Ottawa County, with a yield of 1,311 and 1,278 tons, or 2.2 and 2.1 per cent, respectively, were the next most important grape producers in 1909 (Appendix Table 2). Since then, however, declines in their output which have been both relative and absolute have led to present insignificance.

As might be expected, the increased relative importance of the four southwestern Michigan counties in grape production, as discussed above, has been accompanied by the concentration there of an increased share of the grapevines of the state. Of the 11,913,576 vines of bearing age in Michigan in 1910, some 9,298,587, or 78.1 per cent, were in Berrien, Van Buren, Kalamazoo, and Cass counties.¹ In 1954, when there were 7,948,702 grapevines of all ages in the state, there were 7,520,228 vines, or 94.5 per cent, in these counties. Details for each county can be determined from Appendix Table 3. It should be noted that the increased concentration of vines in southwest Michigan was relative only, since the actual number of vines decreased both in the four counties of the area and in the state as a whole. Partly as

¹ Vines of bearing age were used rather than vines of all ages since statistics for vines not of bearing age in 1910 were available only for the whole state and not for individual counties. Hence, it was impossible to compute the total number of vines in each county.

a consequence of the latter decline, Michigan's share of the national total of grapevines dropped from 5.0 per cent in 1910 to 3.1 per cent in 1954.

Southwest Michigan Vineyard Region

Throughout the rest of this study, the four-county area having nearly ninety-five per cent of Michigan's grapevines, and a correspondingly high proportion of the state's annual grape harvest, will be referred to as the Southwest Michigan Vineyard Region, or the Region. This can be divided into two major areas. One, located mainly in Berrien County, tends to have a greater focus in its western part and will, as a consequence, be termed the St. Joseph-Benton Harbor area. The other, slightly smaller and more concentrated than the first, is located mainly in eastern Van Buren County. In this study it will be called the Paw Paw-Lawton area, although another associated village of importance is Mattawan.

More exactly delimited, the St. Joseph-Benton Harbor area includes all but the southern tier of townships in Berrien County, the Van Buren County townships of Arlington, Bangor, Covert, Hartford, Keeler and the western part of Lawrence, and the two northwestern Cass County townships of Silver Creek and Pokagon. The whole of Alma, Antwerp, Decatur, and Hamilton townships, along with the eastern parts of Lawrence, Paw Paw, Porter, and Waverly townships in Van Buren County, and the two western Kalamazoo County townships

of Oshtemo and Texas make up the Paw Paw-Lawton area (Figs. 3 and 4).

As shown in Figure 4, the Paw Paw-Lawton area is not only smaller in extent, but viticulture is more concentrated in certain localities within it, than is the case of the St. Joseph-Benton Harbor area. Three townships of the Paw Paw-Lawton area contain 82.3 per cent of the Van Buren County grapevines. These, and their percentages of the county total, are: Antwerp, 36.8; Porter, 24.6; and Paw Paw, 20.9¹¹. The number of grapevines in every Van Buren township except Keeler decreased between the years 1935 and 1954 and this has no doubt continued since. The percentage concentration of vines has also decreased, except in Porter, Paw Paw, and Keeler townships. Thus, there has been a trend towards fewer grapevines in the county and at the same time one towards greater concentration of the vines in the leading grape growing townships. (It should be remembered that Keeler township is part of the St. Joseph-Benton Harbor area.)

Because the vineyards are more widely distributed in the St. Joseph-Benton Harbor area, Lincoln, the leading township in Berrien County in number of grapevines, has only 17.8 per cent of that county's total. Royalton, with 8.3 per cent of the vines and Sodus with 8.1 per cent are the second and third most important townships. Thus, in the three lead-

¹¹This percentage includes the village of Paw Paw.

ing townships there is only about 34.3 per cent of the grapes of Berrien County, as compared to 82.3 per cent in the three principal townships of Van Buren County. In Berrien, as in Van Buren County, the number of vines has dropped in recent years except in Berrien Township. The proportion of vines per township to the county total, however, has decreased only in Lake, Benton, Chikaming, St. Joseph, Coloma, and Buchanan and has risen in the other eleven townships.

Analysis of the changes indicates that of the leading townships in number of grapevines in 1935, only Lincoln had a larger proportion of the Berrien County total in 1954. Thus, there has been a loss both relative and absolute in the other grape growing townships of importance in 1935, namely Chikaming, Benton, Lake, and St. Joseph, and a tendency towards dispersal of grapevines rather than greater concentration as has occurred in the Paw Paw-Lawton area. One apparent reason for this has been the urban expansion of Benton Harbor, St. Joseph, and Bridgman.

Within both the Paw Paw-Lawton and the St. Joseph-Benton Harbor areas the two townships of the second and less important county included in each, does not contain a significant share of the vines in the respective areas. They are important, however, as the leading grape growing townships in their respective county. In Kalamazoo County, 63.5 per cent of the vines are in Texas Township and 26.5 per cent in Oshtemo Township. Both Texas and Oshtemo townships had fewer grapevines

in 1954 than in 1935. The percentage concentration had risen, however, from 56.4 to 63.5 per cent in Texas, but dropped from 29.2 to 26.5 per cent in Oshtemo. In Cass County, Pokagon Township contains approximately 33.4 per cent and Silver Creek Township 29.1 per cent of the total number of vines. In 1954, both had fewer grapevines, but a greater share of those in the county, than they did in 1935.

In certain of the aforementioned townships, vineyards not only occupy most of the land devoted to the raising of fruit, but also much of the total acreage of cropped land. The proportion of all land planted in strawberries, fruit orchards, vineyards and nut trees that was used for grapevines in the leading townships of the Paw Paw-Lawton area in 1954, according to the Agricultural Census, was: in Van Buren County, Porter, 94.5 per cent; Antwerp, 93.8 per cent; Paw Paw, 59.1 per cent; and in Kalamazoo County, Texas, 78.7 per cent. In the St. Joseph-Benton Harbor area, on the other hand, the township of greatest importance, Lincoln, had only 54.4 per cent of the fruit land planted in grapes. These figures indicate extreme predominance of viticulture in the fruit-growing activities in the Paw Paw-Lawton area. In the St. Joseph-Benton Harbor area, the ratio of land in grapes to land in all fruits is less.

In the Paw Paw-Lawton area, vineyard acreage in relation to total cropland in the above-mentioned townships is shown by the following percentages: Antwerp, 41.8; Porter, 18.2;

Paw Paw, 16.6; and Texas, 13.8. In the St. Joseph-Benton Harbor area, Lincoln Township, with grapes cultivated on 24.8 per cent of the total cropland, again stands out as the leader. Compared to all the other townships in the Southwest Michigan Vineyard Region, Antwerp in Van Buren County shows the highest percentage of grape land in relation to total cropland. Vineyards in this leading grape growing township of the Paw Paw-Lawton area cover almost one half of the total cultivated acreage; while in Lincoln, the leading township of the St. Joseph-Benton Harbor area, only about one quarter of the cropland is in grapes. Lincoln Township is, nevertheless, second only to Antwerp Township in this regard.

In summary, during the last twenty to thirty years there has been an increasing concentration of Michigan viticulture in the four counties of the Southwest Michigan Vineyard Region, as evidenced by the fact that the share of grapevines in the state outside of the Region declined from 15.5 per cent of the total in 1935 to 5.4 per cent in 1954. Within the Region itself there has been a further tendency towards concentration in a few leading townships in each county, except Berrien where there has been some dispersal, probably largely due to urban expansion in several of the townships which formerly were the leaders in grape growing (Appendix Table 5).

Statement of Problem

The purpose of this thesis is to discuss the economic geography of the grape industry in southwest Michigan. Geography is the study, description, and interpretation of the areal differentiation of the earth's surface. In economic geography this concept is applied to the investigation of man's methods of gaining a livelihood.¹

The writer will attempt to describe and explain the present distribution of vineyards in the Southwest Michigan Vineyard Region, and the differences and similarities between the two constituent areas. Following the introductory chapter, there is one dealing with the relation of the areal arrangement of the vineyards to the physical features of climate, topography, and soils. In chapter three, grape production activities, and in chapter four, the marketing aspects, are investigated. In a concluding chapter, a summary of the main facts is given, as well as some prediction of future trends in the southwest Michigan grape industry.

¹P.E. James and C.F. Jones, American Geography Inventory and Prospect (Association of American Geographers, Syracuse University Press, 1954), pp. 21 and 241.

CHAPTER II

PHYSICAL FEATURES

The present location of vineyards and their concentration in the Southwest Michigan Vineyard Region is the result of more than one hundred years of experience and study.¹ One of the most important factors, either physical or cultural, determining the focusing of Michigan viticulture in this area is that of climate.

Climate

The Region is located at the northern limit of the humid continental climate with long summers (Koppen Dfa). A convectional type of rainfall and much heat and sunshine during the summer is characteristic. Although the long, warm summers promote grape growth and maturation, late summer and early autumn heavy rain and hail storms sometimes damage the crop before it is ready to be harvested.

U.P. Hedrick, in his treatise, The Grapes of New York, published in 1903, discussed the ideal conditions for growing American type grapes. He stated that temperature is the most important climatic element determining the suitability of giv-

¹Early vineyards, if not the first, for commercial production were set near St. Joseph, Berrien County, in 1852; near South Haven, Van Buren County, in 1858; and near Lawton, Van Buren County, in 1860.

on regions for viticulture because it influences the date of berry maturity. The cultivation of American grape varieties usually fails in regions with sudden temperature changes, large annual and diurnal ranges, or late spring and early autumn frosts. Grape leaves, buds, and shoots develop best during a frost-free, mild, rainy, late spring and early summer (May, June, and July), with temperatures averaging between 55° and 65° F. Partial or complete failure of the future crop and severe damage to the vines may result from a spring frost. A relatively dry, long, warm, sunny summer is conducive to berry ripening and wood maturation. It must be relatively dry to help prevent diseases, pest infestation, and excess foliage and weed growth; long, warm, and sunny to increase grape sugar content.

The taste of the berries is influenced by the amount of heat received. In general, cool weather causes higher acid content and a sour taste. Excessively high summer temperatures, however, do not cause as high a sugar content, nor as large a size of the berries, as do slightly cooler temperatures. Optimum conditions for grape maturation during the months of August, September, and October consist of much sunshine and of temperatures averaging from 65° to 75° F.¹ Any sudden temperature change during the ripening period,

¹U.P. Hedrick, et al, The Grapes of New York, Fifteenth Annual Report, Vol. 3, Part 2 (State of New York, Dept. of Agr., 1908), p. 69.

particularly if combined with high humidity, may cause rot and other fungus diseases. A warm to cool, dry, harvest season (usually from early September to mid-October) facilitates picking, transportation, and storage of the crop.

Except for a warmer July and a cooler October, temperatures in the Southwest Michigan Vineyard Region correlate well with those recommended by U.P. Hedrick (Table 1).

Partridge concludes that "an average temperature for the months of May to September inclusive of at least 65.5° F. with a growing season of something more than 160 days, is essential to the successful culture of the Concord grape in Michigan."¹

The greatest climatic advantage for the cultivation of grapes in southwest Michigan is the modifying influence of Lake Michigan upon the temperatures of the Region. Since water both heats and cools slower than land, Lake Michigan remains colder in spring and warmer in autumn than the adjoining land areas.

Prevailing westerly winds cross the lake and carry the "lake influence" into the Southwest Michigan Vineyard Region. This phenomenon is most effective within ten miles of the lake shore. It causes a retardation of vegetation develop-

¹ Newton L. Partridge, "The Young Vineyard", Agr. Exp. Sta. Circ. Bul. No. 124 (Mich. State Co., Hort. Sec., East Lansing, Mich., April 1929), p. 7.

TABLE 1*

CLIMATE OF SELECTED STATIONS, SOUTHWEST MICHIGAN VINEYARD REGION

Mean Monthly Temperatures¹

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
Benton Harbor	27.2	29.2	34.3	47.7	58.0	66.7	71.2	70.3	64.2	53.6	40.1	30.2	48.4
Eau Claire	26.9	27.5	35.9	48.1	59.0	69.8	74.7	72.9	65.3	54.4	39.9	29.3	50.3
Kalamazoo	25.7	27.2	35.3	47.6	58.9	69.0	73.5	71.7	64.5	53.5	39.6	28.8	49.6
Paw Paw	26.5	26.9	35.1	47.4	58.5	68.9	73.4	71.4	63.9	53.0	39.5	28.9	49.5

Mean Monthly Precipitation¹

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver.
Benton Harbor	2.6	2.2	2.2	4.1	3.3	3.7	3.3	2.8	1.8	3.4	2.6	2.4	34.1
Eau Claire	2.0	1.7	2.4	3.2	4.2	4.4	3.0	3.2	3.4	3.4	2.8	2.3	36.1
Kalamazoo	2.3	2.0	2.6	3.1	3.9	3.7	3.1	2.9	3.2	3.0	2.7	2.3	34.8
Paw Paw	2.4	2.0	3.0	3.3	4.4	4.3	3.2	3.1	3.4	3.3	2.9	2.4	37.7

Freeze Data²

Station	Mean date last spring frost	Mean date first autumn frost	Mean number days between dates
Benton Harbor	May 7	Oct. 3	149
Eau Claire	May 4	Oct. 22	170
Kalamazoo	May 9	Oct. 9	152
Paw Paw	May 10	Oct. 6	149

¹Averages for period 1931-1955.

²Based on a freeze threshold temperature of 32° F.

*Data for Eau Claire and Paw Paw, and also Benton Harbor Freeze Data, from U.S. Dept. of Commerce, Weather Bureau, Climates of the States, Michigan, May 1959. Mean monthly temperatures and precipitation for Benton Harbor were computed from data in U.S. Dept. of Commerce, Weather Bureau, Climatological Data, Michigan, Annual Summary, 1950 (Vol. 65, No. 13) to 1960 (Vol. 75, No. 13). Data for Kalamazoo, from mimeographed material released by A.H. Eichmeier, State Climatologist, Weather Bureau Office, East Lansing, Mich.

ment in spring until the likelihood of damage by frost is largely over. In autumn, it tends to delay the first frost until the crop has matured and is nearly all harvested. As a consequence, the average length of growing season¹ in the Region varies from approximately 150 days in eastern Van Buren County to 170 days around Eau Claire in Berrien County (Table 1).² Thus, the average length of the growing season in much of the Southwest Michigan Vineyard Region is apparently less than that Partridge stated as necessary.

It is not length of the growing season alone that is important, but also the dates marking the limits of the growing season. In Paw Paw in the interior, for example, the average date of the last frost in spring is May 10¹, while in Benton Harbor on the lake it is May 7. It is true, however, that cultivation of grapes becomes increasingly hazardous eastward from the lake because of greater departures from the average date of the last frost in spring and of the first one in autumn, and because of colder and more variable winters which increases the danger of winter kill.

¹Growing season is here considered to be the period between the last frost in spring and first frost in autumn, when the temperature drops below 32° F.

²An average growing season of similar length characterizes other localities in Michigan. Lansing has an average growing season of 154 days; Monroe, 165; Port Huron, 166; and Alpena, 156. Although average growing season dates are similar between the various localities, the actual dates determining the growing season each year remain relatively constant in southwest Michigan in contrast to those elsewhere in the state.

Although the Paw Paw-Lewton area is approximately twenty-five miles east of Lake Michigan, the "lake influence" is probably still effective enough to partially explain the concentration of viticulture in the area. No doubt more important is the topographical situation of the vineyards so as to obtain suitable air drainage by way of the valleys of the Paw Paw River and its headstreams, combined with the historical factor that the first men to establish vineyards in the area were very successful. On the whole, mean monthly temperatures in Paw Paw and Kalamazoo are but little different from those in Benton Harbor, except that they are a little colder in the winter and slightly warmer in the summer. The dates limiting the growing seasons are similar in both cases (Table 1), the main difference being that the start and end of the average growing season is several days later in the Paw Paw-Kalamazoo area.

In general, there is a little more rainfall in April, May, and June than during other times of the year, thus conforming approximately to the precipitation requirements stated by Hedrick. Average annual rainfall is about 35 to 40 inches. Unseasonably heavy rain, or drought, do occasionally cause damage, but on the whole the precipitation factor is favorable to grape growing. Although problems arise when weather conditions deviate very much from those considered optimum for viticulture, the most frequent destructive forces are frost and hail.

Frost

In spite of the "lake influence", frost is the most crucial climatic hazard to vineyards in southwest Michigan. Early autumn frosts are not so dangerous as are those in late spring. This is because spring frosts come when the grapevines are just beginning to develop buds. A comparison of Table 2 and Figures 5 and 6 shows a definite correlation between the occurrence of spring frost and the tonnage of grapes harvested, the estimated per cent of full crop obtained,¹ and the price per ton received by growers.

Although Table 2 and Figure 5 include data only as recent as 1949, the information given is adequate to illustrate this climatic-economic relationship. In 1921, 1925, 1938, and 1945, there occurred spring frosts with temperatures cold enough to kill more than one half of the expected harvest. As a consequence, Michigan grape production decreased in tons from 63,960 in 1920 to 26,330 in 1921; from 60,005 in 1924 to 21,485 in 1925; from 67,200 in 1937 to 16,900 in 1938; and from 32,000 in 1944 to 13,500 in 1945 (Appendix Table 11). Apparently the spring frosts, or some other adverse factor, also decreased production in the other principal grape states in northeastern United States during the same years, at least in 1938 and 1945 (Fig. 1). Years

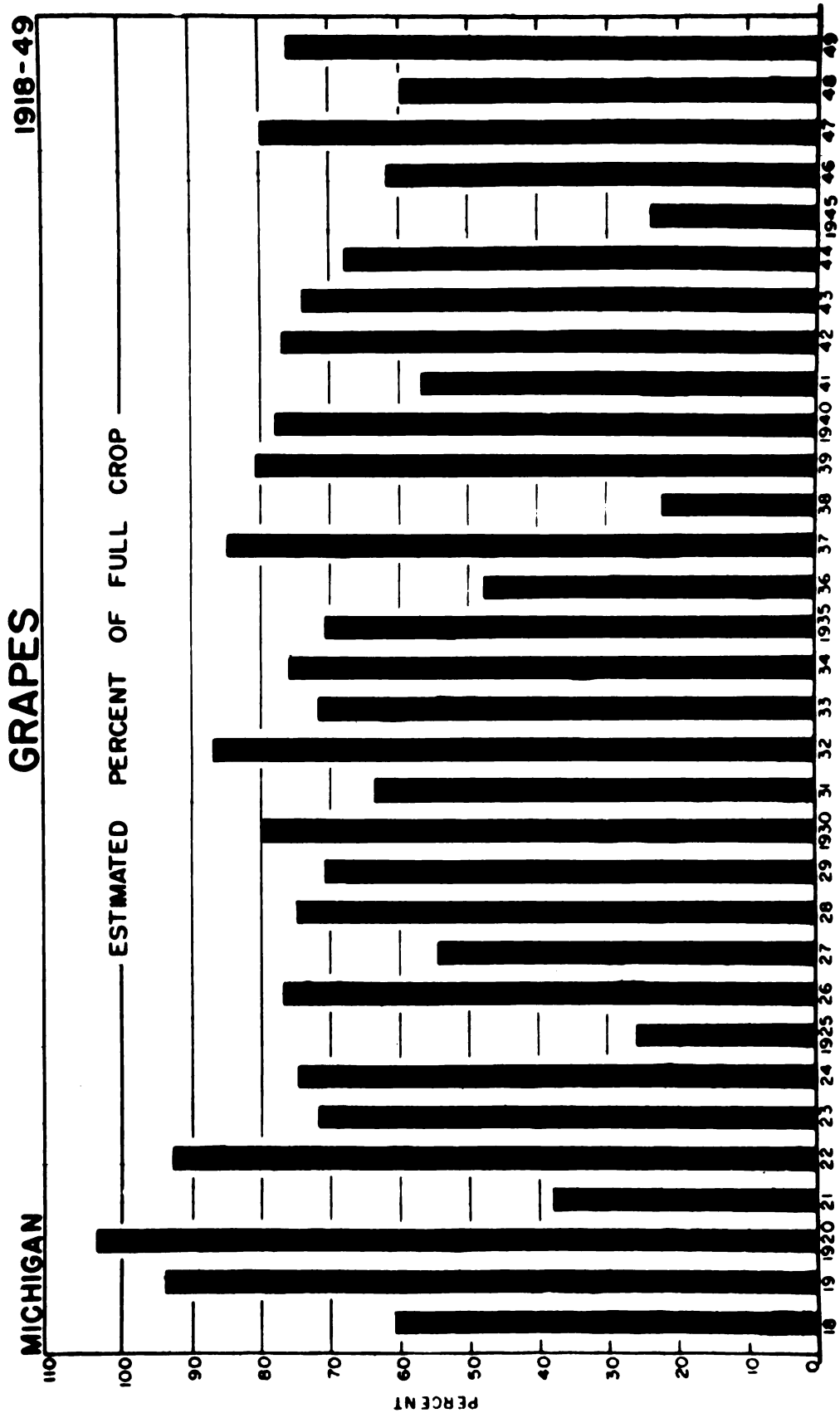
¹ actual harvest for a given year compared to potential harvest obtainable under the most advantageous conditions for the same year.

TABLE 2*

MICHIGAN GRAPE INDUSTRY
ESTIMATED PER CENT OF CROP LOSS FROM CLIMATIC HAZARDS, 1918 - 1949

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Low Winter Temperatures	2**																2	3				2			
Spring Frost	2		4		2		4	2	3	2	2	2	3	1					2	5		3	1		
Autumn Frost						1											3				1				
Hail																									
	43	44	45	46	47	48	49	Total Number of Losses																	
								1	11	26	51	Over													
								to	to	to	to	to	75%	Total	**Estimated Per Cent										
								10%	25%	50%	75%														
Low Winter Temperatures	2				2			5	1								6			1	1	to	10%		
Spring Frost			4	3			2	2	8	4	3	1	18							2	11	to	25%		
Autumn Frost					2			3	1	1							5			3	26	to	50%		
Hail							1										1			4	51	to	75%		
																				5	over	75%			

*Interpretation of data from reports of the Michigan Cooperative Crop Reporting Service and of the U.S. Weather Bureau, taken from a study by Clarence Walter Olmstead, "The Pattern of Orchards in Michigan; a Historical-Geographic Study of the Development of a Pattern of Land Use" (Unpublished Ph.D. dissertation, Dept. of Geography, University of Michigan, 1951), p. 100.



REPORTS OF THE MICHIGAN COOPERATIVE CROP REPORTING SERVICE

Fig. 5.--Taken from a study by Clarence Walter Olmstead, "The Pattern of Orchards in Michigan; a Historical-Geographic Study of the Development of a Pattern of Land Use" (Unpublished Ph.D. dissertation, Dept. of Geography, University of Michigan, 1951), p. 101.

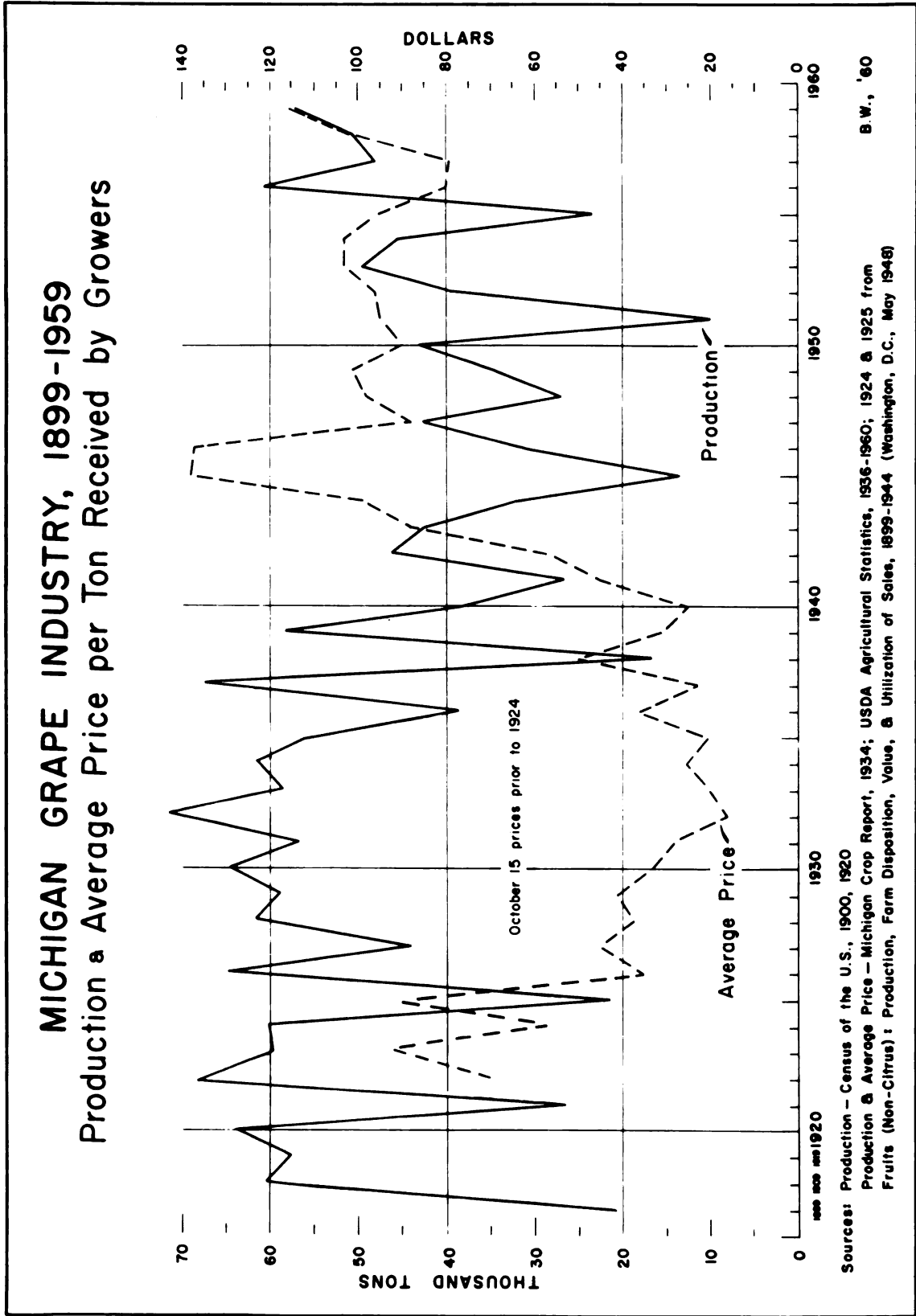


Fig. 6. Michigan Grape Industry, 1899 - 1959.

of low production commonly resulted in high average prices received by the growers. From \$57.00 per ton in 1924, for example, the price rose to \$90.00 in 1925; from \$23.00 in 1937 to \$50.00 in 1938; and from \$99.00 in 1944 to \$138.00 in 1945 (Fig. 6).¹

In autumn, an early frost may injure grapes that are still on the vines. Normally, most grapes are picked before there is chance of frost damage, but sometimes because of picker scarcity, lack of adequate markets, immature berries, or fruit with sugar content too low to be accepted by processing plants, frost occurs before the harvest is complete. Although a light early autumn frost may not harm the fruit or vine wood to any great extent, both are seriously damaged by a severe one. Autumn frosts, however, do not affect grape production as often or as much as do those in spring because they usually occur after the grapes are harvested and the vines are prepared for winter dormancy.²

Due to lack of air drainage, frost deleteriously affects vineyards in hollows and valleys more than it does those grown on slightly sloping land and hillsides. For example, primarily because of frost danger, there are few vineyards

¹Prices were not given for 1920 and 1921 (See Appendix Table 11).

²At times, however, if the Southwest Michigan Vineyard Region has an extraordinarily warm autumn, many young shoots are continually sent out and are seriously injured or killed if the temperature suddenly drops to freezing. Interview with Frank Kotyuk, Soil Conservation Service Agent, Berrien County, Sept. 8, 1959.

in the former Lake Dowagiac bed south of the Layton-Kattawan area. In regions of sloping terrain, air movement tends to prevent the temperature from cooling to a point where frost occurs.

The three types of frost in the Southwest Michigan Vineyard Region are: a) air drainage frost when cold, heavy air descends the slopes into valleys and replaces the warmer, lighter air, b) wind frost when a wind of freezing temperatures may kill grapes grown in a certain area and at a certain elevation, and c) radiation frost when heat absorbed by the earth during the day is radiated unchecked into the atmosphere on cold, clear nights.¹

Interestingly enough, a severe spring frost may not decrease the crop as much as a lighter one. Sometimes, after a severe spring frost, a larger crop than expected results because when the primary shoots are killed or critically injured, fruit clusters are produced on new lateral shoots. After a light spring frost, however, the primary shoots often are not injured enough to induce development of new lateral shoots, and the crop damage is greater than if the frost had been more severe. The recuperative capacity of the vine varies with the variety and the care expended on it. Neglected vines (Fig. 7), and old, diseased plants, will not

¹Interview with the late Jerry Mandigo, Van Buren County District Extension Agent of Horticulture, Sept. 17, 1959.



Fig. 7.--Neglected grapevines, one and one half miles northwest of Paw Paw, looking northwest (Sept. 27, 1959)



Fig. 8.--Well-kept, clean-tilled vine yard, ten miles north of Dowagiac, Cass County, on Highway M-40 (Aug. 8, 1959)

produce as large recuperative crops as do those that are young, healthy, and well cared for (Fig. 8).

Frost may indirectly cause grapes to "shell", or drop off the stem at the least jarring movement. If hot, dry weather follows a frost, the grapes seem more susceptible to "shelling". A virus is also suspected of causing this phenomenon.¹ In the autumn of 1959, a team of three specialists were investigating possible grape "shelling" causes, and effective control measures.²

In southwest Michigan there is little use of smudge pots to keep temperatures in the vineyards above freezing. The late Jerry Mandigo, Van Buren County District Extension Agent of Horticulture, stated that the use of commercially prepared smudge pots to protect vineyards was too costly. In contrast to the case of the extensive orange groves in southern California where smudge pots have been used successfully, their use in the smaller, more sporadically located vineyards of southwest Michigan for protection against a phenomenon that occurs relatively infrequently is uneconomical.

Some growers have devised their own methods of frost protection. When cold weather is predicted, some spray their vineyards with water, which when it freezes protects the

¹Interview with A.N. Fournier, Paw Paw viticulturist, Sept. 25, 1959.

²Interview with Jerry Mandigo, Sept. 11, 1959.

berries with a thin film of ice.¹ One, A.N. Fournier, a viticulturist living northwest of Paw Paw, burns tire casings and hay at the ends of the rows. The radiant heat keeps temperatures above freezing and the smoke and warmth rise to a certain height and then billow out to form a protective "ceiling" over the vineyard, thereby checking terrestrial radiation.² When there is danger of freezing temperatures, special frost warnings are issued on weather forecasts by radio broadcasts within the Region. Many growers also have their own systems for detecting the threat of frost, as for example, alarm bells in their homes which ring when temperatures in the vineyard drop to near critical levels.

Hail

Hail, associated with convectional precipitation, is another climatic threat and occurs during late summer and early autumn, the times of grape maturation and harvest. An example of hail devastation was a storm that occurred on July 19, 1956. Within twenty minutes, in a twelve to fifteen square-mile area between Stevensville andodus, Berrien County, the storm caused half a million dollars worth of damage to vineyard, vegetable and fruit crops. This is an

¹Interview with Dr. Harry K. Bell, Associate Professor, Horticulture, and Extension Specialist, Coop. Ext. Ser., Mich. State Univ., East Lansing, Mich., June 26, 1961.

²Interview with A.N. Fournier, Sept. 29, 1959.

area of heavy vineyard concentration. Some viticulturists suffered almost total crop losses.¹ Some fifteen to twenty farmers needed Farmers' Home Administration type loans. Keith Acker, FHA supervisor for Berrien County, however, did not declare the area in a state of emergency because a survey team ascertained that most growers possessed sufficient available commercial credit and would, therefore, not be eligible for FHA aid.² In the Southwest Michigan Vineyard Region, however, damage is not sufficient to cause more than a small percentage of the growers to carry hail insurance.

Glacial Features

While climate is the control of greatest consequence generally for grape growing, the terrain upon which the vineyard is located becomes locally extremely significant. This is because of the importance of adequate air drainage for protection against frost. Thus, vineyards are placed on sloping, rather than level land, in areas where there is frost danger. This is usually the case in southwest Michigan, except very close to Lake Michigan where the "lake influence" is at a maximum.

The surface of the Southwest Michigan Vineyard Region is the result of glacial deposition during Pleistocene glacia-

¹Benton Harbor News-Palladium, July 10, 1956.

²Ibid., July 20, 1956.

tion and of post-glacial erosion. It is widely varied, ranging from extensive glacial-lake plains and drainage ways to strongly developed moraines associated with the Lake Michigan Lobe (Fig. 9). The general grain of the topography is northeast to southwest, paralleling the Lake Michigan shore, but the drainage finds its way transversely through the major moraines to the lake. In places immediately along the lake shore there are extensive post-glacial dune areas, but these are of no importance as sites for vineyards.

The glacial moraines, till plains or ground moraines, outwash plains, and lake beds and drainage ways are respectively characterized by an increasingly level topography. As a consequence, the greatest concentration of vineyards in the Southwest Michigan Vineyard Region is on the moraines where air drainage is at a maximum, while they are largely absent on the lake plains and drainage ways where it is at a minimum (Fig. 9).

Analysis of the distribution of vineyards (details given in Appendix Table 7),¹ shows that in the whole vineyard area of southwest Michigan, some 3,117,000 vines, or 42 per cent are on moraines; 1,725,000 vines, or 23 per cent on outwash plains; 1,377,000 vines, or 18.5 per cent on till

¹Distribution of vineyards was obtained from aerial photographs, scale 1:7,920, and this information was used as a basis for plotting a large scale dot map, which in turn was superimposed on a glacial map of the same scale to obtain the final counts shown in Appendix Table 7.

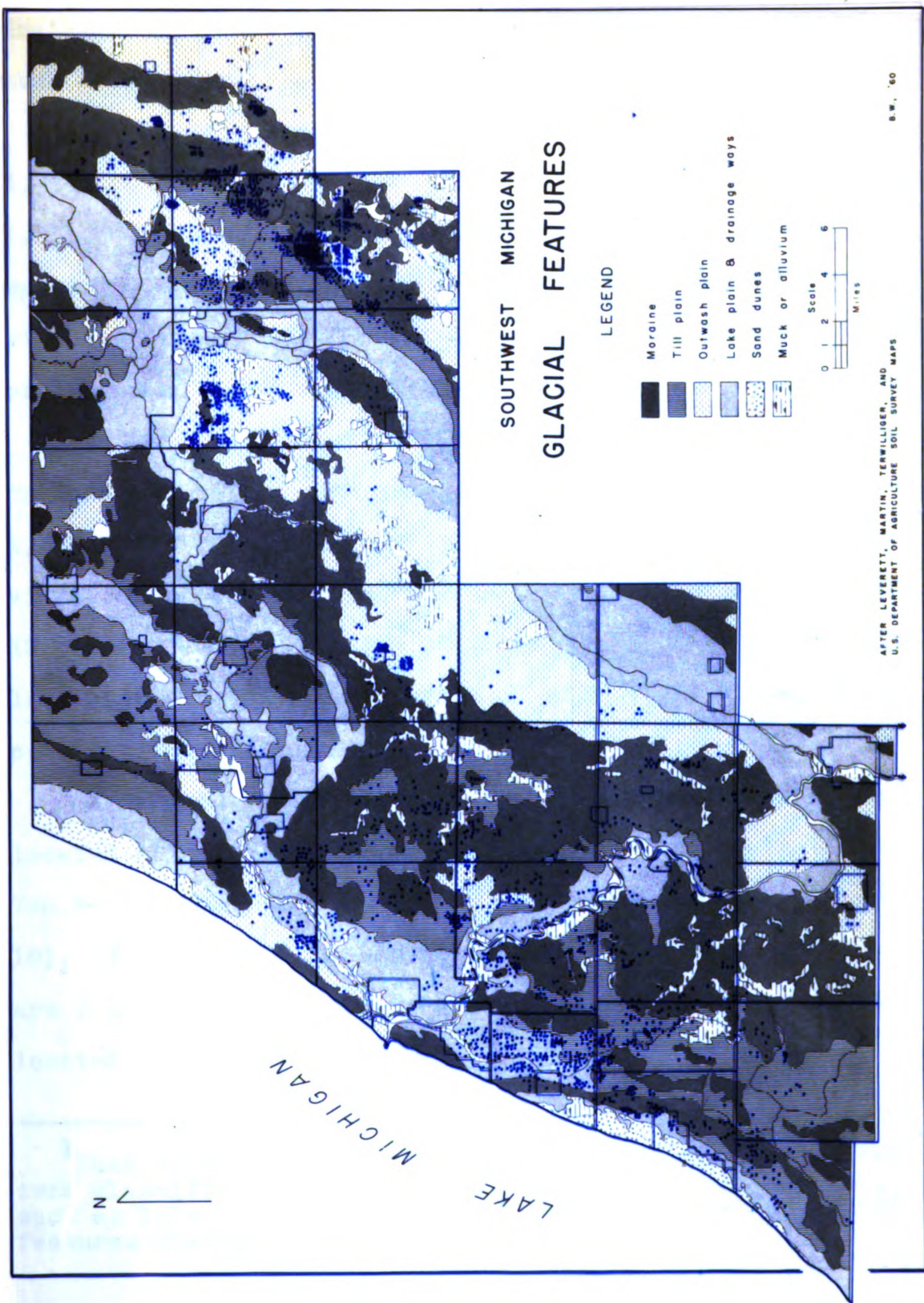
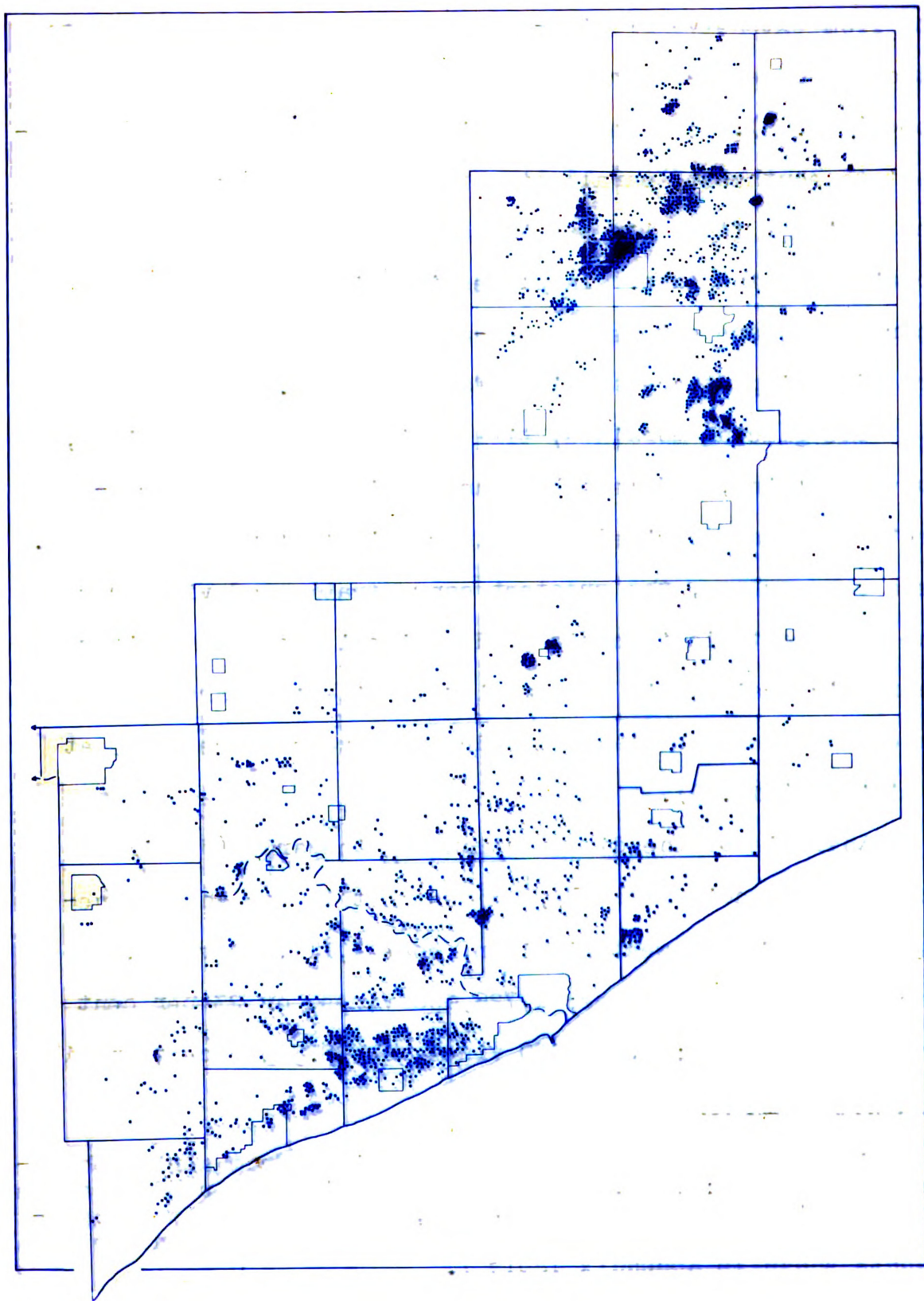


Fig. 9. Southwest Michigan Glacial Features.



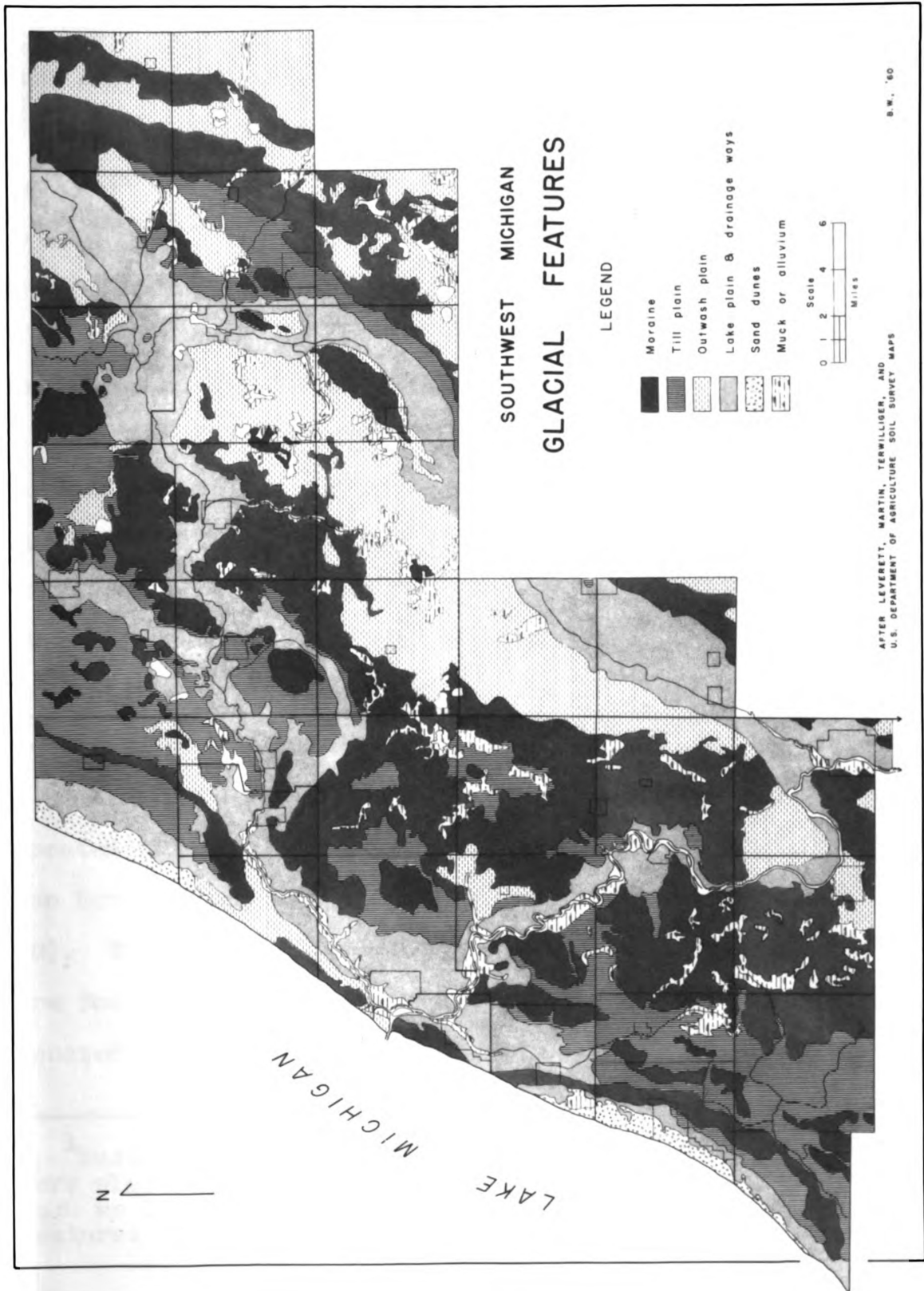


Fig. 9. Southwest Michigan Glacial Features.

plains; 1,173,000 vines, or 16 per cent on lake plains and drainage ways; and only 36,000 vines, or 0.5 per cent in muck areas (Fig. 9).¹

In the St. Joseph-Benton Harbor area, approximately 1,386,000 vines, or 37 per cent are found on moraines; 1,071,000 vines, or 28 per cent on lake plains and drainage ways; 927,000 vines, or 24 per cent on till plains; 375,000 vines, or 10 per cent on outwash plains; and 33,000 vines, or less than 1 per cent in muck areas.

In the Paw Paw-Lawton area the relative concentration on moraines is much greater, there being approximately 1,731,000 vines, or 48 per cent on moraines; 1,350,000 vines, or 37 per cent on outwash plains; 450,000 vines, or 12 per cent on till plains; 102,000 vines, or 3 per cent on lake plains and drainage ways, and only 3,000 vines, or 0.1 per cent in muck areas.

Vineyards on moraines in the Paw Paw-Lawton area are located mainly on parts of the Kalamazoo moraine in eastern Van Buren County and western Kalamazoo County (Figs. 9 and 10). Those in the St. Joseph-Benton Harbor vineyard area are found primarily on segments of the Valparaiso moraine located in Berrien and western Van Buren counties.

¹Muck is a soil type but is included in the glacial feature classification because it is found in level terrain, such as lake plains; or small, flat, spaces within glacial features characterized by a more rugged surface.



Fig. 10.--Vineyard on inner (western) ridge of Kalamazoo moraine, one half mile south of Mattawan on the New York Central Railroad, looking southeast (Oct. 15, 1959). The possibility of good air drainage in this vineyard is evident.

On the other extreme, there are few vineyards anywhere in the bottom of the valley of the Paw Paw River, on the former Lake Dowagiac lake plain, and in most other valley, lake plain, and drainage-way areas. The Dowagiac lake plain comprises a strip of land approximately five miles wide trending southwest-northeast from Niles City in Berrien County, towards Lawton in Van Buren County (Figs. 3 and 9).

Grapes can be grown successfully on lake plains and drainage ways, however, provided other factors compensate for the poor air drainage. In the townships of St. Joseph and Lincoln, Berrien County, grapes are cultivated on such sites because they are near Lake Michigan and the "lake influence" becomes the controlling factor. In addition, there are favorable soils, situation to market is satisfactory, and it must be remembered, too, that the grape industry in this area was started early by immigrants who were skilled in horticultural techniques, and who found they could ship the grapes by water to the Chicago market. Although water transport is today of no consequence, it has great historical significance.

Most of the vineyards around Lawton, Mattawan, and west of Kalamazoo are situated either on moraines or till plains, but practically all those west of Paw Paw are located at the north end of the Valparaiso outwash plain (Fig. 9). Outwash plains are level in relation to moraines and till plains, but there is often enough slope to provide adequate air drainage. In addition, that around Paw Paw is underlain by soils suitable

to viticulture. This satisfactory slope-soil combination occurs also in Hamilton Township, Van Buren County, and elsewhere in the Valparaiso outwash plain that extends southwest from Paw Paw between the Dowagiac lake plain and the Valparaiso moraine. Hardly any grapes are raised other than west of Paw Paw, however, because, in contrast to this locality, others were not settled by viticultural pioneers, and there are no processing plants in the near vicinity where the grapes can be easily marketed. One exception is the concentration in a small area near the center of Keeler Township.¹

Even given a favorable climate, less suitable soils and/or greater distance from markets may render viticulture unprofitable on moraines and till plains. There are, for example, few vineyards on the moraines in most of the southeastern Berrien County townships. The processing plant at Eau Claire is the only one in the district. In three southwestern townships of Van Buren County -- Keeler, Hartford, and Lawrence -- hardly any grapes are grown on the moraine or till plain. Even though there are suitable vineyard soils in all three townships, growers here would be at a disadvantage when compared to those operating on similar site condi-

¹The vineyards in the two grape growing neighborhoods involved belong to one firm, Bronte Champagne and Wine Co. Although the vineyards of one are partly on soils less suitable to viticulture, both are very close to the Bronte processing plant in Keeler and apparently have climatic conditions for success.

tions but nearer the processing plants and other markets.

The exceptional case of the vineyards around Keeler has already been mentioned.

Conversely, grapes can be grown successfully on unfavorable glacial features in districts characterized by a combination of climatic, pedologic, and economic advantages. Much of the vineyard acreage of western Berrien County exemplifies this point. Throughout the entire Southwest Michigan Vineyard Region, a grape locale found on an unsuitable glacial feature will, in addition to having satisfactory climate, nearly always be underlain by a favorable soil. On the other hand, vineyards on less suitable soils are usually set on a favorable glacial feature where slope is sufficient to provide adequate air drainage (Figs. 9 and 12).

The location of vineyards in Berrien County on sites having a varied combination of topographic and soil characteristics indicates that the climatic factor ("lake influence") is the one of primary importance there. In Van Buren County, where the "lake influence" is less, there must be much stricter adherence to sites having a suitable union of topographic and soil conditions. Although the practice of planting vineyards on sloping topography is climatically advantageous, it may be detrimental if soil erosion is not checked. This problem, however, will be discussed in the next chapter.

Soils

Given a suitable climate, either because of location near Lake Michigan or on the slopes of moraines and other surface features, the most important physical feature influencing the distribution of vineyards is the type of soil used. Although productive vineyards are possible on all but the extremely light or extremely heavy soils, competition limits the vineyards for the most part to those soils producing the best combination of high yield and quality of product. It is not fertility, as much as sufficient drainage which is the most important factor in determining the adaptability of a soil for grape culture.

The best soils usually are sandy loams or loamy sands with sandy or gravelly substrata (Fig. 11, Table 3).¹ These soils are characterized by an open structure that permits easy root penetration, adequate subsurface drainage, and movement of soluble elements of fertility to the roots of the plant. Unfortunately, vines grown on the sandier soils are usually poorer in vigor and lower in fruit yield than are those located on soils with more clay. Grape growers prefer the lighter soils, however, as long as they are not pure sands, because they are the most profitable to use (Table 3)

¹N.H. Loomis, "Growing American Bunch Grapes", U.S. Dept. of Agr., Farmers' Bul. No. 2123 (Washington, D.C.: Government Printing Office, 1959), p. 6.



Fig. 11.--Vineyard on coarse, loamy sand soil; good example of one-stem, four-cane Kniffen system of training vines, four miles north of Paw Paw, on M-40 (Aug. 28, 1959).

and because the vines grown here yield berries that mature earlier than do those on heavier soils and are not so liable to be killed by an early autumn frost. "When grape prices are moderately high, vineyards may be profitable on the very lightest sand soils that would support few other crops."¹ As a consequence, the viticulturist does not have to compete for land with very many other farmers.

The principal grapevine supporting soils in the Southwest Michigan Vineyard Region are Plainfield, Coloma, Fox, and Bellefontaine in order of descending importance (Fig. 12). Approximately 83 per cent of the vineyards in the Paw Paw-Lawton area, and 67 per cent of those in the St. Joseph-Benton Harbor area are planted on these four soils.

Each of the four possesses qualities conducive to successful viticulture. All ensure good underdrainage due to porous substrata of sand, loamy sand, and/or gravel. In addition, all are located for the most part in topographical positions which afford satisfactory air and water drainage that grapes need. Plainfield sand, Plainfield sandy loam, and Fox sandy loam are associated with outwash plains, where the gentle overall slope is usually enough to provide adequate air drainage. Coloma loamy sand, Coloma sandy loam, and Bellefontaine sandy loam are associated with glacial moraine areas, where few air drainage problems exist due to the hilly nature of

¹Partridge, "The Young Vineyard", op. cit., p. 7.

the topography.

In the St. Joseph-Benton Harbor area, approximately 2,903 acres, or 27 per cent of the vineyards, are planted on Plainfield sand; 2,263 acres, or 21 per cent on Coloma loamy sand; 1,049 acres, or 10 per cent on Bellefontaine sandy loam; 941 acres, or 9 per cent on Fox sandy loam; and 3,564 acres, or 33 per cent on other soil types (Appendix Table 8).¹

In the Paw Paw-Lawton area, some 2,997 acres, or 29 per cent of the vineyards are on Plainfield sand; 3,411 acres, or 34 per cent on Coloma loamy sand, or sandy loam; 1,423 acres, or 14 per cent on Fox sandy loam; 1,095 acres, or 11 per cent on Bellefontaine sandy loam; and only 1,268 acres, or 12 per cent on other soil types.

A little over 23 per cent of the grapes in the Region are grown on soils other than the main four. Some of these are heavy, compact soils, or clays, that promote heavy crop ton-nages, but also cause intense vine growth and delayed berry ripening, thus increasing danger of frost damage before harvest. Although a large harvest is desirable, the weight of the grapes may break the vine. Heavy vegetation growth complicates picking, and hinders the sun from reaching the grapes, consequently helping to delay the date of maturation. Con-

¹Appendix Table 8 was constructed by first determining the acreage and distribution of vineyards from aerial photographs, scale 1:7,920. This information was then carefully compared with detailed soils maps to determine the acreage of vineyards on each of the four major soils.

pared with the Paw Paw-Lawton area, the percentage of vineyards on other soils in the St. Joseph-Benton Harbor area is high. This is largely because a) there is more total acreage of other soils compared to the four main ones than in the Paw Paw-Lawton area, b) the "lake influence" is strong enough to compensate for less advantageous soil conditions, and c) the vineyard locations may be near enough to a market to risk planting on less favorable soils.

CHAPTER III

GRAPE PRODUCTION

Varieties Produced

Approximately ninety per cent of the plantings in the Southwest Michigan Vineyard Region are of the Concord grape. This is a blue-black variety which is vigorous, productive, and has compact bunches of large round berries. The fruit has an attractive appearance, the quality is good, and it has a certainty of maturity. The berries yield a relatively large amount of juice of maroon-red color and medium acidity, which is most largely used for unfermented grape juice.

Delaware and Niagara plantings, in approximately equal quantities, constitute the only other important grape varieties grown for commercial purposes in southwest Michigan. Both are fairly vigorous, but less hardy than the Concord. The Delaware type yields compact, medium-sized bunches containing small, round reddish berries which are sweet and of excellent quality -- ideal for eating, juice, and wine. The Niagara variety, a "white" Concord grape, is used primarily for fresh consumption and champagne manufacture. The bunches are large and fairly compact with big, amber-colored berries.¹

¹Information concerning grape characteristics obtained from Loomis, op. cit., pp. 4-5.

A variety having less importance in the Region is the Catawba, which produces fruit of high sugar content and thus is used for making wine. Some Champions, Moores, and Wordens are also grown because they all mature earlier than the Concord, but they are poor shippers, and do not adapt to a variety of uses.

Production Costs

Basic grape production costs can be said to involve the following: a) overhead costs -- primarily divided between permanent investment, insurance and taxes, upkeep of the trellises, and vine replacements; b) operating costs -- pruning, tying, spraying, and cultivation; and c) harvesting costs -- containers, transportation, and actual labor.¹

These basic costs, as well as the size of the harvest, vary with the site characteristics of the vineyard, especially the soil being used. Data in Table 3 indicate the influence of soils on average grape production costs in southwest Michigan during the years 1927 to 1929. Costs of maintenance today are higher, but the comparison of costs on different soil types is essentially the same. The average cost of growing a crop per ton is lowest and profit per acre is highest on loamy sands. This is true even though production in tons per

¹Newton L. Partridge, "Grape Production in Michigan", Agr. Expt. Sta., Mich. Sta. Quart., Bul. 2, No. 3 (Mich. Agr. Co., East Lansing, Mich., Feb. 1923), p. 20.

acre tends to be larger on heavier soils. The cost of growing a crop per acre increases as one moves from sands to sandy loams, to loamy sands, to silt loams and loams, in that order (Table 3).

TABLE 3*
THE INFLUENCE OF SOILS ON THE
COST OF PRODUCTION OF GRAPES
1927 - 1929

	Prod'n. in tons per acre	Cost of growing crop per acre ^a	Cost of growing crop per ton ^a	Profit per acre
Sands	1.6	\$24.59	\$19.56	\$ 2.63
Loamy sands	2.4	29.80	10.43	23.59
Sandy loams	2.2	27.79	13.95	11.02
Silt loams and loams	3.0	33.46	16.10	7.50

^aOverhead charges omitted.

*Newton L. Partridge, "Grape Production Costs and Returns in Southwestern Michigan", Agr. Expt. Sta. Spec. Bul. No. 242 (Mich. State Col., Hort. Sec., East Lansing, Mich., Sept. 1933), p. 11.

Yield per acre, an important factor in the cost of production per ton and therefore the amount of profit, is influenced by such things as number of plants per acre, number of cultivations per season, amount of spraying and fertilization, topography, soil type, weather, and variety and age of vineyard. Costs per acre, yields, and net returns tend to vary directly with the amount of labor expended on the vineyard. A close, direct correlation between total expense per acre and the amount of fruit harvested exists because pre-

harvest costs are much the same regardless of yield and harvesting costs fluctuate with the size of the crop.

Moreover, except for pruning and tying the vines, the labor inputs are larger in the harvest than in any other single vineyard activity. A study made in 1957 showed approximately forty-four man hours per acre expended for pre-harvest preparation in vineyards of the Region as compared to sixteen per acre for harvest activities.¹ About three times as much pre-harvest labor, or 33 man hours, was spent in pruning and tying the vines, as was devoted to spraying, cultivation, and other tasks combined. These required six, three, and two labor inputs, respectively. Costs of material inputs in the form of fertilizer, lime, and mulch ranged from \$5.00 to \$39.00 per acre, averaging \$31.00 per acre, and for spray materials from \$7.00 to \$13.00, averaging \$11.00 per acre.²

Vineyard Preparation and Care

Although the costs of producing grapes vary from year to year and from vineyard to vineyard, the basic operation of establishing a new vineyard is much the same regardless of place. A prospective viticulturist procures bound bunches of

¹R.G. Wheeler and E.F. Lord, "The Southwestern Michigan Fruit and Vegetable Farm Business, 1957; Crop Costs and Returns", reprinted from Quart. Bul. Vol. 41, No. 1, Agr. Expt. Sta. (Mich. State Univ., East Lansing, Mich., 1958, pp. 204-218), p. 205.

²Ibid., p. 212.

year old, rooted grapevine cuttings, usually from eight to ten inches long, at an approximate cost of twelve cents each.¹ He usually purchases the cuttings either directly from a friend who owns a vineyard, or from one of the nurseries located in southwest Michigan. Among the better-known Region nurseries that sell vine cuttings are Krieger's Wholesale Nursery and Ackerman's Nursery in Bridgman, and the Enlong Nurseries in Stevensville.

Although southwest Michigan vineyards range from less than one acre to 250 acres in size, the average is about ten acres, and includes 4,000 to 5,000 vines, roughly 1,200 trellis posts, and nearly 29 miles of trellis wire. Obviously, the posts and wire comprise a large percentage of the vineyard setting costs.²

The grape grower follows standard techniques to "set", or lay out, his vineyard. After stringing the wire along the posts to make trellises, he plants the vines at prescribed

¹Vine cutting prices increase proportionately with age due to the additional care and money expended upon them. If only a few cuttings are purchased, the cost may be as high as 50 cents each. Interview with Dr. Harry K. Bell, Aug. 21, 1961.

²Many southwest Michigan grape growers use discarded creosoted railroad ties at evenly measured distances within the rows and for supporting posts at their ends. A.N. Fournier maintains that among Catalpa, Sassafras, and Locust tree trunks, the last produces the best wood for supporting posts. Because of destructive forces such as alternate wet and dry spells and lignivorous insects, the posts tend to decay at the point where they protrude from the soil, and it is here that the posts break during wind storms or under the weight of heavy crops. Interview with A.N. Fournier, Oct. 3, 1959.

distances from each other. While the vines are developing, the farmer applies fertilizer and sometimes soil erosion controls, cultivates between the plants, trains and prunes the vines, and sprays to check disease and insect scourges. The vines begin to bear in about five years.¹

Soil Maintenance

Although the four main soils used for vineyards in southwest Michigan naturally support good grape yields, application of commercial fertilizers can considerably increase the crops if wisely used.² Southwest Michigan viticulturists most commonly apply 12-6-24³ fertilizer on their vineyards.

An example of the benefit of proper fertilizer use is provided in the Lawton-Mattawan area. Grapes here are generally grown on sandy loam soils, where the subsoil may be

¹The overall age of an older vineyard is difficult to determine because as some plants die or become too old, crooked, or diseased to produce a profitable yield, they are replaced. Also, by training a sucker -- or "layering" -- a new cane from an old plant may be started. Hence, from one original vine, many progeny may be obtained. "Layering" is the practice of doubling a long cane near the end of the previous year's fruiting cane from an adjacent vigorous vine and burying one or two of the buds four or five inches under the ground. R.P. Larsen, H.K. Bell, Jerry Mandigo, "Pruning Grapes in Michigan", Coop. Ext. Bul. 347 (Mich. State Univ., East Lansing, Mich., Dec. 1957), pp. 13-14.

²Newton L. Partridge, "Commercial Fertilizers for Grapes", Quart. Bul. Vol. 7, No. 3, Agr. Expt. Sta. (Mich. Agr. Col., Hort. Sec., East Lansing, Mich., Feb. 1925), pp. 98-100), pp. 98-99.

³volume ratio of nitrogen-phosphoric acid-potash.

from 50 to 60 inches below the surface. Formerly, when a predominantly nitrogenous fertilizer was used, yields averaged ^{less} a ton or ~~more~~ per acre than today. They now average from five to six tons of grapes per acre as a result of using fertilizer with a higher proportion of potash and phosphate.¹ Although both foliage growth and fruit production increase proportionately to the amount of nitrogen applied, the increase is greatest in the case of the foliage.² Excessive leaf and vine growth are undesirable because they hinder the sun from reaching the fruit and increasing its sugar content, and it complicates picking.

South of the Lawton-Mattawan district, the vineyards were planted later than those farther north. They are located for the most part on slightly heavier soils which retain moisture better because the subsoil is nearer to the surface.³

¹In 1954, an annual grant of \$3,500.00 was given to the Horticulture Department of Michigan State University in order that specialists might conduct vineyard research in southwest Michigan. In the first year, Drs. A.L. Kenworthy and Harry K. Bell discovered that by augmenting the amount of potash in the fertilizer, they could increase the grape production by one ton per acre. "The Grape Situation and Objectives of the National Grape Growers' Cooperative Association", by Merle R. Stemm, Director, National Grape Co-operative Association, Inc., in Eighty-Seventh Ann. Rept. of the Secy of the State Hort. Soc. of Mich., 1957 (Lansing, Mich.: Speaker-Hines and Thomas, Inc., State Printers, 1957), p. 121.

²Newton L. Partridge and J.C. Veatch, "Fertilizers and Soils in Relation to Concord Grapes in Southwestern Michigan", Agr. Expt. Sta. Tech. Bul. No. 114 (Mich. State Coll., Secs. of Hort. and Soils, East Lansing, Mich., June 1931), pp. 28-30.

³Interview with David Madison, Van Buren County Soils Conservations Service Agent, Aug. 26, 1959.

In addition, the grape growers have applied a great deal of fertilizer to the soil. Yields in this locality range from six to eight tons per acre. The larger production here is not the result of better fertilizer practices than are used in the vineyards farther north, but because of the difference in the soil. Such heavy crops, however, are not necessarily desirable for reasons previously stated. It can be concluded that, "in grape culture, applications of commercial fertilizers can in only rather small measure compensate for soil deficiencies."¹

Since the vineyards in southwest Michigan are usually planted on sloping terrain, gully and sheet erosion are likely to result. The first, occurring on steep hillsides and wreaking more rapid destruction, is more readily evident; but sheet erosion is often, in the long run, more serious because the deleterious effects are seldom noticed until conditions become critical over a large area. Water erosion occurs primarily on the heavier soil types, whereas lighter, sandier soils are more susceptible to wind erosion.² In order to prevent water and wind erosion, root exposure and damage, and consequent decreases in the vigor and fruitfulness of the vines, ~~vit~~ viticulturists may employ one or more methods to control erosion. These include inter-row planting of winter cover crops,

¹Partridge and Veatch, op. cit., p. 23.

²Partridge, "The Young Vineyard", op. cit., pp. 7-9.

planting along contours or on terraces, and formation of mulches.

For the prevention of erosion it would be desirable to have a permanent cover such as grass in the vineyard, but "vineyards must be cultivated if they are to produce sufficient quantities of fruit to be profitable."¹ Consequently, the conventional practice in many Michigan vineyards is to maintain a bare, loose soil surface during the growing season and use a cover crop the rest of the year. Where conditions are conducive to severe erosion, however, the growth of winter cover crops is inadequate to prevent loss of soil and eventual depletion of its organic content.²

Terracing is not much used in southwest Michigan vineyards. For one reason, the sandy soils in many of the vineyards are not heavy enough to anchor the trellis posts when the vines are heavily laden with fruit if the rows are planted across the slopes. For another, the more traditional type of terrace is expensive to build, while the more modern type requires vegetation cover to hold it in place. Vineyards with a permanent cover either in the rows or between them are usu-

¹ Newton L. Partridge, "Cultural Methods in the Bearing Vineyard", Agr. Expt. Sta. Circ. Bul. 130 (rev.) (Mich. State Col., Hort. Sec., East Lansing, Mich., Oct. 1937), p. 16.

² Ibid., p. 16, and H.K. Fleming, R.B. Alderfer, and D.E.H. Frear, "Effect of Fertilization and Cultural Treatments on Growth and Yield of Concord Grapevines", Agr. Expt. Sta. Bul. 523 (State Col., Pa., Mar. 1950), p. 23.

ally not very productive, as was mentioned previously.

Use of some type of mulching is becoming increasingly common and widespread in Michigan vineyards. Trashy cultivation, brush cropping, and hay mulching are all used. Trashy cultivation, a relatively new method for erosion control, involves chopping and only partially disking under the cover crop in order to create a mulch.¹

In brush cropping, the viticulturist leaves autumn vine prunings in and between the grapevine rows.² Eventually, he chops these into smaller pieces with a tractor-towed machine and leaves them to decompose in the vineyard. Brush cropping not only adds humus to restore the soil, but helps prevent erosion and frost damage to the vines.³ At the same time this technique is cheaper than maintaining a cover crop.⁴

Hay mulching, the third type, has been proven effective

¹"Partially removing or decreasing the competition of a growing cover crop by trashy cultivation would more nearly meet the requirements of a good vineyard management practice, which involves obtaining maximum yields, at the same time maintaining the greatest possible protection against soil and water losses through runoff and erosion, and also increasing the organic matter content and available water holding capacity of the soil." Fleming, Alderfer, and Frear, op. cit., p. 23.

²William D. Mulcay, "Enrich Your Vineyard Soil with Grape Prunings", American Fruit Grower, Vol. 73, No. 12 (Willoughby, Ohio: American Fruit Grower Publishing Company, Dec. 1953), p. 17.

³The layer is not high enough to create still air near the bottom of the rows as is sometimes the case with an unmown cover crop.

⁴Interview with Frank Kotyuk, Sept. 9, 1959.

by a successful experiment conducted by two Paw Paw viticulturists. After applying pure hay between the grapevine rows in their vineyard, they concluded that the soil was benefitted by increased organic matter, better nutrient availability, and increased water retentive capacity, in addition to lessening erosion. They also reported that hay produces nearly all the essential mineral nutrients, thus reducing the need for commercial fertilizers.¹

Seasonal Round of Other Activities

Pruning and Training.--Pruning of the vines is the first of the seasonal activities, and usually is done in late winter or spring after the extent of winter injury to the bearing wood is evident. The way in which a vineyard is pruned often has a greater effect on grape production than any other factor. Vines usually thrive and produce best when they are heavily pruned, except in years when frost damage is serious, in which case lighter trimmed vines tend to yield better.² The main purpose in pruning is to regulate the size of the crop by controlling the amount of bearing wood.

The vigor of the vine growth during the preceding year determines the productive ability of the plant during the fol-

¹"Enterprising Pugsleys", American Fruit Grower, Vol. 78, No. 10, Oct. 1958, p. 15.

²Newton L. Partridge, "The Fruiting Habits and Pruning of the Concord Grape", Ann. Expt. Sta. Tech. Bul. No. 69 (Mich. State Col., Hort. Sec., East Lansing, Mich., Oct. 1925), p. 32.

lowing season. Pruning is done not only to train the vine but to remove surplus wood to prevent overbearing. Overbearing one year lessens the crop the following one and weakens the vine, because the larger the crop produced the smaller the amount of shoot growth is that season. In short, "a vine that is overbearing will not mature fruit and canes so early or so well as it would if it were carrying a smaller crop."¹ Optimum crop and cane growth can be obtained by "balanced" pruning, a practice suggested by N.L. Partridge as early as 1929, and today widely used in southwest Michigan.² Yields are reported to increase up to two tons per acre when growers switch from "unbalanced" to "balanced" pruning.

In contrast to the head system of separate plants as practised in California and Arizona, practically all grapevines elsewhere in the United States are trained along trellises. Most southwest Michigan grape growers employ either the one-stem, four-arm Kniffen training system (Fig. 11), or the six-arm Kniffen system if the plants are especially vigorous.³ In recent years, use of the Umbrella Kniffen

¹Newton L. Partridge, "Profitable Pruning of the Concord Grape", Agr. Expt. Sta. Spec. Bul. 141 (rev.) (Mich. State Col., Hort. Sec., East Lansing, Mich., Nov. 1937), p. 4.

²For technical discussion of "balanced" pruning, see Larsen, Bell, and Mandigo, op. cit., p. 9.

³Ibid., pp. 9-15.

method has been gradually increasing.¹ Tying the vine to the trellis wires, usually with twine, although other materials are used by some growers, is done during the pruning and training operations. As previously indicated, pruning, training, and tying of the grapes requires upwards of three quarters of the total labor inputs per acre of a vineyard. Because of the labor time involved, many growers with large acreages must start pruning in late autumn or early winter and run the chance of cold damage to next year's fruiting wood.

Cultivation.--After pruning is finished the next activity in the vineyard is the first cultivation which should be accomplished a week or two before the vines bloom. Following the initial ploughing, which throws soil away from the vines, they are cultivated anywhere from four to ten times during the season with a disc, spring tooth harrow, or other equipment, usually pulled by a tractor.² Both the initial ploughing and subsequent cultivations are shallow, not more than three inches deep, to avoid root injury. More frequent tilling is needed during dry weather and in weak vineyards, especially where weed growth is heavy. Cultivation controls weeds and maintains a mulch which preserves soil moisture, thereby accelerating vine growth. The early ploughing aids in combating black rot and grape-berry moth

¹ Interview with Jerry Mandigo, Sept. 17, 1959.

² Interview with Dr. Harry K. Bell, June 22, 1961.

as well.

In general, cultivation is discontinued when further vine growth is not wanted (usually around late July or early August), because of its competition for soil nutrients with the maturing berries. If the grape crop is small, however, and excessive autumn vine growth appears likely, cultivation is usually stopped earlier. This tends to retard autumn vine growth and to promote more fruitful vines the following year. Conversely, cultivation may be continued throughout August if the crop is heavy and vine growth has nearly ceased by late July.¹ Concurrent with the last cultivation, often a ploughing throwing soil to the vines, a cover crop is usually sown.

Grape Diseases and Insect Control.--Interspersed with the cultivations of the vineyard are activities designed to control damage by insects and grape diseases. Although most of the disease and insect pests attacking vineyards elsewhere in eastern United States are present in southwest Michigan vineyards, the chief grape disease is black rot and the principal insect threats are the grape flea beetle,² the rose chafer,³ the grape-berry moth,⁴ and the grape leaf hopper.⁵

¹Partridge, "Cultural Methods in the Bearing Vineyard", op. cit., pp. 12-13.

²Altica chalybea Illiger.

³Macrodactylus subspinosus Fab.

⁴Polychrosis viteana.

⁵Typhlocyba, or Erythroneura, comes Say.

Black rot, caused by a parasitic fungus, Guignardia bidwellii, is generally a problem with all grape varieties except Delaware.¹ The damage appears as red-brown, black-centered spots on the leaves and brown-red spots on the berries causing them to become shrivelled and mummified. Downy mildew, another fungus disease,² sometimes damages the leaves and affects the berries so that they "shell" or drop from the stems at the slightest touch, but is usually controlled by sprayings to protect the grapes against black rot and other plagues.

Among the insects the grape flea, or Stealy, beetle attacks the vines early in the season, eating out the buds as they are ready to open. The rose chafer infests the vineyards just as the blossoms appear, feeding first on the blossom buds, then on young fruit and still later on larger fruit and leaves.

The grape-berry moth is usually the insect pest causing the most destruction in Michigan vineyards. Two generations develop and sometimes a third during the growing season. Damage is done by the larvae which feed on buds and young fruit in the first generation and inside the grape berries

¹A. E. Mitchell, Alfred C. Dowdy, Edward J. Klos, and Robert H. Fulton, "1959 Fruit Spraying Calendar", Coop. Ext. Ser. Ext. Bul. No. 154 (Mich. State Univ., East Lansing, Mich., 1959), p. 43.

²Plasmopara viticola B. and C. Berl. and De Toni.

themselves in the second generation. Since the moth winters over in cocoons cut from the grape leaf which drop to the ground where they are protected by any vineyard trash and cover crops that may be present, cleaning and ploughing of the vineyard early in the spring is a desirable control method.

The grape leafhopper, a small, active, sucking insect, works on the underside of the leaves causing them to develop slowly or to prematurely die and drop off. This in turn slows development and maturity of the berry causing it to be lacking in sugar and often in size and flavor.¹

Grape diseases and insects thrive best in neglected vineyards. For some years previous to 1940, many Michigan grape growers, especially those with vineyards that were poorly located, old, or otherwise marginal in character, allowed them to deteriorate or abandoned them, because the low prices then being received for grapes made the vineyards unprofitable. In 1940, horticultural inspection teams examined many of these neglected vineyards and found that most of them were infested with pests that were migrating to nearby vineyards under active cultivation and were rendering comparatively ineffective the insect and disease control measures used there. As a consequence, from 1940 to 1953 in-

¹ R.H. Pettit, "The Principal Grape Insects of Michigan", Agr. Expt. Sta. Spec. Bul. No. 239 (Mich. State Col., East Lansing, Mich., July 1933), pp. 3-5, 7-8, 11, 14-15.

clusive, a Berry Moth Eradication Project was conducted in the southwest Michigan counties of Allegan, Berrien, Cass, Kalamazoo, St. Joseph, and Van Buren, with the result that 1,065 berry moth-infested vineyards, totaling some 7,323 acres of vines, were torn out (Table 4).

TABLE 4*

COUNTY TOTALS OF GRAPE BERRY MOTH
ERADICATION PROJECT
1940 - 1953

Allegan	.	.	.	.	.	2	.	.	.	.	.	4.00
Berrien	.	.	.	.	.	223	.	.	.	.	.	775.25
Cass	.	.	.	.	.	46	.	.	.	.	.	323.00
Kalamazoo	.	.	.	.	.	79	.	.	.	.	.	830.25
St. Joseph	.	.	.	.	.	2	.	.	.	.	.	40.00
Van Buren	.	.	.	.	.	713	.	.	.	.	.	5,350.25
Total	.	.	.	.	.	1,065	.	.	.	.	.	7,327.75

*C.A. Boyer and G.S. McIntyre, "Grape Berry Moth Eradication", Budwood Certification, Peach Orchard Inspection, Orchard Removal, Annual Report (Mich. Dept. of Agr., 1953), p. 7.

At least six sprayings a year are recommended by the Cooperative Extension Service of Michigan State University to control the insect and disease pests in Michigan vineyards. The same service issues a Spraying Calendar which is revised annually and is widely used by the growers. Typically, there is one spraying in May, two in June, one in July, and two in August. Although viticulturists formerly handsprayed their vines with hoses from a tank mounted on a horse-drawn wagon, they now spray automatically with apparatus towed behind a

tractor (Fig. 13). Several farmers, who own and control huge vineyard acreages in the Paw Paw-Lawton area, even air spray their crops by contracting with the Berrien County Aerocrop Service which is owned and managed by Frank Deaner, Benton Harbor, Michigan.¹

Usually in May the first covering of DDT is sprayed to prevent grape flea and climbing cutworm infestations prior to bud development. In June, when the shoots measure from four to eight inches long, the second spray covering of Ferbam² or Zineb³ is applied to control black rot. DDT, to combat grape berry moth, is included in this spray.

The third cover, applied just as the blossoms are opening in late June or early July, consists of either Ferbam, or Zineb, or mixed copper, or 4-4-100 Bordeaux⁴ -- any one of which combat black rot. Berry moth and rose chafer are

¹Letter from Jonathan S. Woodman, owner and operator of a large vineyard near Paw Paw, Mich., July 15, 1961.

²ferric dimethyldithiocarbamate.

³zinc ethylenedisithiocarbamate.

⁴Bordeaux is a tank-mix of copper sulfate (bluestone or blue vitriol), hydrated lime, and water. It is identified by a characteristic formula, an example of which is 4-6-100. The '4' means 4 lbs. of copper sulfate; the '6', 6 lbs. of hydrated lime; and the '100' means that the total volume of spray mixture is 100 gallons. Mitchell, Dowdy, Klos, and Fulton, op. cit., p. 10. Bordeaux mixture was perfected by Millardet in France in the late eighteenth century. L.H. Bailey, Sketch of the Evolution of our Native Fruits (New York: The Macmillan Company; London: Macmillan & Company, Ltd., 1898), p. 96.



Fig. 13.--Tractor-towed spraying apparatus of a type commonly used to apply pesticides in southwest Michigan vineyards (Taken from cover of J.B. Demaree and G.W. Still, "Control of Grape Diseases and Insects in Eastern United States", U.S. Dept. of Agr. Farmers' Bul. No. 1893, Washington, D.C., 1942 rev. 1951).

checked with a DDT additive.

The fourth cover, applied immediately after bloom in July, is considered the most critical for the control of black rot, powdery mildew, and downy mildew. To control black rot and insects, growers can use the same chemicals as were used in the third cover. However, if protection against downy or powdery mildew is needed, fixed copper or Bordeaux sprays must be used in place of Fertem or Zineb.

The same pesticides employed in the fourth spraying are used in the fifth and sixth. The fifth application is made ten to fourteen days after the fourth to check black rot, powdery and downy mildew, berry moth, leafhopper, and rose chafer. The sixth cover is applied in August just before the berries begin to touch in the clusters and controls the same pests as before. Although a "sticker" is used with the early sprays, to cause them to stay on the plants and fruit even in the rain, it is not used with sprays containing DDT or DDD within forty days of harvest, that is, after the berries have grown to the size of buck-shot.

A Special Spray Problem.--Vineyard growers have participated but little in the rapid expansion in recent years of use of weed control sprays. Some growers apply Diuron (trade name, Karmex) in spring in a band treatment to help eradicate vegetation between the vines in the rows. Another preparation, CIPC (trade name, Chloro IPC), is sometimes

used during the dormant period of the vine or in early spring before the weeds appear.¹ Most herbicides, however, particularly 2,4-D² and 2,4,5-T,³ harm or kill the vines as well as the weeds. As a consequence, there is a great deal of dispute between grape growers and field croppers who apply the damaging sprays to crops in fields adjacent to vineyards.⁴

On April 30, 1959, George S. McIntyre, Director of Agriculture for the State of Michigan, received petitions, supported by the National Grape Co-operative Association, Inc., from grape growers in various townships of Berrien, Cass, and Van Buren counties. In these petitions, the viticulturists requested the restriction or prohibition of use near their vineyards of the following herbicides: 2,4-D, 2,4,5-T, and MCP.⁵ Two hearings resulted.

¹S.K. Ries and R.F. Carlson, "Chemical Weed Control for Horticultural Crops", Coop. Ext. Ser. Ext. Folder F-241 (3rd rev., April 1961) (Mich. State Univ., East Lansing, Mich.), p. 12.

²2,4-dichlorolphenoxycetic acid.

³2,4,5-trichlorophenoxycetic acid.

⁴In 1959, three western Kalamazoo County viticulturists sued a neighboring corn grower for injury they believed was wrought upon their vineyards by his 2,4-D applications in early June. One received \$5,000.00 insurance, but the other two suits were still pending on Sept. 18, 1959. Interview with Jerry Mandigo, Sept. 18, 1959.

⁵2 methyl, 4 chlorophenoxycetic acid -- another detrimental herbicide.

Testimony submitted at these hearings -- one near Paw Paw, Van Buren County, June 11, 1959, and the other in Berrien Springs, Berrien County, June 12, 1959 -- indicated the following: a) that in the affected areas, commercial production of grapes constitutes a major source of agricultural income; b) that corn is also one of the economically important crops; c) that the use of 2,4-D noticeably decreases weed controlling costs in the cultivation of corn; d) that actual damage to the grapes was caused exclusively by the use of the volatile ester forms of the aforementioned chemicals; and e) that "the amine form of 2,4-D can be used with little damage to grape vineyards or grape crops when proper consideration is given to wind velocity and directions, and proper low pressure sprayers are used at the time of applications."¹

Consequently, on July 16, 1959, Mr. McIntyre decreed that "any and all persons shall cease and desist from the use of the volatile ester forms of 2,4-D, and 2,4,5-T within the above described area⁽²⁾ during the period of

¹Order of the Director of Agriculture, State of Michigan, Dept. of Agriculture, July 16, 1959. (mimeographed). For information concerning use of weed-control chemicals in field crops, see Boyd Churchill and Buford Grigsby, "Weed Control in Field Crops", Coop. Ext. Ser. Ext. Folder F-22 (rev. April 1959) (Mich. State Univ., East Lansing, Mich.)

²One region correlated with the St. Joseph-Benton Harbor vineyard area and comprised all of the land contained in Hagar, Benton, Bainbridge, Coloma, Watervliet, Sodus, Pipestone, Berrien, Oronoko, Roselton, St. Joseph, Lincoln,

July 23 to October 1, 1952."¹ This promulgation was made annually renewable upon receipt of petitions from the vineyardists in the affected areas.

Cover Crops.--Cover crops are commonly sown after the last cultivation of the vineyard in late summer, but before grapes are harvested. Rye, oats, and barley are the most commonly used in Michigan vineyards. Some vineyardists allow grass and weeds to grow between the vine rows and thus act as a cover crop (Fig. 14).

One of the functions of a cover crop is the checking of late season growth of vines, thus causing them to mature their wood so that they have more resistance to winter cold. Another important function is green manuring or the maintaining of the humus content of the soil. A third function is the improvement of soil texture and its moisture-holding qualities, while a fourth function is the prevention and slowing of soil erosion.

Leke, Baroda, Chikaming townships in Berrien County and all sections of any importance in viticulture in Weesaw, Buchanan, and Niles townships of the same county, Pokagon and Silver Creek townships in Cass County, and Hartford and Covert townships in Van Buren County. The other affected region correlated with the Paw Paw-Lawton area: including all of Antwerp, Paw Paw, and Porter townships, and all sections of viticultural importance in Waverly, Lawrence, Decatur, Almena, and Hamilton townships in Van Buren County and all of Texas Township, and all sections of viticultural importance in Oshtemo Township in Kalamazoo County.

¹Order of the Director of Agriculture, op. cit.



Fig. 14.--Grass and weed cover crop to check vine growth. The planting of fruit trees between vine rows, as shown in this view, usually means that the grapes are to be pulled out eventually (Three miles west of Paw Paw along US-12, looking south, Sept. 10, 1959).

Rye is probably the most-used cover crop in southwest Michigan vineyards. Since it does not winter kill, however, it competes with the vines for nutrients in the spring, particularly if the first cultivation of the vineyard is delayed. Winter barley, which also does not winter kill, is cheaper per bushel than rye, but more must be planted per unit area, with the result that the costs of using the two grains for cover cropping differ very little.¹ For a cover crop that does not compete with vines in the spring, some growers prefer oats which winter kill, but nevertheless accomplish the beneficial results listed above.² A few grape growers use wheat for this purpose, but this practice is discouraged because the wheat harbors the Hessian Fly. This pest is a constant menace to wheat fields. Wheat farmers spray their fields against the fly, but viticulturists ignore it thus providing breeding places in their vineyards in case wheat is used for a cover crop. This is another example of differing interests between viticulturists and surrounding field crop farmers.

Harvesting.--The harvest, the last of the seasonal round of activities, is a busy, festive time, extending from late August or early September until early October. Once

¹ Interview with Jerry Mandigo, Sept. 11, 1959.

² Interview with Harry Martin, Van Buren County Agricultural Stabilization and Conservation Fieldman, Aug. 24, 1959.

the crop has matured, it must be removed from the vines with maximum rapidity before an early frost renders the berries unmarketable. At harvest time, the grape farmer buys containers (unless supplied them by a processing establishment), hires pickers, and transports the crop to market.

Most of the southwest Michigan vineyards are owned and operated by families, and only a few are so large as to need extra help other than at harvest time. During this crucial period, however, practically everyone in the locality works in the vineyards and sometimes pickers from outside the area are hired. During the long steel strike in the summer and autumn of 1959, for example, many unemployed steelworkers and their families traveled from northern Illinois and Indiana to the southwest Michigan fruit and vegetable region to find employment harvesting the various crops, among which were grapes. Itinerant laborers from the South and Mexico, however, have little part in the grape harvest, although they work in other crops in the area during the summer. This is because most of them return home before the grape harvest in order to send their children to school.¹

The pickers work from about eight in the morning until six in the evening (Fig. 15). Grapes to be marketed fresh are handled as little as possible and are sent to market immediately after harvesting. Formerly, pickers would

¹ Interview with Dr. Harry K. Bell, June 22, 1961.



Fig. 15.--Woman "fancy packing" Concord grapes into 2-qt. (approximately 3 lbs.) baskets, eight of which will be fitted into the cardboard carton shown behind the picker (One and one half miles northwest of Paw Paw, Sept. 27, 1959).

pack the clusters directly into large baskets, which were then transported to packing houses where professional packers artistically arranged the bunches into attractive smaller containers. This practice, however, has been discontinued due to the increase in labor costs and in sale to processing plants which do not require "fancy packed" grapes.

Marketmen in the Southwest Michigan Vineyard Region formerly preferred 16-quart Climax baskets, each holding approximately nine pounds of fruit, for containers if the grapes were to be marketed as fresh fruit (Fig. 16). Today, 2-quart baskets, packed eight to a carton, are most used.¹ The pickers fill these right in the vineyard rather than in a packing house.

Less care is taken in picking and handling grapes destined for juice and wine processing plants, because an attractive appearance of the fruit is of little significance. These grapes are picked directly into the wooden beer lugs provided by the processing plant (Fig. 17).² In 1959, pickers were paid thirty cents per crate of eight baskets for "fancy pack" grapes and twenty cents per beer lug for wine and juice grapes.

¹ small 2-quart cardboard boxes weighing approximately 3 lbs. when filled, and fashioned with handles to enhance marketability. A crate contains eight 2-quart baskets (Fig. 15).

² heavy wooden boxes, approximately two feet long, one foot wide, and one foot deep, designed primarily to carry beer bottles, but with the dividers removed used as containers to transport grapes (Figs. 17 and 19).

A tractor and flat trailer (Fig. 18) are generally used to distribute the empty containers between the rows of vines and to transport them out of the vineyard after they have been filled. Except for the transporting of the grapes to the fresh-fruit markets and the processing plants, which today is most commonly done by motor truck, this hauling of the grapes out of the vineyard can be considered the last act of a vineyardist's year.



Fig. 16.--6-qt. (approximately 9 lbs.) Climax baskets filled with grapes. In the smaller container, there is from left to right one bunch each of Niagaras, Delawares, and Fredonias (One mile east of Benton Harbor on US-12, Sept. 3, 1959).



Fig. 17.--Beer lugs of grapes at the Paw Paw Grape Juice Co. processing plant. Arriving by truck transportation, the lugs are carried into the plant on roller conveyors. In the background is a pile of "cheese", or grape pulp left after processing. This is returned to the vineyard ~~where~~ where it is used for fertilizer and erosion control (Paw Paw, Sept. 28, 1959).



Fig. 18.--Transporting cardboard containers of "fancy packed" grapes from the vineyard on a tractor-towed trailer (One and one half miles northwest of Paw Paw, Sept. 28, 1959).

CHAPTER IV

GRAPE MARKETING

Today, approximately eight times as many grapes produced in the Southwest Michigan Vineyard Region are sent to processing plants as are marketed as fresh fruit. This is considerably different from the conditions that formerly existed.

Historical Notes

Up until as recently as 1940, one half or more of the grapes were delivered to fresh fruit markets. It is true that some of these grapes found their way into homemade wine and juice, especially during the Prohibition years, but they were marketed as fresh fruit rather than being sent to commercial wineries, juice plants, or other grape product plants.

Another significant change connected with marketing of Michigan grapes is the method of transport used. At present, most of the crop is moved to the fresh fruit markets and processing plants by motor truck (Fig. 19). During much of the present century, however, rail shipments were by far the most important means of transportation. Rail shipments reached a peak in 1922 when 6,020 carlots of grapes were dispatched from stations in Michigan to city markets, es-



Fig. 19.--Grape growers' trucks waiting to unload at Paw Paw Grape Juice Co. processing plant, Paw Paw (Sept. 28, 1959).

pecially Chicago and Detroit. Subsequent to 1930, when 1,620 carlots were shipped, use of the railroads to move the Michigan crop declined rapidly. In no subsequent year has more than 1,000 carlots been shipped and in recent years the number has usually been much less than 100.

Although the railroad had been previously used in moving some grapes to market, its use expanded rapidly after about 1885 with the introduction of the refrigerator car (Fig. 20).¹ Before then, practically all grapes and other fresh fruits and vegetables grown commercially in the Southwest Michigan Vineyard Region were shipped by boat from Benton Harbor and St. Joseph.² "Farmers gathered at the wharves and either sold their produce directly to the ships' captains or consigned it to commission firms in Chicago..... Boat shipments from Benton Harbor and St. Joseph were still of some commercial importance until truck transporta-

¹ For example, in 1863, A.B. Jones of Lawton set out one hundred grapevines, mostly Concord and Delaware, the first fruit of which was shipped to Lansing where it sold for prices of 12 to 15 cents per pound. In a second shipment "the grapes were put up in three-pound baskets and crated, 12 baskets to the crate" whereupon they sold in the Lansing market for prices as high as \$9.00 per crate. Capt. C.W. Rowland, A History of Van Buren County, Michigan, Vol. 1 (Chicago and New York: The Lewis Publishing Company, 1912), p. 320.

² In 1870, of the 71,100 pounds of grapes that were shipped to Chicago and Milwaukee, 27,000 pounds left from St. Joseph; 13,000 from Grand Haven; 14,000 from South Haven; 5,000 from Muskegon; 2,000 from Menistee; 1,900 from Grand Traverse; 1,400 from White River; 600 from Northport; and 500 from Ludington. The Michigan Almanac, 1870. Compiled by Charles K. Beckus (Detroit, Mich.: The Advertiser & Tribune Company, 1870), p. 57.

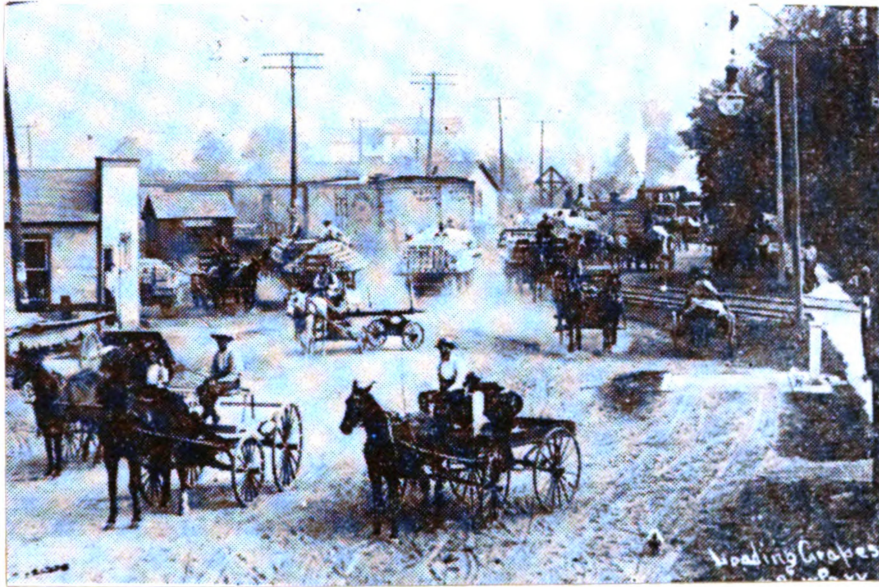


Fig. 20.--Loading grapes at the Paw Paw railroad station (circa 1900-1910). Picture from Paw Paw Centennial: Pictorial History Souvenir Program (Paw Paw, Mich.: Paw Paw Press, 1959), p. 44.

tation reached significant volume after the close of World War I."¹

After the rescinding of Prohibition in December 1933 returned wine making to bonded commercial wineries, and the wartime demand for grape juice, jam, and jelly to be used by the servicemen stimulated production of these products, there was a steady gain in the importance of processing plants as markets for Michigan grapes. In 1953, some 83 per cent of the harvest was processed into wine, juice, and other products, as contrasted with 53 per cent utilized in this way in 1941 and 34 per cent in 1940 (Appendix Table 11). Conversely the grapes used on the farm, and particularly those shipped to the fresh fruit markets, declined drastically during the past two decades. In 1953, only 400 tons, or less than 1 per cent, were kept on the farm and some 4,800 tons, or 11 per cent, were sent to retail markets. In 1940, in comparison, 1,900 tons, or 5 per cent of that year's crop, were used at home and 23,360 tons, nearly 61 per cent, were shipped to the fresh fruit markets (Appendix Table 11). In spite of this relative and absolute decline in shipment of Michigan grapes to the fruit markets, however, the state has been second only to California during most years since 1941 in the marketing of grapes for fresh fruit (Appendix Table 10).

¹G.N. Motts, "The Benton Harbor Fruit Market, 1931-1955", Coop. Ext. Ser. (Mich. State Univ., East Lansing, Mich., 1956), p. 1. (Mimeographed.)

Fresh Grape Markets

The largest part of the grapes marketed as fresh fruit come from the Benton Harbor-St. Joseph area and are sold ~~th~~ through the Benton Harbor Fruit Market. This market, predominantly wholesale, has long been an important factor in selling Michigan grapes, having been located at its present site since 1930. It is claimed that it is the "largest cash to growers outlet in the world". Established when it became increasingly apparent that motor trucks would become the dominant means of transportation in the marketing of Michigan fruits and vegetables, it is owned by the city of Benton Harbor. It is estimated that some 2,250 growers, including vineyardists, within a fifty-mile radius of the market sell all or part of their produce through this center. Some fifty million people within an area encompassing the states of Michigan, Ohio, Indiana, Illinois, and Wisconsin are the ultimate consumers of three quarters or more of the produce sold here,¹ but some of it reaches consumers at a much greater distance.

The relative and absolute decline in the amounts of Michigan grapes marketed as fresh fruit are reflected in the fact that in 1931 some 1,528 carlot equivalents of fresh grapes passed through the Benton Harbor Fruit Market, while in 1955 only 122 carlot equivalents were recorded.² Total equival-

¹"The Benton Harbor Fruit Market". Marketing Research Report No. 390. Transportation and Facilities Research Division. Agricultural Marketing Service. U.S. Dept. of Agriculture, 1960, pp. 5 and 9.

²Motts, "The Benton Harbor Fruit Market", op. cit., p. 5.

ents of all produce handled in 1931 was 7,162, and in 1955 it was 6,031.¹ As a consequence, while the function of the Benton Harbor Fruit Market in disposing of the Michigan grape harvest is still important, the grapes sold are a much smaller part of the total produce handled than in former years.

In an effort to counter the decline in fresh fruit sales, various measures have been taken by Michigan vineyardists. These include improvements in varieties, cultivation practices and materials, packages and packing techniques, and disease and insect control, all designed to present better quality grapes more attractively to the consumers. Also, as reported in 1955, the state of Michigan was spending an annual amount of some \$25,000.00 to advertise fresh grapes, and the Michigan Grape Growers' Association was providing a special package in which the grapes were shipped and displayed.² It is hoped that these benefits will increase the demand for fresh grapes both in stores and at roadside stands (Fig. 21). The latter have become a factor of increasing consequence in marketing grapes and grape products in recent years, but it is probable that their importance will not increase much more because travelers other than local will be using the new limited access highways along which no stands are permitted.

¹Ibid., p. 3.

²Gino Orsolini, "A History of the Development and Growth of the Grape Industry of the Paw Paw-Lorton Area of Southern Michigan from 1858 to 1955" (Papers from the History Seminar of Kalamazoo College, unpublished paper, 1955), p. 17.



Fig. 21.--A roadside fruit stand one half mile west of Paw Paw on US-12, selling fresh and processed products of orchards and vineyards (Sept. 18, 1959).

Although a larger investment is required for the production of grapes for the "fancy pack" market than for processing plants, the profits cleared from the sale of the former are usually greater. Most growers with large vineyards who might best be able to develop a quality grade brand and pack, however, do not care to go to the extra expense and trouble of producing it, in view of the relatively limited market and the gamble involved because of price fluctuation. Rather, they favor receiving adequate, more dependable prices per ton for grapes sold on contract in quantity to the processing plants.¹ Consequently, nearly 90 per cent of the grapes in southwest Michigan are sent to processing plants within the Region.

Processing Plants

Sixteen grape processing plants operated in southwest Michigan in 1957 (Fig. 3) and fifteen in 1958.² Listed by vineyard area, these were:

Paw Paw-Lawton Area

(Van Buren County)

~~A.F. Murch, Co.~~
A.F. Murch, Co.
Paw Paw, Mich.

Edward Higley
Mattawan, Mich.

Frontenac Winery
Paw Paw, Mich.

Michigan Wineries, Inc.
Lawton, Mich.

Paw Paw Grape Juice Co.
Paw Paw, Mich.

Paw Paw Wine Co.^a
Paw Paw, Mich.

St. Julian Winery
Paw Paw, Mich.

The Welch Grape Juice Co.
Lawton, Mich.

¹Article in American Fruit Grower, Vol. 76, No. 1, Jan. 1956, p. 20.

²Unpublished material obtained from G.A. Swanson, Agricultural Statistician, Michigan Crop and Livestock Reporting Service, Nov. 11, 1959. For plant locations, refer to Fig. 3.

St. Joseph-Benton Harbor Area
(Berrien County)

House of David Preserve Dept. ^b St. Joseph, Mich.	Bronte Wine & Champagne Keeler, Mich. Co.
Pearl Grange Fruit Exchange, Inc. R. 1 Napier & Hillendale Benton Harbor, Mich.	Soloma Cooperative ^c Soloma, Mich.
Silver Hill Frozen Foods, Inc. ^c Eau Claire, Mich.	Molly Pitcher Winery Harbert, Mich.
Spinks Corners Fruit Exchange R.F.D., Benton Harbor, Mich.	Sodus Fruit Exchange Sodus, Mich.

^a Antonio Misuraca, the owner of Paw Paw Wine Co., was adjudged bankrupt by the federal court bankruptcy referee in Dec. 1960. Hence, the company no longer operates.

^b Active up to, and including, 1957.

^c Active up to, and including, 1957.

.....

Practically all grapes produced in the Paw Paw-Lawton area are trucked to one of the nearby processors. The three largest processing firms in the whole Southwest Michigan Vineyard Region are in the area, namely the Welch Grape Juice Company in Lawton, and the Paw Paw Grape Juice Co. and the A.F. Murch Co., both in Paw Paw. These companies receive most of the grapes grown in the vicinity and make unfermented grape products.

The local plant of the Welch Grape Juice Co., whose headquarters are in Westfield, New York,¹ manufactures the great-

¹ On Sept. 1, 1956, ownership of all plants of the Welch Grape Juice Company was officially transferred from the private owner to members of the National Grape Co-operative Association, Inc., but they still operate under the Welch name. News of Farmer Coops, Special Institute Issue, Oct. 1956, p. 3.

est amount and variety of products. Contracted vineyards supplying grapes to this plant are located not only in the Fawcett-Lawton area, but are scattered throughout the Southwest Michigan Vineyard Region (Fig. 22). The present plant at Lawton (Fig. 23), represents an investment of over three million dollars. Welch purchased this plant in 1919 from the Wilson Company who formerly operated it, and have based their Michigan branch here ever since.¹ The processing facilities include unloading equipment, destemmers, juice presses, twenty-eight juice storage tanks of 147,000 gallons capacity each which are located in refrigerated rooms, cook rooms, high-speed bottling lines, and warehousing areas. In a different section of the factory there is also equipment for making grape jellies and products other than juice. In 1957, from the juice stored in the tanks of over four million gallons total capacity, some 1,125,000 cases of Welch products such as Grape Juice, Frozen Grape Juice Concentrate, Grape Jelly, Grapeclade, Fruit-of-the-Vine, and Welchade were manufactured. Between 150 and 175 men are employed on a year round basis. This number increases to between 300 and 350 during the harvest season. The payroll in 1957 totalled \$520,000.²

The Welch Co. also has a plant four miles northeast of the

¹The Lawton Story: Centennial Edition, 1852-1952 (Lawton, Mich.: The Lawton Leader, 1952), p. 17.

²Ibid., pp. 14-17.

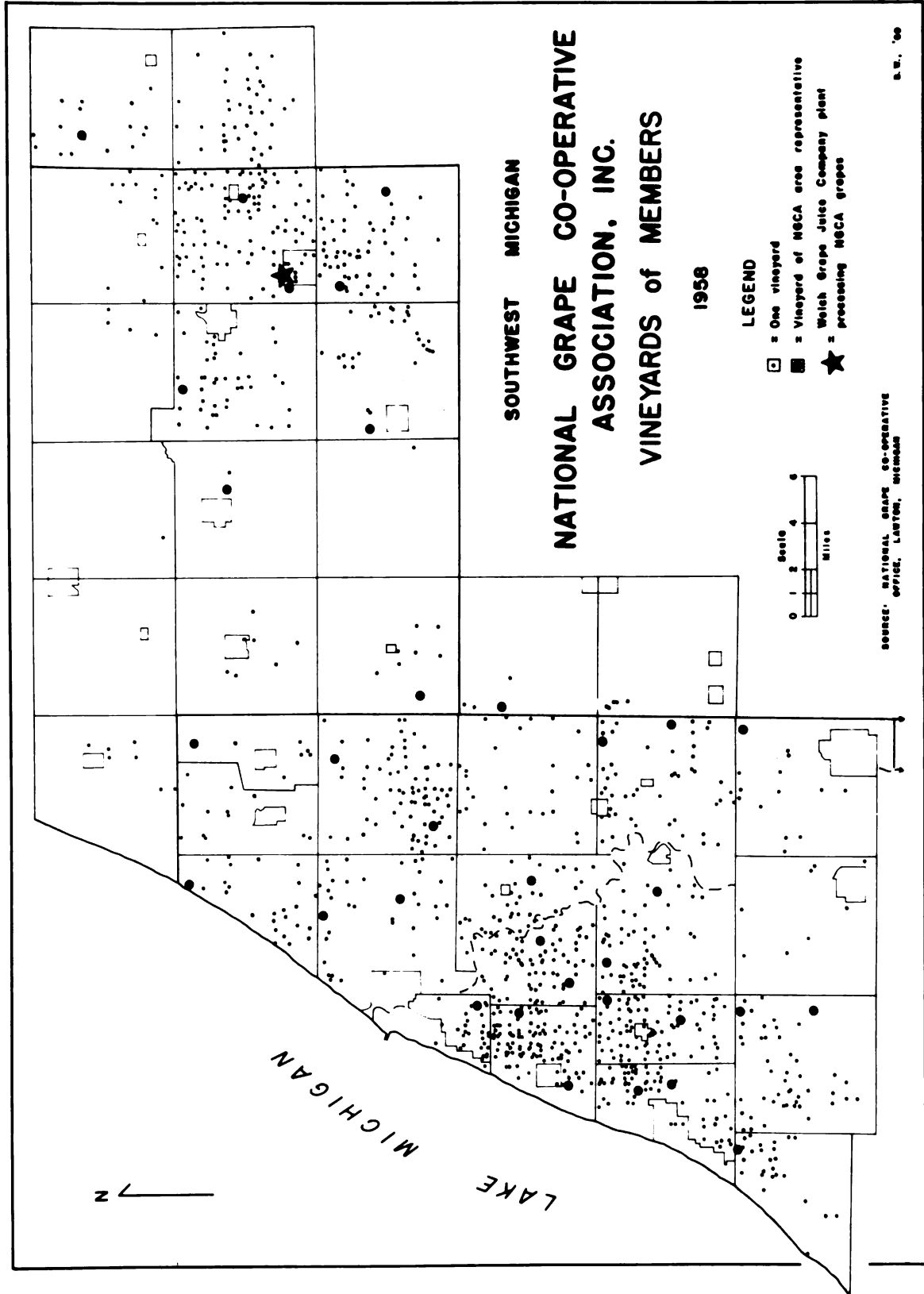


Fig. 22. National Grape Co-operative Association, Inc., Vineyards of Members.



Fig. 23.--Welch Grape Juice Plant in Lawton, Michigan -- now owned by National Grape Co-operative Association, Inc. (Taken from The Lawton Story: Centennial Edition, 1858-1958, Lawton, Mich.: The Lawton Leader, 1958, p. 16).

one in Lawton, at Mattawan. This was acquired from Armour Co. (meat packing) in the late 1920's. Although used as recently as 1950 for pressing and bottling operations,¹ the plant of late has been used only for grape pressing when there is an overload at Lawton and for the storage and shipment of grape products which have been processed and packaged at Lawton. Plans for reactivation in January, 1955, to manufacture Grape Jelly, Grapelade, and Fruit-of-the-Vine apparently came to naught.²

Although the Welch plant processes primarily Concord grapes, some Fredonias, Wordens, Moores Early, and Van Burens are also accepted. These are taken only at a twenty-five per cent discount from prices paid for Concord, however, since they do not produce Concord color and do not have the same distinctive flavor.³ Contrary to tonnage contracts made by most of the other establishments in the area, Welch contracts by the acre. Growers who contract all or part of their vineyards must deliver all grapes produced on the contracted acreage to the Welch plant which is bound to accept them. A grower who, for any reason, takes grapes from contracted acres elsewhere, runs the chance of losing the next year's contract with the company, even though he wishes to retain it, and is other-

¹Kalamazoo Gazette, Fri. Oct..6, 1950, p. 16.

²National Grape Co-op. News, No. 13, Oct. 1954. (Pamphlet).

³National Grape Co-op. News, No. 23, Aug. 1956. (Pamphlet).

wise penalized. Growers contract with the National Grape Co-operative Association, Inc., owners of the Welch Grape Juice Co., and become members of the Association. When they deliver their grapes to the processing plant, they receive certain advances, but inasmuch as this is a cooperative venture, in the end the price received for the grapes depends upon the profits from the operation of the Welch Grape Juice Co.'s entire eastern division.¹

The Paw Paw Grape Juice Co. in Paw Paw is Michigan's second largest grape juice plant. It is operated by John Turner and his brothers. They also own and operate Michigan's largest winery, Michigan Wineries, Inc., located in Lawton, and extensive vineyards in the area. Each of the two plants has a total storage capacity of one million gallons. They have been in the grape growing business since 1904, their father having started some ten to twelve years previous to that time. Today, their vineyards total almost 250 acres. They maintain an office and warehouse at Lawton, near the winery, where vineyard supplies are handled in large quantities.²

A.F. Murch Co. of Paw Paw is primarily a manufacturer of grape concentrate, some of which is shipped to a company in Florida, who either sells it as a concentrate or dilutes it

¹National Grape Co-operative Association, Inc., eastern contract form.

²The Lawton Story, op. cit., p. 13.

to produce grape juice. A.F. Murch in turn sells orange concentrate in Michigan shipped to him from Florida, and is contemplating the manufacture of juices and concentrates from a number of other fruits. Problems in marketing surplus fruit grown in the area may be partly solved by this manufacture of juice concentrates. The concentrate is less bulky than the juice that can be made from it and is, therefore, easier and cheaper to transport to market. Although Murch formerly made champagne at the Paw Paw plant, he presently processes no wine, but distributes Cadillac Wines made by a firm outside the Region.¹

The rest of the processing concerns in the Paw Paw-Lorton area are smaller than those described. The same is true of the eight companies that were operating in 1957 in the St. Joseph-Benton Harbor area. These latter are also more widely scattered throughout the area, a reflection, no doubt, of the fact that a larger proportion of the grapes in Berrien County are marketed as fresh fruit and the vineyards are less concentrated than in Van Buren County.

Each processing plant employs one or more fieldmen. Growers who send their grapes to a processor usually have signed a contract with the company's district field representative. Those who have not signed such a contract simply deliver their grapes to a processor who either verbally agrees

¹Interview with A.F. Murch, Oct. 14, 1959.

to purchase the present truckload or refuses, depending on the needs at the time. A grower may sell grapes from his vineyard to several different processors.

Although quality control and grading of grapes is not as strict as that enforced in the case of those destined for fresh fruit markets, there are, nevertheless, standards established by the Division of Foods and Standards, Michigan Department of Agriculture, for processing and freezing grade grapes which are held to. There are also certain state laws dealing with the quality of grapes to be manufactured into wine in Michigan. Each year the Michigan Department of Agriculture, in conjunction with the Enforcement Division of the Liquor Control Commission places a trailer laboratory at Paw Paw in which skilled technicians inspect and taste the grapes to ensure the proper quality.¹ The processing plants themselves employ control technicians to check the quality of the grapes delivered to them, particularly the sugar content of these grapes.

Because the processors pay more for grapes with a higher sugar percentage and often refuse those with less than a certain sugar content, vineyardists try to wait until their grapes attain the optimum sugar content before delivering them. In attempts to maintain a balance between the amount of grapes

¹Just as France enjoyed a "vintage year" in 1959, the Michigan grape crop of that year also reached the condition of highest quality and sugar content in several years, as reported by the Michigan Department of Agriculture's Chemical Laboratories Division.

delivered to the presses and the amount they can handle, the plant operators commonly demand a specific amount of grapes per day from each contractor. At times when harvests are poor, or the weather during harvest is adverse, the growers find it difficult to meet this quota; when crops are heavy, as in 1950, they wish to deliver more than wanted in order to market the ripe berries at peak quality and before hail storms or early autumn frosts damage them.

The growers are usually paid by the ton for their grapes, prices rising proportionately with sugar content percentage above an amount set by the processing plant. There is no law placing a lower limit on prices the processor ~~pays~~ pays, except one passed by the Michigan Legislature which established an \$5.00 per ton minimum that must be paid for those to be used for making wine within the state of Michigan.¹

In a normal season, Niagaras, Delawares, and Concordes ripen and are harvested successively. Previous to the initial run of Niagaras, or "whites", the processing plant machinery is completely cleaned so as to make the clearest wine and/or champagne possible. The equipment does not have to be thoroughly cleaned between successive processing of the "whites" (Niagaras) and the "reds" (Delawares) and the "blues" (Concordes)

¹Article 16, Section 16a, as added by Public Act 231, 1937, and subsequently amended by Public Act. No. 12, 1950 (Extra Session). Portions of these regulations, as copied from "Wine Rules and Regulations", Michigan Liquor Control Commission, July 1948, are cited on the next couple of pages.

due to the graduation of light to dark in juice colors.

Final processing begins only after the pressed juice storage tanks of the plant are filled. In some years, when the harvest is too small to fill the tanks, grapes or juice are imported from other areas where there is a surplus. In other years, the same vineyards may yield unusually large harvests. At such times the processing plants will often take more grapes than they have contracted for, shipping the excess juice to other plants and storage centers.¹

Laws and Problems Concerning Marketing of Wine Grapes.--

For some years before March 30, 1951, one of the most significant problems connected with the marketing of Michigan grapes was the fact that wines from California were being sold cheaper in Michigan than were comparable wines made in Michigan. Michigan wine makers sought to meet this competition by importing grapes and juice from California because this was cheaper than

¹ In 1959, for example, due to a grape surplus in the Paw Paw-Lawton area, the Welch plant in Lawton was sending juice by stainless steel-lined tanker trucks to their Arkansas plant where processing had already commenced and grape juice storage space was available (Interview with Robert Ashby, Welch fieldman, Oct. 13, 1959). On Sept. 10, 1959, Edward Cox, Earton Harbor Fruit Market, Market Master, received a letter from the Watkins Glen, New York, processing plant requesting Niagara and Delaware grapes, which due primarily to the lighter soils and "lake influence", usually ripen later in southwest Michigan than in New York where they were in short supply (Interview with Edward Cox, Sept. 10, 1959). John Turner, owner and operator of both the Paw Paw Grape Juice Co. and Michigan Wineries, Inc., sends surplus juice and pomace to a cold storage plant in Decatur, Cass County, whence it is obtained by A & P chainstore agents and processed into grape products for sale (Conversation with an official of Michigan Wineries, Inc., Sept. 17, 1959).

purchasing Michigan grapes. As a consequence, Michigan grape growers complained to state officials that the competition of California wines, grapes, and juice was so severely depressing the prices which they received for their grapes that operation was unprofitable. As a consequence, the Michigan Legislature in 1937 sought to provide relief by amending and adding to certain sections of the Michigan State Liquor Law Amendment to the Constitution as established by Act. No. 8 of the Public Acts of 1933 (Extra Session). One pertinent addition by Act 281, Public Acts 1937, was Section 16a. This, in part, stated that:

There shall be levied and collected by the commission on all wines sold in this state and manufactured from grapes or fruits not grown in this state, a tax at the rate of fifty cents per gallon if sold in bulk and in like ratio if sold in smaller quantities: Provided, how-
however, That the commission shall reduce the tax forty-six cents per gallon on all wines manufactured in Michigan from grapes grown in Michigan, for which the wineries, blenders or rectifiers have paid, in cash, the Michigan grape growers fifty-five dollars, per ton, or more, at the shipping point, the buyer furnishing at his expense, all necessary packages or containers and paying transportation charges beyond such shipping point: the tax shall likewise be reduced on wines manufactured in Michigan from Michigan grown fruits, other than grapes, and also on such wines when blended with wine or wine spirits manufactured from grapes and fruits not grown in Michigan, when such blend does not use in the finished product over 25 per cent in volume of wines or wine spirits manufactured outside the state of Michigan. All wines not manufactured and not entitled to tax reduction as provided herein shall be subject to and shall pay to the commission the full amount of tax as provided herein.¹

¹ "Wine Rules and Regulations", op. cit., p. 56.

Section 16b, added by the same Act, provided that:

There shall be levied and collected by the commission a tax of ten cents per gallon on wine manufactured from grapes or fruits not grown in this state, and imported or purchased by bonded Michigan wineries, blenders or rectifiers to be used for blending purposes only.¹

Section 16 of the original Act of 1933 was amended from time to time (Act 281 - 1937; Act 133 - 1945; Act 349 - 1947). The most important provision of this Section states:

That wine manufactured in Michigan from the juice of grapes grown in Michigan shall be sold at prices that shall not exceed the cost to the commission of buying and distributing such wine, and shall in no case exceed a gross profit to the commission of 10 per cent.²

While these various amendments and additions to the Michigan State Liquor Law helped, they did not entirely satisfy the Michigan grape growers. In 1950, the minimum price that must be paid Michigan grape growers to qualify for the reduction in the tax on wines manufactured in Michigan was raised from \$55.00 to \$85.00 per ton by an amendment to Section 16a through Act. 12, Public Acts 1950 (Extra Session). The same bill provided that:

.....the minimum price for wine of over 16 per cent of alcohol by volume, shall be based upon the minimum price of grapes per ton as set forth in Section 16a, and shall be 1 per cent of the minimum price of grapes per ton for each one-fifth gallon of wine or fraction thereof.....³

¹Ibid., p. 57.

²Ibid., pp. 55-56.

³Senate Substitute for Senate Bill No. 17, Michigan 65th Legislature, Extra Session of 1950, a bill to amend Sections 16, 16a, and 19 of Act No. 8 of the Public Acts of the Extra Session of 1933.

These various measures were, of course, opposed by California vineyardists and authorities. Consequently, representatives from Michigan and California met with the Michigan Committee on Interstate Cooperation on March 1, 1951. Conclusions reached were that a) California wines were being sold in Michigan at prices lower than what they were being sold for in other states, and even California, and b) under existing or contemplated legislation in Michigan, California wines of the same quality and characteristics, would have to compete on an even price basis with Michigan wines.¹

Thus, there is today an established minimum price that must be paid for Michigan grapes manufactured into wine in Michigan; also wine made from Michigan grapes is benefitted by near-elimination of a heavy tax levied on wines not made from Michigan grapes and by the establishment of a minimum price for the sale of wines of over 16 per cent of alcohol by volume, regardless of where manufactured and the origin of the grapes used. This minimum price is based on the one that must be paid for Michigan grapes used in manufacturing wines in Michigan. These measures were designed to directly or indirectly aid the Michigan grape growers.

¹"Liquor Intergovernmental Relations", Michigan Committee on Interstate Cooperation, Lansing, Mich., Mar. 8, 1951, unpublished information borrowed from the Council of State Governments, Chicago, Ill., p. 51.

Vineyard Associations

Throughout the history of commercial grape production in southwest Michigan, various grape growers' cooperatives and other associations have played an important part in the production and marketing of the grape crops. Over the years, a large number of these cooperatives have come into being, operated for a time, and in most cases, passed out of existence. One of the first, if not the first, to be formed was the South Haven Pomological Society, organized in 1870 primarily in order to teach the fruit farmers about the growing of varieties best suited to the area.¹

One organization of particular significance was the Southern Michigan Fruit Association which was started at Lawton in 1898. It built up a membership of as many as 600 growers, who at peak operations loaded as many as one hundred refrigerator cars at thirteen railroad stations in a single day and had sales returns as high as \$1,500,000 for one harvest. In 1923, the Association was amalgamated with the Paw Paw Fruit Growers' Union which was established in 1902, and is apparently still active.²

Today, in addition to the National Grape Co-operative

¹ T.T. Lyon, "History of Michigan Fruit Culture", in Eighth Annual Report of the Secy. of the State Pomological Soc. of Michigan, 1879 (Lansing, Mich.: W.S. George & Co., State Printers and Binders, 1879), p. 178.

² Paw Paw Centennial: Pictorial History Souvenir Program (Paw Paw, Mich.: Paw Paw Press, 1953), p. 44.

Association, Inc., which has been previously noted as owning and operating the Lawton plant of the Welch Grape Juice Co., there are several other more important groups that should be mentioned. The Paw Paw Co-operative Association, in Paw Paw, originally formed in June, 1920, as a grape growers' organization under the presidency of M.D. Buskirk, later bought out the older Wolverine Grape Growers' Association. In 1959, this group included 2,115 members.¹ The Wine Institute of Michigan, organized in 1938 by seven important processors in Paw Paw and in Detroit, functions as a manufacturers cooperative by arbitrating with the Liquor Control Commission, the Department of Agriculture, and the grape growers. It also sets annual prices for grapes to be made into wine which have ranged from \$35.00 per ton to \$127.00 per ton as was paid in 1945.²

Two other significant cooperatives represented within the Southwest Michigan Vineyard Region are the Farm Bureau and Farmers' Union. The former, based in Lansing, Michigan, provides its members with a) a legislative voice in State and Federal issues, b) life, fire, auto, and hospital insurance, and c) discounts on farm equipment and supplies, chief among which is gasoline. Of the 6,956 Farm Bureau members who reside in the Region, many produce grapes. As of April 18, 1960, some 2,652 members were located in Berrien County;

¹Paw Paw Centennial, op. cit., p. 27.

²Orsolini, op. cit., p. 27.

2,193 in Van Buren; 1,311 in Kalamazoo; and 800 in Cass.¹

Farmers' Union, a smaller organization than the Farm Bureau, among other activities, maintains a legislative affairs office in Washington, D.C., and constantly strives to increase prices and incomes for the individual farmer. Approximately 250 Farmers' Union members live in southwest Michigan, about 100 of whom operate commercial vineyards.²

¹Interview with Roger Foersch, Organization Coordinator of Farm Bureau, Lansing, Mich., Nov. 6, 1959.

²Letter from Ernest Sawyer, President, Michigan Farmers' Union, May 9, 1960.

CHAPTER V

SUMMARY AND CONCLUSIONS

Four counties in the southwestern corner of the state usually account for some 95 per cent of Michigan's grape production. These and their respective share of the 1953 harvest were: Van Buren, 51 per cent; Berrien, 38 per cent; Kalamazoo, 6 per cent; and Cass, 1 per cent. Michigan, in turn, usually places third in national production being surpassed only by California and New York, and commonly is second only to New York in the harvest of American type grapes.

Within the four counties named, there are two areas of greater vineyard concentration. One of these centers in eastern Van Buren County around the villages of Paw Paw and Lawton; the other is more widely dispersed, but focuses on the **twin cities** of St. Joseph and Benton Harbor. Indicative of the differences in degree of concentration are the facts that three townships of the Paw Paw-Lawton area contain 82 per cent of the grapevines in Van Buren County, whereas the three leading townships of the St. Joseph-Benton Harbor area contain only 34 per cent of those in Berrien County. Within the townships of greatest grape growing activity, this crop accounts for a significant part of the total culti-

vated acreage, being as much as 41 per cent in Antwerp Township, Van Buren County, and 24 per cent in Lincoln Township, Berrien County.

The present location of vineyards within the Southwest Michigan Vineyard Region and the concentration there of such a large share of Michigan's commercial grape production, is the result of more than one hundred years experience and study. Without doubt the favorable climate has been the most important physical factor explaining this development. Prevailing westerly winds carry the "lake influence" into the Region from Lake Michigan, causing retardation of vegetation growth in the spring until likelihood of frost is past and delaying frost in the autumn until the harvest is accomplished. Many parts of Michigan have a sufficiently long average growing season for grape production, but have a greater number of years with departures from the average date of the last spring frost and of the first autumn frost than occur in southwest Michigan. Even so, spring frosts are the single most important cause of grape crop damage in the Southwest Michigan Vineyard Region.

Since the "lake influence" is most effective within ten miles of the lake shore, the cultivation of grapes tends to become increasingly hazardous climatically farther in the interior to the east. Correspondingly, greater attention must be paid to the selection of vineyard sites that have sufficient air drainage to offset increased chance of frost damage. In other words, the topography upon which the vine-

yards are located is more significant in the Paw Paw-Lawton area than it is in much of the St. Joseph-Benton Harbor area. Vineyards are placed on sloping, rather than level, land in both areas, however, except very close to Lake Michigan where the "lake influence" is at a maximum.

Study of the distribution of vineyards in relation to surface forms revealed that in the entire Region some 42 per cent of the vines were on moraines, 23 per cent on outwash plains, and 18.5 per cent on till plains. The fact that 97 per cent of the vines in the Paw Paw-Lawton area were associated with these three glacial features, as compared to 71 per cent in the St. Joseph-Benton Harbor area, would seem to substantiate the conclusion concerning the increased importance of proper site selection the farther from Lake Michigan the vineyard is located. Some 29 per cent of the vines in the St. Joseph-Benton Harbor area are located on what is usually considered unsuitable terrain (lake plains, drainage ways, and muck) but most of these are within the zone of maximum "lake influence" on the climate.

Given a suitable climate, either because of location near Lake Michigan or on slopes providing satisfactory air drainage, soil becomes a physical factor of importance influencing vineyard location. Productive vineyards are possible on all but the extremely light or extremely heavy soils, but the most profitable soils to use are loamy sands and sandy loams with sandy or gravelly substrata. The

principal vineyard soils in southwest Michigan are Plainfield, Coloma, Fox, and Bellefontaine in order of decreasing importance. All of these ensure good underdrainage and are associated for the most part with topographical conditions affording satisfactory air and water surface drainage.

Plainfield sand, Plainfield sandy loam, and Fox sandy loam commonly correlate with outwash plains and Coloma loamy sand, Coloma sandy loam, and Bellefontaine sandy loam with moraines. Approximately 83 per cent of the vineyard acreage in the Paw Paw-Lawton area and 67 per cent of that in the St. Joseph-Benton Harbor area are planted on these soils. Since the area of suitable soils, like the areas of suitable topography and climate, is much more extensive than that of the vineyards, it is evident that within the limits set by the physical environment, cultural factors such as early establishment of successful viticulture, access to transportation to carry the grapes to fresh fruit markets, and location of processing plants for wine, juice, and other products have also had a part in fixing the present location of the vineyards.

While the varieties produced and the vineyard practices differ greatly from those in California, they are much the same as in other grape producing regions in the northeastern part of the United States. Approximately 90 per cent of the plantings in the Southwest Michigan Vineyard Region are of the Concord grape. The number of Delaware and Niagara vines

are approximately equal, with some Catawba, Champions, Moores, and Wordens also grown. Although the vineyards range from less than one acre to 250 acres in size, the average is about ten acres.

Pruning of the vines is the first of the seasonal activities and is usually done in late winter or spring. Because of increased yields obtained, a practice known as "balanced" pruning, which was developed by N.L. Partridge of Michigan State University as early as 1929, is today widely used in southwest Michigan. The vines, as elsewhere in the northeastern states, are trained along vertical trellises. Either the one-stem, 4-arm Kniffen or the 6-arm Kniffen training system is normally used, although in recent years there has been an increase in use of the Umbrella Kniffen method. Application of commercial fertilizers is the usual practice, a 12-6-24 fertilizer being most commonly applied. Other soil maintenance and improvement practices generally followed are planting along contours or on terraces, the use of some type of mulching, and the establishment of a winter cover crop, usually rye, at the time of the last cultivation in the late summer.

Following initial ploughing a week or two before the vines bloom, there are anywhere from four to ten cultivations. The last of these is usually in late July or early August. Interspersed with the cultivations are activities for control of insect and disease pests. Black rot is the chief

cause of damage by disease and the grape-berry moth is usually the insect causing the most destruction. At least six sprayings a year are recommended by the Cooperative Extension Service of Michigan State University and a Spraying Calendar, issued annually by the university, is widely used by the growers.

An interesting special problem encountered by the vineyardists is the use of weed control sprays by neighboring field crop farmers that are damaging to the grapes. As a consequence of the dispute between grape growers and field croppers, the Director of Agriculture for the State of Michigan has decreed that certain forms of weed control chemicals should not be used in the vicinity of the vineyards. Another example of differing interests of the viticulturists and surrounding field crop farmers is the use by the grape growers of wheat as cover crop without spraying this to prevent it becoming a breeding place for the Hessian fly. This pest is a constant menace to wheat fields and the wheat farmers take measures to protect themselves from it, so are at odds with the viticulturists who ignore it.

Pruning and tying of the vines requires the largest amount of labor inputs of any single vineyard activity. An average of 33 man hours of labor per acre are expended doing this, six hours are needed for spraying, three for cultivation, and two for other pre-harvest tasks. The harvest is the second most demanding on the vineyardist's time, requiring on an average sixteen hours of labor per acre.

The harvest extends from late August to early October. During this period practically everyone in the locality works in the vineyards, but immigrant labor from the South and Mexico is little used. Nearly 90 per cent of the grapes are sent to processing plants within the Region and the remainder are marketed as fresh fruit mainly through the Benton Harbor Fruit Market. Pickers fill the containers right in the vineyards -- ordinarily 2-quart baskets, packed eight to a carton, if the grapes are to be marketed fresh, and wooden beer lugs if they are to be processed.

Two outstanding historic changes have characterized the marketing of Michigan grapes. First, the means of transportation has developed from boat during the latter half of the nineteenth century, to rail from about 1890 to 1920, and to truck which is used today. Second, up until as recently as 1940, half or more of the grapes were delivered to fresh fruit markets. Today these are relatively unimportant. The amount of fruit used by the vineyardists themselves has also declined greatly during the last two decades. A proportionately larger amount of the total crop in the St. Joseph-Benton Harbor area is sold as fresh fruit than is the case in the Paw Paw-Lawton area.

Of the sixteen processing plants operating in the Region in 1957, the three largest were located in the Paw Paw-Lawton area, namely the Welch Grape Juice Company in Lawton, and the Paw Paw Grape Juice Co. and the A.F. Murch Co. in Paw Paw. All three manufacture unfermented grape products. The

largest winery in the Region, the Michigan Wineries, Inc., is also located at Lawton.

Michigan grape growers are usually paid by the ton for their grapes to be processed, the price increasing in direct proportion to the amount of sugar content above a base set by the processing plant. For some years prior to 1951, Michigan growers were receiving unprofitably low prices for grapes sold for wine manufacture because wineries in Michigan, in order to produce wines cheaply enough to compete with those from California, paid low prices and were also importing grapes and juice from California. Briefly speaking, after amending and adding to certain sections of the Michigan State Liquor Law Amendment to the Constitution established by Act No. 8, Public Acts of 1933 (Extra Session), the Michigan Legislature levied a tax on all wines sold in Michigan other than those made in Michigan from Michigan grapes. In the latter case the tax was greatly reduced if the wineries had paid the growers a set minimum price, or more. Today this price is \$35.00.

Throughout the history of commercial grape production in southwest Michigan, various grape growers' cooperatives and other associations have played an important part in the production and marketing of the grape crops. The most important ones in the Region at present are the National Grape Co-operative Association, Inc., which has owned and operated the Lawton plant of the Welch Grape Juice Co. since Sept. 1, 1956, the Paw Paw Co-operative Association, the Wine Insti-

tute of Michigan, the Farm Bureau, and the Farmers' Union -- all of which offer various benefits to the southwest Michigan viticulturists who are members.

Subsequent to a long, irregular decline in both grape production and number of vines in the Southwest Michigan Vineyard Region, reaching a low point about 1945, there has been an upward trend. That this increase is likely to continue is substantiated by plans for expansion by many of the vineyardists in the Region. As a consequence of protective laws passed by the State Legislature, and activities of the cooperatives, particularly the National Grape Co-operative Association, Inc. which controls the marketing and processing of the largest share of the grapes, the growers in recent years have benefitted from relatively high and stable prices and have been reasonably prosperous.

The prospect for the future appears to be an increasing demand for southwest Michigan grapes, if for no other reason than because the population of the state and surrounding areas is increasing. One thing is certain. Sites with satisfactory conditions for the production of several times as many grapes as are now produced are available in the Southwest Michigan Vineyard Region. Also, there seems to be little doubt but that the concentration of an even larger proportion of the total vineyard acreage of the state will occur in the Region as demand increases, if past experience is any indication of the future. The Southwest Michigan Vineyard Region has evolved to where it is now a well-defined part of the Michigan landscape.

APPENDIX TABLE 1*

GRAPE PRODUCTION, 1899 - 1959 (SHORT TONS)

Year	U.S.	Calif.	N.Y.	Mich.	Pa.	Ohio	Others ³
1899	650,492	360,717	123,849	20,765	23,563	39,587	82,011
1909	1,285,533	989,843	126,503	60,348	17,010	21,967	69,862
1919	1,258,420	1,027,822	76,241	57,936	21,341	20,861	54,219
1929	1,941,699	1,691,111	77,205	58,911	21,662	14,121	78,689
1933	1,909,481	1,660,000	64,800	58,562	17,808	27,412	80,899
1934	1,931,168	1,700,000	49,400	61,145	18,981	22,720	78,922
1935	2,454,615	2,194,000	68,500	56,310	24,750	29,110	83,945
1936	1,916,460	1,714,000	49,300	38,700	16,000	26,400	72,060
1937	2,776,770	2,454,000	89,100	67,200	26,000	37,800	102,670
1938	2,703,560	2,531,000	55,600	16,900	15,700	9,800	74,560
1939	2,525,830	2,228,000	75,600	58,100	23,200	42,800	98,130
1940	2,467,150	2,250,000	59,800	38,200	17,300	22,500	79,350
1941	2,727,500	2,547,000	47,600	26,700	12,500	14,800	78,900
1942	2,402,350	2,160,000	69,600	46,000	21,500	22,400	82,850
1943	2,972,900	2,789,000	39,200	42,400	15,300	17,900	69,100
1944	2,712,100	2,514,000	51,600	32,000	19,500	18,600	76,400
1945	2,781,400	2,663,000	31,300	13,500	6,000	5,100	62,500
1946	3,159,500	2,958,000	64,500	31,000	19,500	12,500	74,000
1947	3,036,400	2,836,000	60,000	42,500	18,100	15,400	64,400
1948	3,073,400	2,891,000	65,200	27,000	17,200	11,000	67,000
1949	2,650,100	2,473,000	48,400	34,300	14,100	15,800	64,500
1950	2,687,900	2,440,000	95,800	43,000	30,900	19,100	59,100
1951	3,389,800	3,228,000	60,700	10,000	17,400	15,600	58,100
1952	3,164,400	2,967,000	62,300	39,600	18,000	13,700	63,800
1953	2,700,000	2,479,000	67,200	49,500	17,000	16,500	70,800
1954	2,562,900	2,327,000	94,000	45,500	26,000	16,900	53,500
1955	3,241,350	3,020,000	88,500	23,500	24,000	17,000	68,350
1956	2,912,250	2,641,000	106,000	60,500	31,600	13,800	59,350
1957	2,598,750	2,382,000	66,000	48,000	19,500	10,900	72,350
1958	3,026,070	2,741,000	100,600	50,500	29,000	20,000	84,970
1959 ²	3,231,350	2,950,000	84,000	57,000	29,000	16,000	95,350

¹Includes small quantities not harvested on account of market conditions as follows: Calif., 3,000 tons sold but left on vines in 1933; N.Y., 6,310 tons in 1937; Mich., 3,360 tons in 1937.

²Indicated.

³From 1950 to 1959 inclusive, Washington produced the following tonnages: 1950 - 23,000; 1951 - 22,700; 1952 - 33,100; 1953 - 46,100; 1954 - 30,700; 1955 - 48,600; 1956 - 30,000; 1957 - 50,000; 1958 - 54,000; 1959 - 57,000. With the exception of Washington in recent years, and Missouri in earlier ones, the states in the table were the leaders.

*U.S., Census of Agric., 1899 - 1929; Agricultural Statistics, U.S. Dept. of Agric., 1936 - 1960.

APPENDIX TABLE 2*

MICHIGAN GRAPE PRODUCTION TOTAL AND IN LEADING COUNTIES, 1909 - 1953 (POUNDS AND PER CENT OF STATE TOTAL)

Year	<u>State Total</u>	<u>Van Buren</u>	<u>Berrien</u>	<u>Kalamazoo</u>	<u>Allegan</u>
1909	120,695,997	44,406,720	53,022,711	3,893,239	1,360,292
1919	115,871,465	38,295,123	50,071,547	5,028,601	859,824
1929	117,822,405	44,762,985	56,976,228	5,442,745	1,658,085
1934	127,762,784	46,173,530	56,246,943	7,725,641	1,825,072
1939	71,398,565	23,665,201	31,956,180	4,300,831	1,218,271
1944	50,987,035	20,920,050	19,394,357	3,170,003	778,805
1949	48,357,678	19,138,453	22,655,931	2,986,524	497,800
1953	74,471,088	38,083,067	28,679,954	4,210,323	966,569
	<u>Cass</u>	<u>Monroe</u>	<u>Kent</u>	<u>Ottawa</u>	<u>Others</u>
1909	3,221,877	1,292,906	2,621,927	2,555,822	8,320,503
1919	1,437,436	1,087,332	1,531,789	1,865,635	6,093,173
1929	1,310,102	208,196	1,439,438	1,806,401	4,299,973
1934	2,731,504	989,373	1,786,543	1,623,353	8,260,825
1939	1,176,319	800,380	933,532	506,404	6,841,447
1944	528,132	433,068	566,829	306,971	4,898,820
1949	604,107	240,339	177,387	80,397	2,036,740
1953	726,861	120,448	110,084	47,998	1,525,734
1909		2.7	2.2	2.1	6.9
1919		1.2	1.3	1.6	5.3
1929		1.1	1.2	1.5	3.8
1934		2.1	1.4	1.3	6.5
1939		1.6	1.3	0.7	9.6
1944		1.0	1.1	0.6	9.6
1949		1.2	0.4	0.2	4.2
1953		1.0	0.1	0.1	2.0

*U.S., Bureau of the Census, Agriculture, 1910 - 1954.

APPENDIX TABLE 3*

MICHIGAN GRAPEVINES
TOTAL AND IN LEADING COUNTIES, 1910 - 1954
(NUMBER AND PER CENT OF STATE TOTAL)

Year	<u>State Total</u>			Per Cent
	Not of Bearing Age	Of Bearing Age	Total	
1910	1,869,648	11,913,476	13,783,224	100.0
1920	607,149	11,097,734	11,704,883	100.0
1925			17,219,054	100.0
1930	879,868	16,919,628	17,799,496	100.0
1935	480,601	17,840,130	18,320,731	100.0
1940	361,448	11,176,193	11,537,641	100.0
1945			10,355,496	100.0
1950	431,483	8,039,965	8,471,348	100.0
1954	462,705	7,485,997	7,948,702	100.0
<u>Van Buren</u>				
1910		6,000,348		50.4 ¹
1920	104,939	4,429,189	4,534,178	38.9
1925			5,970,321	34.7
1930	116,944	5,965,014	6,081,958	34.2
1935	56,202	6,717,018	6,773,220	37.0
1940	15,409	4,224,568	4,239,977	36.7
1945			4,294,563	41.5
1950	260,414	3,569,716	3,830,130	45.2
1954	84,376	3,379,853	3,464,229	43.6
<u>Berrien</u>				
1910		2,192,008		18.4 ¹
1920	259,587	4,319,218	4,578,805	39.1
1925			7,612,977	44.2
1930	301,339	7,557,244	7,858,583	44.2
1935	155,395	6,990,028	7,145,423	39.1
1940	96,041	4,407,122	4,503,163	39.0
1945			3,911,657	37.8
1950	30,474	3,256,213	3,286,687	38.8
1954	305,731	3,094,646	3,400,377	42.8

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APPENDIX TABLE 3 (continued)

Kalamazoo

Year	Not of Bearing Age	Of Bearing Age	Total	Per Cent
1910		694,462		5.8 ¹
1920	44,847	669,002	713,849	6.1
1925			514,305	3.0
1930	53,008	973,492	1,026,500	5.8
1935	22,512	1,161,909	1,184,421	6.5
1940	7,893	759,282	767,175	6.6
1945			672,818	6.5
1950	23,764	537,498	561,262	6.6
1954	14,134	561,234	575,368	7.2

Allegan

1910		172,361		1.4 ¹
1920	3,599	94,276	97,875	0.8
1925			367,040	2.1
1930	30,520	272,355	302,875	1.7
1935	9,940	249,463	259,403	1.4
1940	5,221	151,452	156,673	1.4
1945			153,693	1.5
1950	16,242	71,046	87,288	1.0
1954	7,163	102,364	109,527	1.4

Cass

1910		411,769		3.5 ¹
1920	8,158	200,752	208,910	1.8
1925			243,120	1.4
1930	25,466	303,917	329,383	1.9
1935	4,096	368,099	372,195	2.0
1940	24,093	167,547	191,640	1.7
1945			120,032	1.2
1950	12,127	83,649	95,776	1.1
1954	7,494	72,760	80,254	1.0

Monroe

1910		176,629		1.5 ¹
1920	10,518	175,056	185,574	1.6
1925			366,652	2.1
1930	34,455	209,505	243,960	1.4
1935	20,902	273,799	294,699	1.6
1940	11,097	169,966	181,063	1.6
1945			96,538	1.0
1950	14,124	66,426	80,550	1.0
1954	610	24,378	27,988	0.4

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APPENDIX TABLE 3 (continued)

Kent

Year	Not of Bearing Age	Of Bearing Age	Total	Per Cent ¹
1910		253,198		2.1 ¹
1920	12,626	209,741	222,367	1.9
1925			335,361	1.9
1930	31,601	214,373	245,974	1.4
1935	7,248	264,570	271,818	1.5
1940	11,466	124,432	135,898	1.2
1945			119,464	1.2
1950	3,605	44,166	47,771	0.6
1954	626	24,179	24,805	0.3

Ottawa

1910		337,933		2.8 ¹
1920	43,036	283,187	331,223	2.8
1925			418,669	2.4
1930	19,563	398,380	417,943	2.3
1935	11,407	397,105	408,512	2.2
1940	2,500	140,358	142,858	1.2
1945			119,885	1.2
1950	1,799	18,723	20,522	0.2
1954	2,017	11,968	13,985	0.2

Others

1910		1,684,868		14.1 ¹
1920	119,789	712,313	832,102	7.1
1925			1,390,609	8.1
1930	266,972	1,025,348	1,292,320	7.3
1935	213,801	1,691,938	1,905,739	10.4
1940	198,825	1,201,432	1,400,257	12.1
1945			963,384	9.3
1950	83,058	458,854	541,912	6.4
1954	41,164	238,993	280,157	3.5

¹ Computed from the total number of vines of bearing age only.

*U.S. Bureau of the Census, Agriculture, 1910 - 1954.

APPENDIX TABLE 4*

NUMBER OF GRAPEVINES NOT OF BEARING AGE
LEADING COUNTIES AND TOWNSHIPS OF SOUTHWEST MICHIGAN

<u>State</u>						
	Year	Amount	Per Cent			
	1935	480,601	100.0			
	1954	462,705	100.0			
<u>Berrien County</u>				<u>Cass County</u>		
	Year	Amount	Per ¹ Cent		Amount	Per Cent
	1935	155,395	32.3		4,096	0.9
	1954	305,731	66.1		7,494	1.6
<u>Berrien Townships</u>						
	<u>Lincoln</u>			<u>Royalton</u>		
	Year	Amount	Per ¹ Cent	Year	Amount	Per Cent
	1935	17,940	11.5		7,375	4.7
	1954	56,825	18.6		30,493	10.0
	<u>Baroda</u>			<u>Bainbridge</u>		
	Year	Amount	Per ¹ Cent	Year	Amount	Per Cent
	1935	28,199	18.2		8,369	5.4
	1954	25,815	8.4		25,298	8.3
	<u>Pipestone</u>			<u>Oronoko</u>		
	Year	Amount	Per ¹ Cent	Year	Amount	Per Cent
	1935	3,688	2.4		3,515	2.3
	1954	16,756	5.5		16,682	5.5
	<u>Hagar</u>			<u>Sodus</u>		
	Year	Amount	Per ¹ Cent	Year	Amount	Per Cent
	1935	4,675	3.0		2,840	1.8
	1954	15,245	5.0		14,002	4.6
	<u>Watervliet</u>			<u>St. Joseph</u>		
	Year	Amount	Per ¹ Cent	Year	Amount	Per Cent
	1935	615	0.4		38	---
	1954	8,530	2.8		5,497	1.8

APPENDIX TABLE 4 (continued)

Berrien Townships (continued)

<u>Chikaming</u>			<u>Coloma</u>		<u>Buchanan</u>	
Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	6,205	4.0	6,890	4.4	4,342	2.8
1954	4,390	1.4	2,354	0.8	2,343	0.8

Others

1935	6,563	4.2
1954	773	0.3

Cass Townships

<u>Silver Creek</u>			<u>Pokagon</u>		<u>Others</u>	
Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	----	----	445	10.9	3,651	89.1
1954	2,670	35.6	1,000	13.3	3,824	51.0

Van Buren County

Kalamazoo County

Year	Amount	Per Cent	Amount	Per Cent
1935	56,202	11.7	22,512	4.7
1954	84,376	13.2	14,134	3.1

Van Buren Townships

<u>Paw Paw</u>			<u>Porter</u>		<u>Antwerp</u>	
Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
191935	5,103	9.1	7,605	13.5	----	----
1954	19,641	23.3	17,697	21.0	12,706	15.1

Keeler

Decatur

Almena

1935	----	----	13,340	23.7	8,280	14.7
1954	8,480	10.1	6,840	8.1	5,333	6.3

Hamilton

Hartford

Lawrence

1935	270	0.5	2,200	3.9	125	0.2
1954	4,020	4.8	2,300	2.7	2,200	2.6

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APPENDIX TABLE 4 (continued)

Van Buren Townships (continued)

Year	<u>Covert</u>		<u>Arlington</u>		<u>Bangor</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	13,173	23.4	----	----	----	----
1954	2,195	2.6	1,200	1.4	845	1.0
	<u>Waverly</u>		<u>Others</u>			
	Amount	Per Cent	Amount	Per Cent		
1935	1,710	3.0	4,391	7.8		
1954	400	0.5	519	0.6		

Kalamazoo Townships

Year	<u>Texas</u>		<u>Oshkemo</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	1,004	4.6	7,588	33.7	13,920	61.8
1954	6,683	47.3	4,196	29.7	3,255	23.0

Data for counties in Michigan other than the four mentioned were: 242,396, 50.4 per cent, in 1935; and 50,970, 11.0 per cent, in 1954.

¹ Percentages given are of state totals in the case of counties and of county totals in the case of townships.

*Data for 1935 from 1935 Census of Agriculture for Michigan by Townships, Michigan Agricultural Statistics, 1951. Data for 1954 from 1954 Census of Agriculture for Michigan by Counties and Minor Civil Divisions (Townships), Michigan Agricultural Statistics, 1956.

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1958

APPENDIX TABLE 5*

TOTAL NUMBER OF GRAPEVINES
LEADING COUNTIES AND TOWNSHIPS OF SOUTHWEST MICHIGAN

State

Year	Amount	Per Cent
1935	18,320,731	100.0
1945	10,355,496	100.0
1954	7,948,702	100.0

Van Buren County

Kalamazoo County

Year	Amount	Per ¹ Cent	Amount	Per Cent
1935	6,773,220	37.0	1,184,421	6.5
1945	4,294,563	41.5	672,818	6.5
1954	3,464,229	43.6	575,368	7.2

Van Buren Townships

Antwerp

Porter

Paw Paw

Year	Amount	Per ¹ Cent	Amount	Per Cent	Amount	Per Cent
1935	2,746,345	40.5	1,273,455	18.8	1,034,754	15.3
1945	1,264,076	29.4	1,116,915	26.0	813,804	18.9
1954	1,276,068	30.8	851,536	24.6	722,812	20.9

Keeler

Decatur

Almena

1935	173,928	2.6	352,940	5.2	232,442	4.2
1945	94,355	2.2	189,974	4.4	142,450	3.3
1954	205,326	5.9	130,404	3.8	89,467	2.6

Hartford

Waverly

Lawrence

1935	122,076	1.8	108,063	1.6	105,724	1.6
1945	68,612	1.6	100,290	2.3	116,596	2.7
1954	41,606	1.2	30,903	0.9	29,194	0.8

Covert

Arlington

Hamilton

1935	158,705	2.3	66,684	1.0	143,413	2.1
1945	45,628	1.1	26,252	0.6	81,263	1.9
1954	24,217	0.7	24,100	0.7	14,660	0.4

APPENDIX TABLE 5 (continued)

Van Buren Townships (continued)

Year	<u>Bangor</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent
1935	17,352	0.3	182,339	2.7
1945	28,868	0.7	205,475	4.8
1954	8,690	0.3	15,241	0.4

Kalamazoo Townships

Year	<u>Texas</u>		<u>Oshkosh</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	668,428	56.4	345,482	29.2	171,511	14.5
1945	470,643	70.0	170,160	24.3	32,015	4.8
1954	365,631	63.5	152,587	26.5	57,150	9.9

Berrien County

Cass County

Year	Amount	Per Cent	Amount	Per Cent
1935	7,145,423	39.0	372,195	2.0
1945	3,911,657	37.8	120,032	1.2
1954	3,400,377	42.8	80,254	1.0

Berrien Townships

Year	<u>Lincoln</u>		<u>Royalton</u>		<u>Sodus</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	951,159	13.3	454,793	6.4	417,935	5.8
1945	499,825	12.8	233,762	6.0	254,143	6.5
1954	604,950	17.8	232,761	8.3	275,647	8.1

Bainbridge

Baroda

Lake

Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	480,328	6.7	401,170	5.6	546,997	7.7
1945	255,366	6.5	180,739	4.6	234,413	6.0
1954	247,715	7.3	244,622	7.2	229,390	6.8

Benton

Berrien

Cronoko

Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	756,533	10.6	202,115	2.8	256,320	3.6
1945	449,598	11.5	146,735	3.8	174,350	4.5
1954	226,496	6.7	207,906	6.1	194,813	5.7

APPENDIX TABLE 5 (continued)

Berrien Townships (continued)

Year	<u>Pipestone</u>		<u>Hagar</u>		<u>Chikaming</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	212,957	3.0	320,449	4.5	765,808	10.7
1945	170,788	4.4	294,728	7.5	323,313	8.3
1954	162,498	4.8	158,610	4.7	113,150	3.3
	<u>Weesaw</u>		<u>St. Joseph</u>		<u>Coloma</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	205,792	2.9	524,696	7.3	300,631	4.2
1945	103,044	2.6	155,280	4.0	177,473	4.5
1954	104,873	3.1	104,268	3.1	97,487	2.9
	<u>Niles</u>		<u>Watervliet</u>		<u>Buchanan</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	97,100	1.4	45,402	0.6	56,362	0.8
1945	75,746	1.9	26,145	0.7	32,172	0.8
1954	53,188	1.6	41,218	1.2	22,947	0.7
	<u>Others</u>					
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	148,876	2.1				
1945	123,534	3.2				
1954	27,338	0.8				

Cass Townships

Year	<u>Pokagon</u>		<u>Silver Creek</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1935	86,879	23.3	87,428	23.5	197,888	53.2
1945	13,670	11.4	28,217	23.5	78,145	65.1
1954	26,822	33.4	23,370	29.1	30,062	37.5

Data for counties in Michigan other than the four mentioned were: 2,845,472, 15.5 per cent, in 1935; 1,356,426, 13.1 per cent, in 1945; and 428,474, 5.4 per cent, in 1954.

¹ Percentages given are of state totals in the case of counties and of county totals in the case of townships.

*Data for 1935 from 1935 Census of Agriculture for Michigan by Townships, Michigan Agricultural Statistics, 1951. Data for 1945 and 1954 from 1945 and 1954 Censuses of Agriculture for Michigan by Counties and Minor Civil Divisions (Townships), Michigan Agricultural Statistics, 1946 and 1950, respectively.

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APPENDIX TABLE 6*

GRAPE PRODUCTION
LEADING COUNTIES AND TOWNSHIPS OF SOUTHWEST MICHIGAN

State

Year	Amount	Per Cent
1935	127,762,784	100.0
1945	50,987,035	100.0
1954	74,471,088	100.0

Van Buren County

Kalamazoo County

Year	Amount	Per ¹ Cent	Amount	Per Cent
1935	46,173,530	36.1	7,725,641	6.0
1945	20,920,050	41.0	3,170,003	6.2
1954	33,083,067	51.1	4,210,323	5.7

Van Buren Townships

Antwerp

Porter

Paw Paw

Year	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	16,217,841	35.1	7,881,065	17.1	10,712,268	23.2
1944	5,639,400	27.2	5,843,582	27.9	5,231,315	25.0
1953	(Grape production was reported by county but not by township.)					

Keeler

Decatur

Almena

1934	1,585,240	3.4	2,233,750	4.8	2,125,849	4.6
1944	235,500	1.1	1,041,240	5.0	587,867	2.8

Hartford

Waverly

Lawrence

1934	835,825	1.8	661,660	1.4	603,976	1.3
1944	257,825	1.2	209,500	1.0	249,342	1.2

Covert

Arlington

Hamilton

1934	769,644	1.7	359,485	0.8	1,298,610	2.8
1944	60,300	0.3	189,920	0.9	487,605	2.3

Bangor

Others

1934	92,192	0.2	796,125	1.7
1944	27,892	0.1	808,762	3.9

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APPENDIX TABLE 6 (continued)

Kalamazoo Townships

Year	<u>Texas</u>		<u>Oshkosh</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	4,603,100	59.6	2,003,330	25.9	1,119,161	14.5
1944	2,896,650	91.4	116,900	3.7	156,453	4.9

Berrien County

Cass County

Year	Amount	Per Cent	Amount	Per Cent
1934	56,646,943	44.3	2,731,504	2.1
1944	19,394,357	38.0	528,132	1.0
1954	28,679,954	33.5	726,861	1.0

Berrien Townships

Year	<u>Lincoln</u>		<u>Royalton</u>		<u>Sodus</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	6,159,101	10.9	4,096,414	7.2	3,872,214	6.8
1944	2,931,379	15.1	1,338,446	6.9	1,536,230	7.9

Year	<u>Bainbridge</u>		<u>Baroda</u>		<u>Lake</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	5,348,981	9.4	2,119,617	3.7	4,653,445	8.2
1944	1,410,250	7.3	1,328,495	6.8	1,356,643	7.0

Year	<u>Benton</u>		<u>Berrien</u>		<u>Oronoko</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	6,939,542	12.3	2,564,690	4.5	3,193,805	5.6
1944	1,198,360	6.2	906,118	4.7	1,301,961	6.7

Year	<u>Pipestone</u>		<u>Hagar</u>		<u>Chikaming</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	2,411,640	4.3	2,957,993	5.2	4,013,526	7.1
1944	910,532	4.7	697,690	3.6	1,426,100	7.4

Year	<u>Weesaw</u>		<u>St. Joseph</u>		<u>Coloma</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	1,355,565	2.4	3,392,037	6.0	1,973,591	3.5
1944	660,448	3.4	503,058	2.6	708,674	3.7

APPENDIX TABLE 6 (continued)

Berrien Townships (continued)

Year	<u>Niles</u>		<u>Watervliet</u>		<u>Buchanan</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	291,098	0.5	229,505	0.4	362,480	0.6
1944	347,657	1.8	86,013	0.4	135,040	0.7

Others

1934	701,694	1.2
1944	611,258	3.2

Cass Townships

Year	<u>Pokagon</u>		<u>Silver Creek</u>		<u>Others</u>	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
1934	796,474	29.2	511,401	18.7	1,423,629	52.1
1944	74,940	14.2	135,300	25.6	317,892	60.2

Data for counties in Michigan other than the four mentioned were: 15,585,166, 11.3 per cent, in 1934; 6,974,493, 13.7 per cent, in 1944; and 2,770,883, 3.7 per cent, in 1953.

¹ Percentages given are of state totals in the case of counties and of county totals in the case of townships.

*Data for 1935 from 1935 Census of Agriculture for Michigan by Townships, Michigan Agricultural Statistics, 1951. Data for 1944 and 1953 from 1945 and 1954 Censuses of Agriculture for Michigan by Counties and Minor Civil Divisions (Townships), Michigan Agricultural Statistics, 1946 and 1950, respectively.

APPENDIX TABLE 7*

SOUTHWEST MICHIGAN VINEYARD REGION APPROXIMATE NUMBER OF GRAPEVINES AND ASSOCIATED GLACIAL FEATURES (BY COUNTY AND TOWNSHIP IN EACH MAJOR AREA)

Paw Paw-Lawton Area

Van Buren County

Township	<u>Moraine</u>		<u>Till Plain</u>		<u>Outwash Plain</u>		<u>Lake Plain & Muck or Drainage Ways Alluvium</u>		<u>Total</u>
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number
Almena	9,000	10.0	6,000	6.7	63,000	70.0	12,000	13.3	90,000
Antwerp	729,000	57.2	363,000	23.5	159,000	12.5	12,000	0.9	1,263,000
Decatur	84,000	65.1	42,000	32.6	3,000	2.3			129,000
Hamilton	3,000	20.0			12,000	80.0			15,000
Lawrence (east)	12,000	80.0			3,000	20.0			15,000
Paw Paw	66,000	9.1			579,000	80.1	78,000	10.8	723,000
Porter	546,000	64.1	36,000	4.2	267,000	31.3	3,000	0.4	852,000
Maverly	12,000	40.0	3,000	10.0	15,000	50.0			30,000
County Total	1,461,000	46.9	450,000	14.4	1,101,000	35.3	102,000	3.3	3,117,000

Kalamazoo County

Oshtemo	81,000	52.9	72,000	47.1					153,000
Texas	189,000	51.6	177,000	48.4					366,000
County Total	270,000	52.0	249,000	43.0					519,000
AREA TOTAL	1,731,000	47.6	450,000	12.4	1,350,000	37.1	102,000	2.8	3,636,000

APPENDIX TABLE 7 (continued)

St. Joseph-Benton Harbor Area

Berrien County

Township	<u>Loraine</u>		<u>Till Plain</u>		<u>Outwash</u>		<u>Lake Plain & Drainage Ways</u>		<u>Muck or Alluvium</u>		<u>Total</u>
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number
Bainbridge	231,000	92.8	18,000	7.2							249,000
Baroda	36,000	14.6	207,000	84.1							246,000
Benton	69,000	30.7	72,000	32.0	3,000	1.3	81,000	36.0	3,000	1.2	225,000
Berrien	162,000	78.3			3,000	1.4	42,000	20.3			207,000
Buchanan	6,000	25.0			15,000	62.5	3,000	12.5			24,000
Chalkaming	48,000	42.1					12,000	10.5			114,000
Coloma	54,000	56.3					42,000	43.8			96,000
Hagar	30,000	18.9			39,000	24.5	87,000	54.7	3,000	1.9	159,000
Lake	123,000	53.2	69,000	29.9			39,000	16.9			231,000
Lincoln	39,000	6.4	135,000	22.3			432,000	71.3			606,000
Miles	39,000	72.2			9,000	16.7	6,000	11.1			54,000
Cronoko	159,000	81.5	9,000	4.6			27,000	13.8			195,000
Pipestone	129,000	79.6	21,000	13.0	12,000	7.4					162,000
Royalton	69,000	24.5	141,000	50.0			63,000	22.3	9,000	3.2	282,000
St. Joseph							105,000	100.0			105,000
Sodus	60,000	21.7	39,000	14.1	78,000	28.3	87,000	31.5	12,000	4.3	276,000
Watervliet	9,000	21.4	6,000	14.3	6,000	14.3	21,000	50.0			42,000
Weesaw	27,000	25.7	78,000	74.3							105,000

County

Total 1,290,000 38.2 849,000 25.1 165,000 4.9 1,047,000 31.0 27,000 0.8 3,378,000

APPENDIX TABLE 7 (continued)

St. Joseph-Benton Harbor Area (continued)

Van Buren County

Township	<u>Moraine</u>		<u>Till Plain</u>		<u>Outwash Plain</u>		<u>Lake Plain & Drainage Ways</u>		<u>Muck or Alluvium</u>		<u>Total</u>
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	
Arlington	15,000	62.5	3,000	12.5			6,000	25.0			24,000
Bangor	3,000	33.3	6,000	66.7							9,000
Covert	12,000	50.0	9,000	37.5	3,000	12.5					24,000
Hartford	18,000	20.7	60,000	69.0			9,000	10.3			87,000
Keeler	36,000	17.6			162,000	79.4			6,000	2.9	204,000
Lawrence (west)	9,000	60.0					6,000	40.0			15,000
County Total	93,000	25.6	78,000	21.5	165,000	45.5	21,000	5.8	6,000	1.7	363,000
Cass County											
Pokagon					24,000	88.9	3,000	11.1			27,000
Silver Creek	3,000	12.5			21,000	45.5					24,000
County Total	3,000	5.9			45,000	88.2	3,000	5.9			51,000
AREA TOTAL	1,386,000	36.6	927,000	24.4	375,000	9.9	1,071,000	28.2	33,000	0.93	792,000
REGION TOTAL	3,117,000	42.0	1,377,000	18.5	1,725,000	23.2	1,173,000	15.8	36,000	0.57	428,000

APPENDIX TABLE 7 (continued)

*Agricultural Stabilization and Conservation Service aerial photographs, scale 1:7,920, 1955. U.S. Dept. of Agriculture Soil Survey maps, Berrien County, 1927; and Kalamazoo and Van Buren counties, 1926. "Glacial Map of Southern Peninsula of Michigan", in Frank Leverett and Frank B. Taylor, The Pleistocene of Indiana and Michigan and the History of Great Lakes, U.S. Geologic Survey, Monograph 53, Plate 7, 1915. Helen M. Martin, Map of the Surface Formations of the Southern Peninsula of Michigan, Dept. of Conservation and Geological Survey Division, Publication 49, 1955. F. Wells Terwilliger, The Glacial Geology and Groundwater Resources of Van Buren County, Michigan, Occasional Papers for 1954 on the Geology of Michigan, Publication 43, Lansing, Mich.: Franklin DeKleine Company, 1954. 1954 Census of Agriculture for Michigan by Counties and Minor Civil Divisions (Townships), Michigan Agricultural Statistics, 1956.

APPENDIX TABLE 8*

SOUTHWEST MICHIGAN VINEYARD REGION
APPROXIMATE VINEYARD ACREAGE AND ASSOCIATED SOILS
(BY COUNTY AND TOWNSHIP IN EACH MAJOR AREA)

Paw Paw-Lawton Area

Van Buren County

Township	<u>Bellefontaine</u>		<u>Coloma</u>		<u>Fox</u>		<u>Plainfield</u>		<u>Others</u>		<u>Total</u>
	<u>Sandy Loam</u>	Per Cent	<u>Loamy Sand</u>	Per Cent	<u>Sandy Loam</u>	Per Cent	<u>Sand</u>	Per Cent	Acres	Per Cent	Acres
Almena	23.3	5.8	71.0	17.6	14.0	3.5	296.0	73.2	41.5	1.4	404.3
Antwerp	266.5	9.0	1,153.3	39.0	117.3	4.0	1,381.0	46.7			2,959.6
Decatur	52.0	18.7	36.0	12.9	10.0	3.6	180.0	64.7			278.0
Hamilton			21.0	10.7	109.5	55.7	53.5	27.2	12.5	6.4	196.5
Lawrence (east)	49.8	32.5			43.8	31.9			54.5	35.6	153.1
Paw Paw	44.5	2.8	89.8	5.6	916.3	56.8	298.5	18.5	265.5	16.4	1,614.6
Porter	538.8	31.9	418.8	24.8	127.0	7.5	503.5	29.8	99.0	5.9	1,637.1
Waverly	24.0	35.8	4.5	6.7	7.3	10.8	2.0	3.0	29.3	43.7	67.1
County Total	1,046.9	11.9	2,602.9	29.7	1,386.7	15.8	2,855.5	32.5	885.3	10.1	8,777.3

Kalamazoo County

Oshemo	48.0	15.9	189.5	62.7			36.0	11.9	28.5	9.4	302.0
Texas			619.0	55.5	36.5	3.3	105.0	9.4	354.5	31.8	1,115.0
County Total	48.0	3.4	808.5	57.1	36.5	2.6	141.0	10.0	383.0	27.0	1,417.0
AREA TOTAL	1,094.9	10.7	3,411.4	33.5	1,423.2	14.0	2,996.5	29.4	1,268.3	12.4	10,194.3

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APPENDIX TABLE 8 (continued)

St. Joseph-Benton Harbor Area

Berrien County

Township	<u>Bellefontaine</u>		<u>Coloma</u>		<u>Fox</u>		<u>Plainfield</u>		<u>Others</u>		<u>Total</u>
	<u>Sandy Loam</u>	<u>Per</u>	<u>Loamy Sand</u>	<u>Per</u>	<u>Sandy Loam</u>	<u>Per</u>	<u>Sand</u>	<u>Per</u>	Acres	Per	Acres
	Acres	Cent	Acres	Cent	Acres	Cent	Acres	Cent		Cent	
Bainbridge	77.8	7.7	925.3	91.4			9.0	0.9			1,012.1
Baroda	53.3	11.0	8.3	1.6			35.8	6.7	429.0	80.8	531.4
Benton	8.8	0.9	312.0	30.4	115.3	11.2	592.0	57.6			1,028.1
Berrien	253.3	42.9	139.0	23.1	159.5	26.5			45.0	7.5	601.8
Buchanan	5.8	11.1			19.3	37.2			26.8	51.7	51.9
Chikaming									165.3	67.4	245.1
Coloma	36.5	9.0	192.5	47.4	6.3	1.5	79.8	32.6	41.0	10.1	405.8
Hagar			131.3	18.8			129.5	31.9	77.8	11.2	697.1
Lake							483.0	70.0	247.0	49.4	499.5
Lincoln							252.5	50.6	835.8	63.6	1,315.1
Niles	45.3	23.5	27.3	14.1	64.3	33.3	12.5	6.5	43.5	22.6	1,192.9
Oronoko	131.3	22.2	5.0	0.8	44.3	7.5			412.0	69.5	592.6
Pipestone	103.3	29.2	127.0	34.2					110.5	28.8	371.1
Royalton	15.5	2.5			9.8	1.6	25.3	6.8	435.0	73.9	614.6
St. Joseph					3.0	1.0	104.3	17.0			314.5
Sodus	154.5	19.3	5.0	0.6	285.5	35.6	311.5	99.0	166.0	20.7	801.8
Watervliet	5.0	5.6	17.8	19.8			190.8	23.8	44.0	49.2	89.6
Weesaw	44.3	19.5					22.8	25.4	160.0	70.3	227.6
County Total	949.7	9.9	1,890.5	19.7	707.3	7.4	2,756.4	28.7	3,288.7	34.3	9,592.6

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APPENDIX TABLE 8 (continued)

St. Joseph-Benton Harbor Area (continued)

Van Buren County

Township	<u>Bellefontaine</u>		<u>Coloma</u>		<u>Fox</u>		<u>Plainfield</u>		<u>Others</u>		<u>Total</u>
	<u>Sandy Loam</u>	Per Cent	<u>Loamy Sand</u>	Per Cent	<u>Sandy Loam</u>	Per Cent	<u>Sand</u>	Per Cent	Acres	Per Cent	Acres
Arlington	11.3	14.6	39.8	51.6			8.3	11.0	26.0	33.8	77.1
Bangor	6.8	9.0	59.8	79.9			8.0	7.7	44.0	42.3	74.9
Covert			52.0	50.0			51.0	28.5	46.8	26.1	104.0
Hartford			81.5	45.5			74.5	12.3	153.5	26.2	179.3
Keeler	80.8	13.4	57.3	9.5	233.5	38.6	5.0	5.7			604.6
Lawrence (west)			82.5	94.3							87.5
County Total	93.9	3.8	372.9	33.1	233.5	20.7	146.8	13.0	275.3	24.4	1,127.4
AREA TOTAL	1,043.6	9.8	2,263.4	21.1	940.8	8.8	2,903.2	27.1	3,564.0	33.2	10,720.0
<u>REGION TOTAL</u>	2,143.5	10.2	5,674.8	27.1	2,364.0	11.3	5,899.7	28.2	4,832.3	23.1	20,914.3

*Agricultural Stabilization and Conservation Service aerial photographs, scale 1:7,920, 1955. U.S. Dept. of Agriculture Soil Survey maps, Berrien County, 1927, and Kalamazoo and Van Buren counties, 1926. 1954 Census of Agriculture for Michigan by Counties and Minor Civil Divisions (Townships), Michigan Agricultural Statistics, 1956.

Since the latest detailed soil survey of Cass County was published in 1906 and the soils classifications used did not correlate with those employed in surveys of Berrien, Kalamazoo and Van Buren counties made later, Cass County data were omitted from this table.

APPENDIX TABLE 9*

WINE AND JUICE PRODUCTION, 1850 - 1919 NATIONAL AND LEADING STATES (GALLONS)

	1850	1860	1870	1899	1909	1919
	Wine	Wine	Wine	Wine & Juice	Wine & Juice	Juice
United States	218,023	1,617,954	3,092,330	8,246,344	18,636,225	2,202,848
California	58,055	246,518	1,814,656	5,492,216	16,005,519	1,820,895
New York	9,172	61,407	82,607	290,365	346,953	45,320
Michigan	1,654	14,427	21,832	134,859	199,030	29,205
Ohio	48,207	568,617	212,912	350,615	264,213	36,071
Pennsylvania	25,590	38,621	97,165	194,610	106,756	11,803
Others	75,345	688,364	863,158	2,113,148	2,019,540	259,554

*Data for 1850 and 1860 from Eighth Census of the United States: 1860 (Agriculture of the United States, 1864), Vol. 1 pp. 186 and 190. Data for 1870 and 1899 from Twelfth Census of the United States, Agriculture: 1900 (Census Reports, 1902), Vol. VI, Part 2, pp. 14 and 619. Data for 1909 and 1919 from Fourteenth Census of the United States, Agriculture: 1920 (U.S. Dept. of Interior, Census Office, 1922), Vol. VI, Part 1, p. 62.

APPENDIX TABLE 10*

GRAPE DISPOSITION, 1941 - 1958
NATIONAL AND LEADING STATES
(TONS)

1941	Production	Used on Farm	Sold As Fresh Fruit	Sold For Other ¹ Uses
United States	2,727,500	34,270	626,077	1,208,869
California	2,547,000	3,300	565,700	1,120,000
New York	47,600	1,480	6,700	39,420
Michigan	26,700	1,750	9,493	15,457
Ohio	14,800	2,200	4,600	8,000
Pennsylvania	12,500	2,400	4,500	5,600
Others	78,900	23,140	34,084	20,392
1950				
United States	2,687,100	24,700	522,833	1,483,951
California	2,440,000	2,700	497,400	1,291,300
New York	95,800	1,400	6,700	85,500
Michigan	43,000	1,400	6,030	35,520
Ohio	19,100	2,400	2,500	14,200
Pennsylvania	30,900	1,930	920	26,800
Others	58,300	14,820	9,238	35,631
1954 (Prelim.)				
United States	2,569,400	20,010	541,365	1,309,825
California	2,329,000	9,710	521,600	1,107,000
New York	94,000	1,000	3,400	89,600
Michigan	46,000	1,080	4,970	39,950
Ohio	17,500	2,300	2,300	12,900
Pennsylvania	26,600	1,600	800	24,200
Others	56,300	4,320	8,795	36,175
1958 (Prelim.)				
United States	3,026,070	12,650	527,947	1,705,473
California	2,741,000	2,700	500,700	1,457,600
New York	100,600	600	4,000	95,940
Michigan	50,500	400	5,500	44,600
Ohio	20,000	720	3,760	15,520
Pennsylvania	29,000	700	900	27,400
Others	84,970	7,470	13,037	64,413

¹Mostly crushed for wine, brandy, and juices.

*Agricultural Statistics (U.S. Dept. of Agriculture, 1944) p. 176, (1952) p. 227, (1955) p. 172, (1959) p. 184.

APPENDIX TABLE 11*
MICHIGAN GRAPES
TONS PRODUCTION, AVERAGE PRICE PER TON, AND DISPOSITION, 1909 - 1959

Year	Production			Aver. Price Home /Ton Use	Disposition			
	Source One	Source Two	Source Three		Total Sold	Fresh	For Wine	For Juice
1909	60,300			4,810	55,490			
1910	33,800			4,170	29,630			
1911	64,300			5,030	59,270			
1912	59,300			4,870	54,430			
1913	41,800			4,360	37,440			
1914	62,100			4,980	57,120			
1915	31,800			3,870	27,930			
1916	37,700			4,150	33,550			
1917	42,900			4,430	38,470			
1918	37,200			4,290	32,910			
1919	57,900	57,936		4,830	53,070			
1920	64,200	63,960		5,000	59,200			
1921	26,200	26,330		3,700	22,500			
1922	67,100	68,365	63,750	5,430	61,670			
1923	57,000	59,800	44,000	5,030	51,970			
1924	58,600	60,005	51,000	5,030	53,570			
1925	21,800	21,485	22,100	3,400	18,400			
1926	67,900	64,805	60,900	5,230	62,670			
1927	47,500	44,030	51,700	4,880	42,640			
1928	67,200	61,565	72,800	4,970	62,230			
1929	66,200	58,911	69,000	4,610	61,590			
1930	73,000	64,495	66,400	4,760	68,240			
1931	63,300	56,750	57,270	4,550	58,750			
1932	77,900	71,220	71,220	4,980	72,920			
1933	62,200	58,565	58,562	4,320	57,880			
1934	63,900	63,900	61,145	5,000	58,900			
1935	55,800	58,500	56,810	4,120	51,680			
1936	34,600	38,700	38,700	2,610	31,990			
1937	55,000	67,200	67,200	3,660	48,540			

APPENDIX TABLE 11 (continued)

Year	Source One	Source Two	Source Three	Price /Ton	Home Use	Total Sold	Fresh	For Wine	For Juice	Frozen	Other
1938	12,800	16,900	16,900	50	2,250	10,550					
1939	40,600	58,100	58,100	31	3,080	37,520					12,940
1940	38,200	38,200	38,200	25	1,900	36,300	23,360				15,460
1941	26,700	26,700	26,700	45	1,750	24,950	9,490				19,300
1942	46,000	46,000	46,000	57	1,700	44,300	19,500				22,700
1943	42,400	42,400	42,400	88	1,800	40,600	13,100				14,000
1944	32,000	32,000	32,000	99	1,800	30,200	10,500				4,400
1945	13,500	13,500	13,500	138	1,120	12,380	3,780				12,400
1946	29,800	29,800	29,800	137	1,100	28,700	8,700				23,800
1947	41,100	41,100	41,100	88	1,100	40,000	13,450				14,700
1948	26,000	26,000	26,000	98	960	25,040	7,020				20,300
1949	32,000	32,000	32,000	101	1,050	30,950	5,860				21,100
1950	43,000	43,000	43,000	90	1,400	41,600	6,080				2,600
1951	10,000	10,000	10,000	95	500	9,500	2,890				70
1952	39,000	39,000	39,000	96	700	38,300	7,100				14,000
1953	49,000	49,000	49,000	103	700	48,300	6,100				31,600
1954	45,500	45,500	45,500	103	600	44,900	4,900				28,600
1955	23,500	23,500	23,500	95	400	23,100	2,800				13,600
1956	60,500	60,500	60,500	80	500	60,000	8,400				34,700
1957	48,000	48,000	48,000	79	400	47,600	7,900				28,300
1958	50,500	50,500	50,500	100	400	50,100	5,500				31,900
1959 (Prelim.)	57,000	57,000	57,000	115	400	56,600	4,800				34,500

*Shown as 1924 = \$57 and 1925 = \$90 in Fruits (Non-citrus): Production, Farm Disposition, Value, and Utilization of Sales, 1889-1944 (Washington, D.C., May 1948).

¹October 15 prices prior to 1926.

²Wine and other, computed by subtracting "Juice" figures in Michigan Agricultural Statistics, 1959, from "Wine, Brandy, and Juices, Etc." figures in Agricultural Statistics, U.S. Dept. of Agriculture, 1955-1959.

Source One-Production, Home Use, & Total Sold, 1909-1944 from Fruits (Non-citrus): Production, Farm Disposition, Value, and Utilization of Sales, 1889-1944, (Washington, D.C., May 1948).

Source Two-Production and Aver. Price/Ton, 1919-1939 from Annual Crop Summary, Michigan Crop Report, 1934, p. 27; and 1939, p. 31. Production and Disposition, 1940-1959 from Michigan Agricultural Statistics, 1953, p. 31; 1956, p. 17; and 1960, p. 23.

Source Three-Production and Aver. Price/Ton, 1933-1959 from Agricultural Statistics, U.S. Dept. of Agriculture, 1936-1960.

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