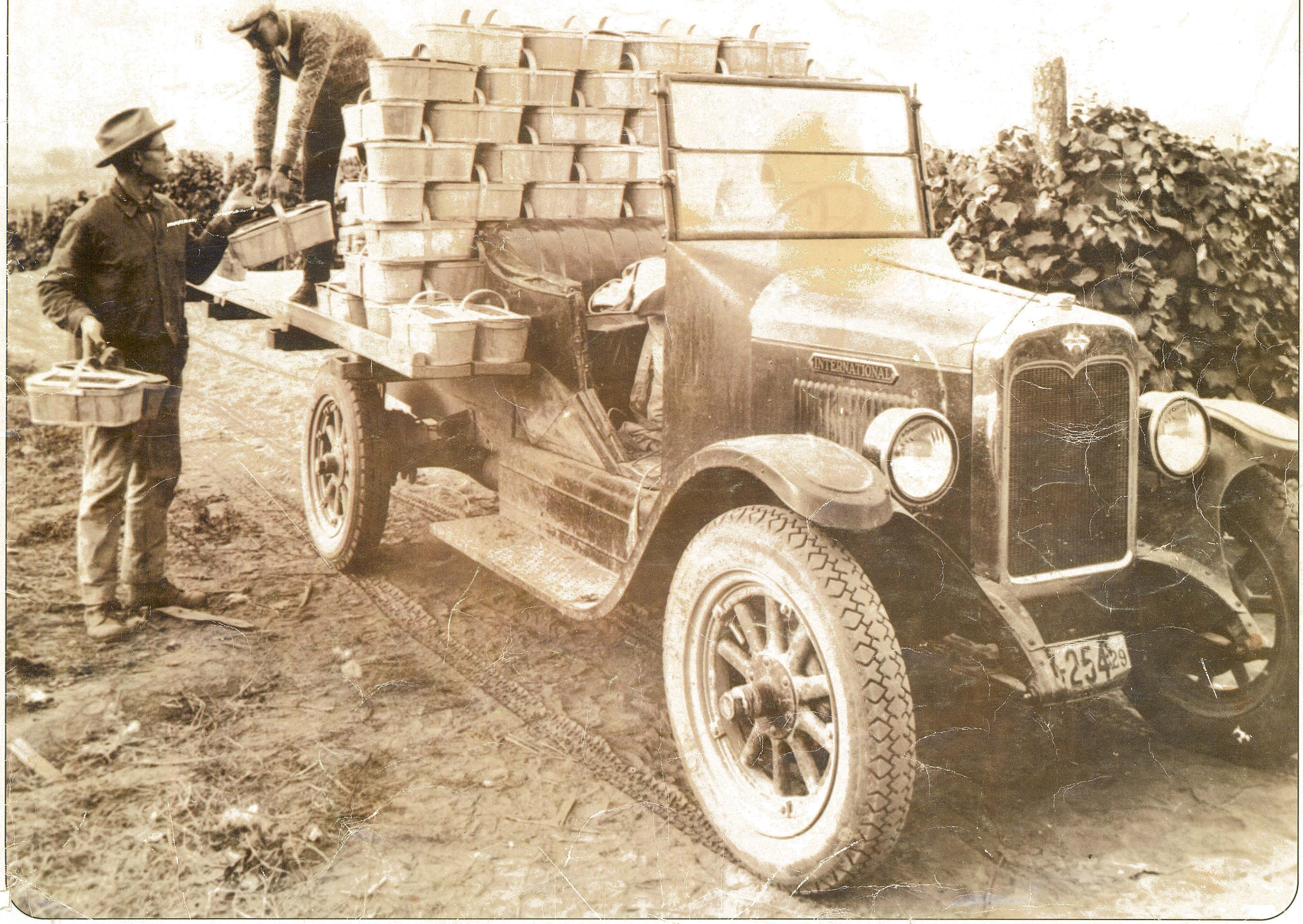
ATLAS OF SUITABLE GRAPE GROWING LOCATIONS

IN THE OKANAGAN AND SIMILKAMEEN VALLEYS OF BRITISH COLUMBIA



HI[illegible]TORI[illegible]AL PHOTO 1929. J.W. Hughes and Bill Yokum (on truck)

Agriculture
Canada

ATLAS OF SUITABLE GRAPE GROWING LOCATIONS

IN THE OKANAGAN AND SIMILKAMEEN VALLEYS OF BRITISH COLUMBIA

ASSOCIATION OF BRITISH COLUMBIA
GRAPE GROWERS

KELOWNA
1984

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INTRODUCTION

The purpose of this Atlas is to identify land areas in the Okanagan and Similkameen Valleys of British Columbia that have a growing season climate (excludes winter months) and soil characteristics suitable for grape production.

This information is presented through the use of diagrams, maps, tables and written information. Users are encouraged to read all of the narratives before referring to the maps. These narratives outline important details that may not be presented elsewhere.

No specific recommendations for cultural or management practices are made in this atlas, but broad comments are made that could influence some climate or soil conditions. Users who wish specific recommendations are advised to refer to other publications. Local representatives of the British Columbia Ministry of Agriculture and Food are available for consultation on specific farm management decisions. British Columbia Ministry of Environment, Fish and Wildlife officers are available for consultation regarding the probabilities of wildlife conflicts in areas where overwintering ranges for deer or other wildlife exist. These conflict areas exist on all lower slopes and terraces, particularly those with southern or south-western exposures.

A glossary is provided to help users understand some of the terminology that is used. A list of references is also provided.

The Atlas provides information in several sections, each dealing with a particular theme. The section on climate deals with themes on solar radiation, growing degree days, autumn freeze risk and winter damage. This information is presented as maps, tables, diagrams and in written form. Tables are designed to permit users to calculate the risk of certain events. Winter damage to vines and low winter temperatures have historically been erratic. Damage to vines during the winter months has also been influenced by adverse management practices. A map of winter damage was not developed for these reasons. A tabular presentation of winter temperature risk for various areas is presented instead.

The section on soils deals with themes of soil development, glaciation, soil properties and soil groups. Soil maps in the atlas were produced by grouping soils with physically similar characteristics. These soil groups are presented in tabular form. Some diversification within these groupings can be expected. These maps are therefore not a substitute for proper soil sampling and analysis. Management practices that could alter the classification placed on a soil were discussed but have not been taken into consideration in these classifications. Detailed soil maps for the atlas area are available from the British Columbia Ministry of Environment.

The section on grape production deals with historical and current trends, and provides information on grape varieties and sites suitable for grape production. Tables and maps are used to present this information. The grape variety suitability table is not complete as many varieties are still under evaluation. It does, however, identify suitable areas for many commercial varieties at the time of publication.

The site suitability maps were developed by overlaying all the climate and soil themes. Boundaries in some map units may at times appear abrupt as a result of this procedure. These maps are not a substitute for sound reasoning and observation. They are a guideline to site selection. The scale of mapping used (1:50,000) allows for a fairly detailed presentation of topography. However, the scale is too small to allow detailed analysis of climate and soil for each farm parcel. Individual farms have variations in soil, topography, aspect, elevation and vine training.

In this map area, much still needs to be learned about the environmental influences on grape production. The choice of a proper site, together with suitable varieties is a decisive question for grape growers. This atlas will provide assistance in that important decision.

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1. HISTORICAL PROGRESSION

Grape plants have been grown in many areas of British Columbia. Early explorers and settlers brought grape plants or cuttings with them, or imported grape varieties from other countries.

The development of a grape growing industry in British Columbia during the 1930's to the 1950's was centered in the Fraser Valley and Okanagan Valley. Grape production has since declined in the Fraser Valley and expanded in the Atlas area.

Within this area, the earliest record of a serious attempt at grape production appears to have been made in 1907 by Mr. W.J. Wilcox of Salmon Arm. The Wilcox planting consisted of 0.3 hectares (3/4 acre) of North American varieties such as Concord, Campbell's Early, Moore's Worden, Niagara, Green Mountain, White Diamond, Brighton and Delaware. Some of these varieties, and others planted in 1928, have suffered damage from cold winters. Some recovered and are still in production today.

Many different types of grape varieties were planted during these early years. Most were planted without any advice of suitability for the area, markets or winter hardiness. Consequently, a wide range of varieties were grown, based on whatever was grown elsewhere, such as Eastern Canada, United States or Europe. Many plantings failed due to a lack of irrigation, unfavourable climate or unfavourable soils. These areas have, over the years, reverted to other land uses. Valley bottoms, for example, developed into dairy, forage or vegetable growing areas.

The first successful large vineyards were planted in the Kelowna area by Mr. J.W. Hughes in 1926, with cuttings he obtained from the Wilcox planting and others. Mr. Hughes also planted a vineyard on Black Mountain, near Kelowna. This planting later failed. By 1930, he had planted 49 hectares (125 acres). Another 29.5 hectares (75 acres) were planted in 1939. Other people, also, planted grapes. They were generally small acreages. Many of these depended on Mr. Hughes to market their crop.

Amongst those others were brothers, Virgil J. and Eugene A. Rittich who brought 40 grape varieties from Europe. After 10 years of evaluations of these and other varieties on Black Mountain and in the Ellison area near Kelowna, they recommended the planting of Perle of Csaba, Muscat Ottonel, Riesling, Sylvaner, Muscat Ferdinand de Lessepe, Blue and White Burgunder, Siebel 5279, White and Red Chasselas, Sylvaner and Excellent. Of these, Perle of Csaba, Muscat Ottonel and Siebel 5279 (now know as Aurora) are still grown in small quantities in the area today.

A small planting was established by Mr. E. Rittich at the home of Mr. J. Renyi in Oliver in 1936. It is believed that Okanagan Riesling spread to the existing grape industry from that planting. Still another planting was made in Vernon, at the farm of Mr. Norley F. Tunbridge. This planting apparently did not do well and was removed.

Through the efforts of pioneers such as Mr. J.W. Hughes, the Rittich brothers and others, grape acreage gradually increased. Extensive experimentation at the Agriculture Canada Research Station at Summerland (known as the Dominion Experimental Farm at that time) fostered the development of the fledgling industry. By 1947 the station had tested 112 grape varieties. Most of them were eliminated because of tenderness or extreme susceptibility to powdery mildew. Some of them were:

Black Burgundy
Black Hamburg
Black Muscat
Cabernet Sauvignon
Excellent (Ezerjo)
Furmint

Gewurztraminer
Muscat F. de Lessepe
Muscat Angevine
Rauschling
Ribier
Semillon

Thompson Seedless
Tinta Madeira
Valdepenas
Vergennes
Yates

Varieties that were recommended for planting at that time included the following:

Table 1
Early Varieties

Home Use	Restricted Commerical Or Winery	General Use
Agawam	Blue Burgunder (Blau Frankisch)	Campbell Early
Beta	Clinton	Concord
Clinton	Delaware	Delaware
Delaware	White Diamond	Patricia
Eden	Golden Chasselas	Sheridan
Herbert	Niagara	
Ontario	Ontario	
Pearl of Csaba	Pearl of Csaba	
Sheridan	Siebel 5279	
	Sheridan	
	White Burgunder	

Interest in wine grapes grew in the 1930's because:

1) two commercial wineries requested grapes for wine making;
2) there were adverse market conditions for apples;
3) of expectations of stable markets for grapes;
4) of early production, lower levels of management required when compared to tree fruit production;
5) of development of superior varieties;
6) of potential for mechanical harvesting.

Slowly, but gradually, during the latter part of the 1950's, experimentation again began with non traditional varieties. Word from Ontario about French Hybrids, suitable for colder areas and resistant to disease, encouragd several grape growers and researchers to import small quantities of many such varieties.

By 1952, there were 120 hectares (425 acres) of vineyards in the Okanagan, mostly around Kelowna. Varieties planted were still the native North American types, mainly because the more difficult to grow European grapes were not winter hardy, were more prone to disease, cost more to produce and were valued at the same price as hardier and disease resistant varieties such as White Diamond and Campbell Early.

By 1959, word spread that these varieties produced good wine. Several plantings were made at Cawston, Westbank, Summerland and Kelowna. In 1964, the climatic potential of the Oliver area was tested with the planting of the first of what would become a succession of large vineyards located on very sandy soil. Grape area by 1966 totalled 753 hectares (1,912 acres). Of this, 280 hectares (711 acres) were more than four years old. The grape industry had entered a period of consolidation when new acreages were just coming into production and present and prospective growers were assessing the success of their ventures from current vineyard performance before expanding grape production. By 1974, the total grape plantings had increased to 1241 hectares (3,066 acres). The planting of grape varieties during this period proliferated and retracted. Since 1974 there has been a resurgence of interest in newer grape varieties. Attempts to grow European type grapes from California have been unsuccessful in this area. Despite this historical knowledge, attempts are continually made to grow such grapes. Promotion of the V. vinifera species in 1974 led to large importations of various varieties of this species from California and Washington. Most of these plantings were killed in the winter of 1978-79. Several hybrid grape plantings were severely damaged during this winter. They have recovered or were replanted and are in production again today. The planting of north European selections of V. vinifera has taken place after 1978. Some of these selections appear to have promise, but the absence of a cold winter since 1979 has prevented the evaluation of their hardiness. Such winters have historically occurred approximately every seven years (1894, 1909, 1915-16, 1924-1925, 1930-31, 1935-36, 1949-50, 1955-56, 1964-65, 1968-69, 1972-73, 1978-79). Site selection, management practices and variety selection have proven to be the key to winter survival. Despite these severe winters, the interest in grape production has continued to grow.

Table 2
Total Hectares (Acres) of Grapes Planted
in the Okanagan and Similkameen Valleys

Year	Hectares	(Acreage)
1952	172	(425)
1964	480	(1,187)
1970	977	(2,414)
1972	1,093	(2,702)
1974	1,241	(3,066)
1979	1,310	(3,236)
1982	1,223	(3,022)

1.1 CURRENT AND FUTURE PROSPECTS

The 1980's should be a period of extensive varietal experimentation followed by a period of sorting and evaluation. New and improved wine making and fresh market grape varieties have been produced through a breeding program at the Agriculture Canada Research Station at Summerland. These varieties, as well as ones from evaluation plantings consisting of imported north European varieties, new French hybrids, varieties from the breeding program of the Ontario Ministry of Agriculture and Food and from the United States will eventually form a base for the continued growth in the commercial grape industry. With these new varieties will come the technological innovations, improved cultural practices and better pest control methods that will all contribute greatly to successful vineyard operations. Productivity has increased from historical yields (1952-1970) of 10.64 tonnes/h (4.75 tons/ac) to 11.04 tonnes/h (4.93 tons/ac) during 1970-1978.

Table 3
Average Production per Hectare (Ton/Acre)
in the Okanagan and Similkameen Valleys

District	1970	1972	1974	1978	Average
	Tonnes per hectare (Tons/Acre)				
Winfield North	16 (7)	5 (2)	6 (3)	11 (5)	9 (4)
Kelowna	11 (5)	11 (5)	19 (9)	19 (9)	15 (7)
Westbank	15 (7)	7 (3)	9 (4)	13 (6)	11 (5)
Peachland, Summerland	10 (5)	10 (4)	9 (4)	9 (4)	9 (4)
Penticton, Naramata, Okanagan Falls and Similkameen Valley	6 (3)	11 (5)	13 (6)	15 (7)	11 (5)
Oliver-Osoyoos	5 (2)	12 (6)	9 (4)	15 (6)	10 (5)
Averages	10.5(4.8)	9.3(4.2)	10.8(5)	13.7(6.2)	10.8(5)

Production techniques involving trellising, irrigation and cultural practices are in a stage of change. Traditional Kniffen trellising (two and three wire) has been replaced largely by the more productive T-Bar system. Newer trellising methods specifically designed for vigorous grape varieties hold promise of greater yields while varieties suitable for cordon training and the European loop system respond by increasing yields when they are trained to these systems. These productivity gains will have beneficial effects on the high costs of grape growing.

Grape production records are available from the year 1930 onwards. In that year, 122 tonnes (136 tons) of grapes were produced. The largest tonnage between 1930 and 1961 was produced in 1944 and amounted to 1469 tonnes (1,632 tons). The period between 1944 and 1960 had an average production of 605 tonnes (675 tons), with the exception of 1956, when only 195 tonnes (217 tons) were produced. By 1950, only 60 percent of the total crop was sold as fresh fruit. This percentage declined further to 39 percent by 1959, a reflection of the growing demand for grapes by British Columbia wineries at that time, and the competitive returns provided by the two existing markets. Production since 1960 is presented in Table 4, additional information pertaining to grape varieties, grape producing areas and types of grapes planted are presented in Tables 5, 6, 7 and 8.

Table 4
Total Grape Production in the
Okanagan and Similkameen Valleys

Year	Tonnes	Tons	Value $	% of Total Crop Sold As: Fresh Fruit	% of Total Crop Sold As: Fruit For Processing
1960	598	(634)	80,535	33	67
1961	1,605	(1,783)	261,850	21	79
1962	1,498	(1,665)	238,007	36	64
1963	1,845	(2,050)	251,500	8	92
1964	2,583	(2,870)	372,933	10	90
1965	167	(185)	26,280	14	86
1966	2,701	(3,001)	396,510	11	89
1967	3,359	(3,733)	525,778	13	87
1968	5,546	(6,162)	835,294	8	92
1969	1,543	(1,714)	242,038	6	94
1970	8,134	(9,038)	1,481,118	5	95
1971	8,197	(9,107)	1,568,428	6	94
1972	9,025	(10,028)	2,042,441	6	94
1973	5,764	(6,404)	1,428,694	11	89
1974	10,928	(12,142)	3,383,315	6	94
1975	11,300	(12,589)	3,952,765	7	93
1976	11,410	(12,678)	3,735,077	8	92
1977	10,542	(11,713)	3,859,583	11	89
1978	16,564	(18,404)	6,410,062	6	94
1979	9,393	(10,437)	4,307,116	9	91
1980	12,379	(13,755)	6,335,157	6	94
1981	10,507	(11,674)	5,808,468	6	94
1982	14,066	(15,629)	8,699,838	4	96

Table 5
The 12 Most Important Grape Varieties
(and Groupings) Produced in the Okanagan
and Similkameen Valleys in 1982

Variety	Type of Grape	Color	% of Total Production	% of Total Hectares (Acreage)
Marshall Foch	Hybrid	Blue	25	19
De Chaunac (S-9549)	Hybrid	Blue	22	16
Okanagan Riesling	unknown	White	21	25
Verdelet (S-9110)	Hybrid	White	5	8
Rougeon (S-5898)	Hybrid	Blue	5	4
White Diamond	V. labrusca	White	4	6
Fresh Market	V. labrusca	Blue	4	1.5
Johannisberg Riesling	V. vinifera	White	2	3
Chelois (S-10878)	Hybrid	Blue	1.5	2
Rosette (S-1000)	Hybrid	Blue	1.5	1
Bath	Hybrid	Blue	1.3	1
Ehrenfelser	V. vinifera	White	1	1.5

Table 6
Some of the Less Important Grape Varieties
Produced in the Okanagan and
Similkameen Valleys in 1982

Variety	Type of Grape	Color	% of Total Production	% of Total Hectares (Acreage)
Delaware	Hybrid	Pink	0.7	1
Chancellor (S-7053)	Hybrid	Blue	0.6	1
Aurora (S-5279)	Hybrid	White	0.6	1
Baco Noir	Hybrid	Blue	0.5	1
Himrod	Hybrid	White	0.5	1
Gewurztraminer	V. vinifera	Pink	0.3	1
Chenin Blanc	V. vinifera	White	0.3	1
All others			3.5	6

Table 7
Percentages of Grape Production by District

District	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Oliver-Osoyoos	42	38	38	27	36	42	44	43	27	33	33	38
Penticton, Naramata, Okanagan Falls and Similkameen Valley	4	8	2	6	5	9	7	8	7	7	8	8
Summerland, Peachland	4	4	4	4	5	4	3	3	3	3	4	4
Westbank	9	12	17	15	14	12	10	11	16	14	12	12
Kelowna	39	35	33	45	34	28	31	31	40	37	35	30
Winfield North	2	3	6	3	6	5	5	4	7	6	8	8

Table 8
Total Grape Area Planted and the Percentage
of Area Occupied by Type of Grape

Grape Type	1974 Total Hectares (Acreage)	1974 Percent of Total	1979 Total Hectares (Acreage)	1979 Percent of Total	1982 Total Hectares (Acreage)	1982 Percent of Total
Direct Producers (French Hybrids)	618(1,527)	50	677(1,673)	52	668(1,650)	55
Other Hybrids	355 (878)	28	320 (792)	24	305 (753)	24
V. labrusca	250 (618)	20	191 (473)	15	168 (415)	14
V. vinifera	18 (44)	2	121 (298)	9	82 (204)	7
TOTAL:	1,241(3,067)	100	1,309(3,236)	100	1,223(3,022)	100

1.2 VINEYARD ESTABLISHMENT AND PRODUCTION COST

Establishment and production costs of a commercial vineyard are always difficult to determine. The availability and cost of suitable land on suitable sites, equipment, supplies and interest charges make grape growing a high cost enterprise. Influences of market demand for specific varieties changes, as does the technology of vine spacing, trellising, cultural practices and pest control. These factors together with uncertainty produced by climate, also contribute to make grape growing a high risk enterprise.

Studies in 1982 show that the cash cost of establishing a vineyard of this size in 3 years range from $107,092 to $180,497 and maintenance cost for such a vineyard range from $30,875 to $31,544. Breakdown of these costs are given in Table 9.

Table 9
Relative Cost of Various Items that affect
the Accumulated Costs of Establishing and
Maintaining a Mature 8.7 Hectares
(21.5 Acre) Vineyard

Items	Approximate Percentage of Total Cash Cost: Establishment	Production
Fertilizer	1	0.5 - 1.4
Plants	6 - 15	-
Fungicide	1 - 2	- 3.0
Water	1 - 2	1.5 2.0
Machine rental	1 - 2	7 - 0.1
Other supply and services (trellis, material, harvest cost)	10 - 13	0.1 - 0.5
Tractor operating cost	4 - 5	- 5.0
Machinery operating cost	4 - 5	4.0 - 4.5
Hired labour	12 - 13	- 10.0
Cash overhead (insurance, telephone, electric power, accounting)	2 - 2	2.5
Marketing fee	0.5	1
Custom work	2	10 - 13
Total cash cost	50 - 60	40 - 45

Additional costs to consider are interest on operating capital, depreciation (building, equipment), interest on investment and operator labour value.

The major pieces of equipment used on the average 8.7 hectares (21.5 acre) vineyard are listed in Table 10.

Table 10
Costs of Equipment and Buildings

		Approximate Cost (New - 1982)
1.	Tractor - 50 H.P. (Diesel)	$16,400
2.	Front end loader and forks	3,300
3.	Disc - seven foot	1,500
4.	Cultivator - seven foot	700
5.	Grape hoe	5,000
6.	Fertilizer spreader	900
7.	Sprayer - 100 gallons	4,200
8.	Irrigation system	33,000
9.	Truck - 1.2 ton (used)	7,600
10.	Grape trimmer	1,500
11.	Rear fork lift	200
12.	Bird alarm	900
13.	Pruning sweep	400
14.	Small tools and equipment	1,020
15.	Storage shed (1,000 square feet)	8,100

Other equipment that could be used from time to time include tractor mounted soil auger, post pounder, wire reel or compressors. These pieces of equipment, as well as the ones listed above, may be rented or could be used on a custom basis. The hours of actual use of any piece of equipment is a factor considered whether it is rented or purchased.

1.3 GRAPE MARKETING

The marketing of grapes involves several distinctly different marketing systems. In this presentation, the added value of the grapes as they move through the marketing channels is not taken into consideration.

Most of the grapes produced in the Okanagan and Similkameen Valleys are purchased by wineries located in British Columbia. The marketing of these grapes is governed by the actions of agencies such as the Association of British Columbia Grape Growers, Grape Marketing Board, Grape and Wine Institute, Provincial Ministries of Consumer and Corporate Affairs and Agriculture and Food.

The Grape Marketing Board came into existence in 1970, after a plebiscite by established grape growers requested its formation under the Natural Products Marketing (British Columbia) Act. The Board derived its' powers as a marketing board through this act and the British Columbia Grape Marketing Scheme. Prior to the Board's formation, wineries negotiated directly with producers for their grapes. Increased demand for wine, and a demand for higher grape prices, led to the formation of the Grape Marketing Board.

Under this marketing system, any person who owns three acres or more of grapes that are offered for sale to wineries must register with the Grape Marketing Board. Any winery that offers to buy grapes must buy grapes only from producers who are registered with the Marketing Board. The Board issues, to registered producers, a license to sell grapes to wineries. The Board establishes the prices that are paid for grapes on a per ton basis, and a quality standard that is based on the soluble solids content of grapes in the field, through a negotiating process with wineries.

Membership on the Board consists of five grape growers elected by registered producers. Appeals to a decision of the Board may be made to the British Columbia Marketing Board. This Board consists of five members appointed by the British Columbia Ministry of Agriculture and Food. These members do not include grape growers or winery representatives, but may include representation from other agricultural or non agricultural backgrounds.

The Ministry of Consumer and Corporate Affairs, through its regulatory authority, and the Ministry of Agriculture and Food, through it's Legislative authority and it's extension and research programs, have established policies of support for the development of both the wine and grape producing industries in the province.

The Ministry of Consumer and Corporate Affairs regulates the importation of grape production shortfalls by grape growers and regulates the marketing of all alcoholic products. The total capacity of wineries in British Columbia is given in Table 11.

Table 11
Wineries in British Columbia and their
Total Capacity in Gallons (1983)

	Winery	Total Capacity (1983)
1.	Andres Wines Ltd.	2,600,000
2.	Brights' Wines Ltd.	800,000
3.	Calona Wines Ltd.	4,600,000
4.	Casabello Wines Ltd.	2,400,000
5.	Claremont Estate Wines	60,000
6.	Devino Estate Wines	40,000
7.	Gray Monk Estate Wines	16,000
8.	Mission Hill Vineyards Ltd.	600,000
9.	Beaupre Wines	120,000
10.	St. Michelle Wines (Jordan Cellars)	4,000,000
11.	Sumac Ridge Estate Wines	40,000
12.	Uniacke Estate Wines	17,000

Marketing of British Columbia table grapes is less complicated. Prior to the existing fresh grape marketing system, fresh grapes were marketed directly from vineyards to retailers, via brokerage firms in larger centers. Grapes were sold in British Columbia, Alberta, Saskatchewan and Manitoba in six quart baskets. Shipments were made by railway. More recently, the Association of British Columbia Grape Growers, through its Basket Committee, organizes the harvest; the delivery of packaged baskets to centrally located tree fruit packing houses and the payment for these grapes via British Columbia Tree Fruits Ltd. Sales of grapes and the delivery to market are a responsibility assigned to this latter agency. A pooling system exists, whereby the returns paid for grapes and costs incurred in marketing are considered before payment to producers is made.

The marketing system for fresh grapes is not controlled by the Grape Marketing Board and sales via British Columbia Tree Fruits Ltd. are on a voluntary basis. Direct marketing from vineyards to retailers and wholesalers can still take place.

Harvest costs and changing consumer demand have resulted in a sharp reduction of the quantities of grapes sold on this market. Table grapes traditionally require careful hand harvesting and expensive packaging. Consumer demand for green, seedless V. vinifera grapes which enter the province duty free, and at relatively low prices, have changed the markets for traditional varieties such as Concord, Campbell Early and Sheridan. The choice of grape varieties available to the producers, to compete on this market has not been satisfactory. New varieties now under evaluation appear to have some promise, but without renewed interest by table grape producers, it is doubtful that the large quantities sold in the past through this channel will be reached again.

2. CLIMATE

2.1 MECHANISMS AFFECTING THE MACROCLIMATE OF THE OKANAGAN AND SIMILKAMEEN VALLEYS

The climate in the Okanagan and Similkameen Valleys is governed by the region's location in the lee of the Coast Mountain Range. These mountains, with peaks to over 2450 metres (8 000 ft), are extremely effective at removing moisture from the precipitation bearing westerly winds through orographic lifting of the air mass, resulting in a wet mild climate west of the Coast Range. In the lee of the Coast Mountains, a rain shadow effect is produced and cloud and precipitation amounts are decreased, sunshine is increased, humidities are lowered and the range of seasonal temperature is greater than on the windward side.

During the winter months the predominantly westerly upper air flow (Figure 1) contains weak weather systems which produce light rain or snow in the interior valleys. Occasionally, severe outbreaks of arctic air penetrate into the Okanagan and Similkameen Valleys reducing minimum temperatures below -25°C. Heavy snowfall often occurs as these cold air masses are replaced by more moist and mild Pacific air masses.

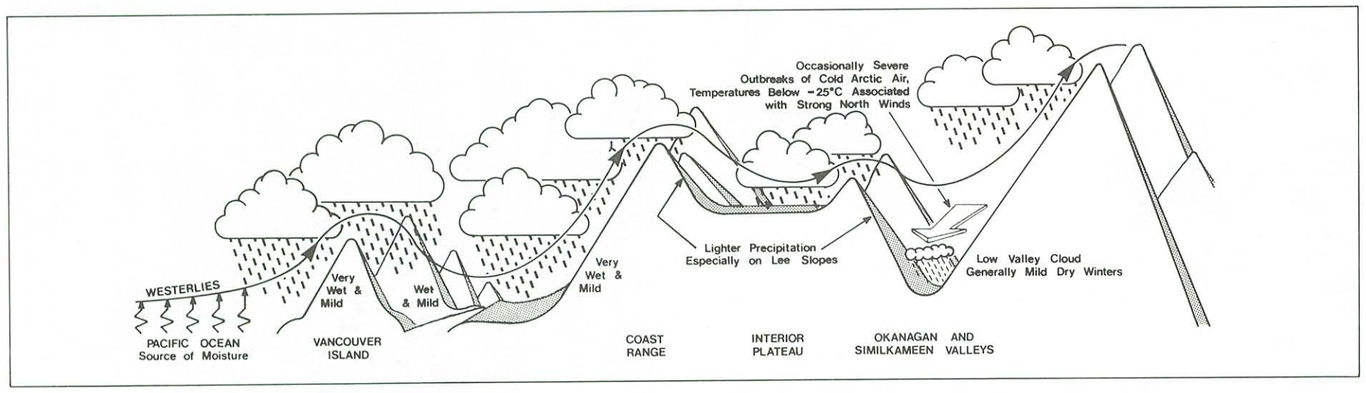

Figure 1 Typical Winter Weather Patterns in Southern British Columbia

Summer months in the study area are dry and warm with precipitation usually in the form of brief showers or thunderstorms (Figure 2). June is the wettest month while July, August and September are usually dominated by a high pressure ridge which produces warm and dry conditions over the interior. Brief, very hot periods occur when modified dry continental tropical air invades the area from the desert region of the southwestern United States (Kendrew and Kerr, 1955) often raising temperatures to 35°C or more.

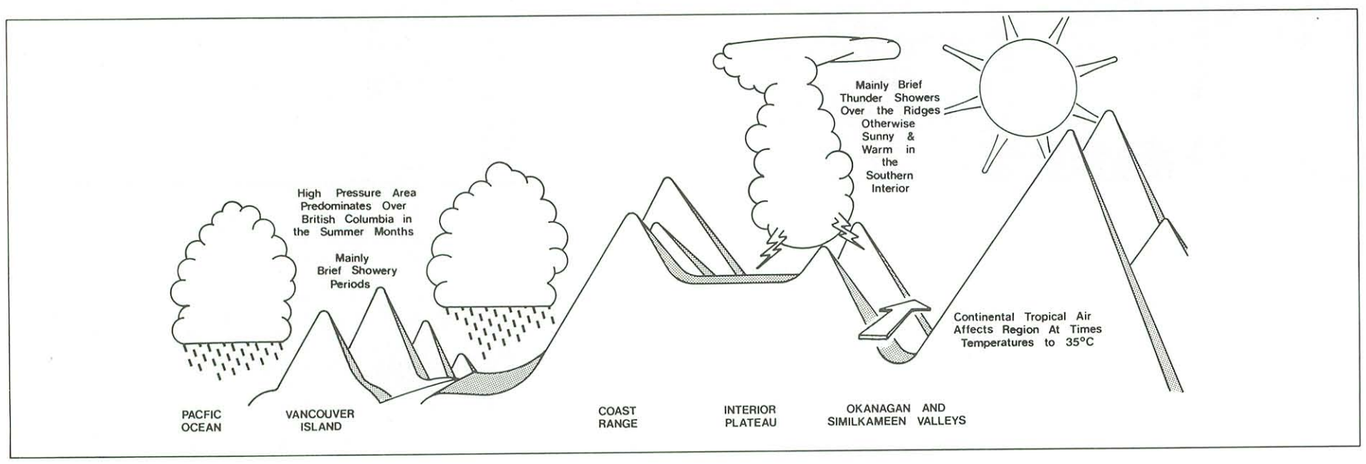

Figure 2 Typical Summer Weather Patterns in Southern British Columbia

Climatological data for selected stations in the Okanagan and Similkameen Valleys are included in Appendix A.

2.2 SOLAR RADIATION

The growing of grapes requires careful consideration of the microclimate of the selected location. Growing conditions are determined largely by the solar radiation received at a site. The sun is the primary energy source for practically all physical and biological processes on earth. Solar radiation has a direct effect on air and soil temperature, transpiration, soil moisture, atmospheric humidity, photosynthesis, and photostimulus processes such as heliotropism, elongation, flowering, etc.

Solar radiation intensity influences the level of soluble solids in grapes. When inadequate solar radiation conditions occur, due to cloudy weather, desirable sugar values may not be reached. Growers can compensate for low solar radiation intensity to some degree by thinning to give a higher ratio of leaves to fruit, and through the use of trellis designs which allow maximum light penetration into the vines.

The amount of solar radiation received at a site varies widely with slope and aspect, particularly in hilly or mountainous areas. Figure 3 illustrates the large variation of total growing season solar radiation at Summerland with slope and aspect. The total growing season solar radiation is the sum of solar radiation, in megajoules per square metre (MJ/m^2), received over the period from April 1 to October 31 (i.e. 1 MJ/m^2 = 8.81 BTU/ft^2). As can be seen from this figure, the greatest amount of solar radiation over the growing season is received on 20° to 40° south-facing slopes. Steep north-facing slopes receive considerably less radiation, while east and west slopes receive an intermediate amount. In general, westerly facing slopes will be warmer than their easterly facing counterparts. This occurs because energy received in the morning is often used to evaporate dew as opposed to heating the air or soil. Within a particular area, warmer air and soil temperatures will occur on southerly and southwesterly sloping sites.

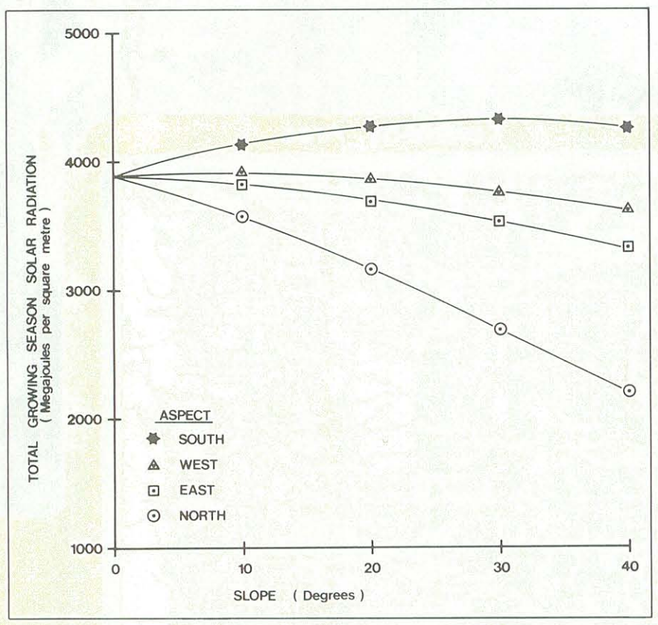

Figure 3 Total Growing Season Solar Radiation (MJ/m^2) at Summerland as a Function of Slope and Aspect

Topographic shading of direct solar radiation from adjacent mountains or hills is a factor to consider when selecting a vineyard site. Sites which are shaded for substantial periods, particularly from the afternoon sun should be avoided.

The solar radiation mapping was produced by applying solar radiation information from Hay (1979) to slope and aspect units delineated on 1:50 000 scale topographic maps.

Four solar radiation classes were developed as follows:

Class	Solar Radiation (MJ/m^2)	Rating
1	4000 and above	Most suitable
2	3600 to 3999	Good suitability
3	3200 to 3599	Fair suitability
4	Less than 3200	Questionable suitability

The area of the Okanagan Valley north of Okanagan Falls to Peachland was mapped using Summerland solar radiation on slopes data. Data from Mount Kobau were used to map the area south of Okanagan Falls including the Similkameen Valley. The portion of the study area from Westbank north was mapped using estimated data derived from Summerland solar radiation information and sunshine data from Kelowna Airport. Total growing season solar radiation for a horizontal surface at Mount Kobau is 4108 MJ/m^2 compared to 3897 MJ/m^2 at Summerland and an estimated 3551 MJ/m^2 at Kelowna, indicating the general solar radiation gradient in the area due to increasing cloudiness from south to north. This reduction in solar energy may result in less suitable environments for grapes when proceeding from south to north through the study area. For example, a 10°north-facing slope in the Similkameen would be rated as Class 2 while the same slope in the Summerland area would be rated as Class 3. Detailed solar radiation data are presented in Tables 12 to 14.

Table 12
Seasonal (April to October) Solar Radiation on Inclined Surfaces at Mt. Kobau (MJ/m^2)

SLOPE (DEGREES)	ASPECT							
	N	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
10	3774	3827	4029	4241	4349	4309	4125	3898
20	3352	3477	3902	4304	4493	4429	4080	3617
30	2862	3087	3742	4292	4533	4463	3984	3274
40	2354	2701	3556	4196	4475	4406	3844	2924
50	1848	2357	3342	4032	4310	4266	3660	2598
60	1420	2066	3102	3780	4042	4030	3436	2308
Horizontal Surface = 4108								

Table 13
Seasonal (April to October) Solar Radiation on Inclined Surfaces at Summerland (MJ/m^2)

SLOPE (DEGREES)	ASPECT							
	N	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
10	3570	3624	3818	4025	4132	4089	3907	3689
20	3162	3282	3687	4082	4273	4202	3856	3406
30	2689	2900	3520	4064	4314	4233	3755	3074
40	2200	2520	3328	3965	4259	4174	3609	2729
50	1716	2183	3109	3799	4103	4037	3421	2406
60	1308	1899	2868	3549	3848	3806	3192	2117
Horizontal Surface = 3897								

Table 14
Seasonal (April to October) Solar Radiation on Inclined Surfaces at Kelowna (MJ/m^2)

SLOPE (DEGREES)	ASPECT							
	N	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
10	3254	3302	3479	3668	3766	3726	3560	3362
20	2881	2991	3360	3719	3894	3829	3514	3104
30	2450	2643	3208	3703	3931	3857	3422	2800
40	2004	2296	3032	3613	3881	3803	3289	2486
50	1563	1989	2832	3462	3739	3678	3117	2192
60	1192	1730	2613	3234	3507	3469	2908	1929
Horizontal Surface = 3551								

In the Similkameen and the south Okanagan most agricultural lands fall into Class 1. Only steep northerly facing slopes (>25° slope) fall into Class 4. North of Okanagan Falls the majority of agricultural lands fall into Class 2 with only southerly facing slopes falling into Class 1. Steep northerly facing slopes fall into Class 4 while moderate northerly facing slopes fall into Class 3. Generally, slope and aspect configuration becomes more critical to the microclimatic suitability for grapes in the north and central Okanagan than in the south Okanagan and Similkameen.